

**43rd International Conference
ON ORGANIZATIONAL SCIENCE DEVELOPMENT**

**Green and Digital Transition –
Challenge or Opportunity**

**43. mednarodna konferenca
O RAZVOJU ORGANIZACIJSKIH ZNANOSTI**

**Zeleni in digitalni prehod –
izziv ali priložnost**

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**Polona Šprajc
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TOWARDS A DOMAIN SPECIFIC LANGUAGE FOR DESCRIPTION OF LONGITUDINAL BUSINESS PROCESSES RELATED TO DIGITAL AND GREEN TRANSFORMATION

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We investigate abstract common traits of longitudinal processes related to digital and green transformation of business processes, such as LCA analysis, CO₂ footprint evaluation, and production cost analysis. The common abstraction allows to develop general tools and joint understanding of the three most relevant analytical processes significant to economic entities: production cost allows the undertaking to stay competitive, while conforming to forthcoming regulation involving either calculation of CO₂ footprint (relevant to most value chains in European economy) or LCA analysis of products (relevant to major undertakings that are subject to sustainability reporting regulations). The result is an idea for a domain specific language that describes the concepts to calculate the stated process indicators and describe the data required in these calculations.

Keywords:

LCA analysis,
CO₂ footprint,
production
cost,
longitudinal
process,
domain
specific
language,
mathematical
modelling,
evaluation,
analysis

1 Introduction

In digital transformation, organizations or companies leverage digital technologies to change how they conduct their business activities, communicate with customers, develop products and services, and manage their internal processes. Green transformation signifies a shift towards a more sustainable and environmentally friendly way of conducting business. It entails organizations' efforts to reduce their negative impact on the environment, focus more on sustainable development, and employ environmentally friendly practices, products, and technologies. This transformation includes taking measures to reduce carbon footprint, efficient use of resources, recycling, utilization of renewable energy sources, development of eco-friendly products, and waste reduction. The aim of green transformation is to create a more sustainable, environmentally friendly, and socially responsible business approach. The integration of digital and green transformations enables the creation of a more sustainable and innovative business model. Our investigation focuses on key elements of digital and green transformation, such as Life Cycle Assessment (LCA), CO₂ footprint evaluation, and production cost analysis. Through identifying common mathematical abstractions of these processes, we aim to develop comprehensive tools and foster a collective comprehension of the most crucial analytical procedures pertinent to economic entities. This achieves synergy between progress, efficiency, and environmental responsibility, resulting in better outcomes for humankind and the environment.²

In subsequent sections, we undertake a comprehensive review of concepts and learning space used. Then we explore the mathematical basis concerning CO₂ calculation, production cost analysis, and Life Cycle Assessment (LCA). Following the development of the mathematical model, an innovative Domain-Specific Language (DSL) is conceptualized and expounded upon, with detailed explanation provided in the subsequent illustrative example, focusing on the well known process of baking a pizza. To establish a foundational understanding, the discourse initiates with background research on LCA, PCA, and carbon footprint.

2 Background research on LCA, PCA, and Carbon Footprint

LCA began as an approach to assess the environmental implications of products and evolved into a standardized method for systematically evaluating the potential environmental impacts of products, services, and technologies. Recent efforts have also focused on expanding the LCA methodology to capture indirect effects through the use of economic techniques and models (consequential LCA) and broadening the traditional LCA framework to integrate environmental, social, and economic aspects into the analysis, referred to as life cycle sustainability assessment (LCSA) (Ciambrone, 1997, Nuss, 2014).

The significance of the growing number of carbon footprint reports is a response to both legislative requirements and the business environment, leading to global acceptance and adoption of the Greenhouse Gas Protocol (GHG Protocol) set by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) (GHG Protocol, 2004). Sources emphasize the importance of proper measurement and reduction of greenhouse gas emissions, as well as the significance of conducting appropriate analyses for understanding and taking action in an environment constrained by carbon production (Franchetti & Apul, 2012, Onat et al., 2013).

We first review the structure of the data that will serve as the basis for developing general tools and a shared understanding of the mentioned most relevant analytical processes. Data for life cycle costing analysis, life cycle assessment, and carbon footprint analysis are interconnected and vital for understanding the impact of operations on the economy, environment, and social responsibility. These analyses provide insights into various aspects of business processes and products. Life cycle costing analysis (PCA - Production Cost Analysis) assesses the total costs of a product or service throughout its entire life cycle, including acquisition, use, maintenance, and final disposal. This information aids in evaluating the economic consequences and profitability of a product or service and in decision-making. Life cycle assessment (LCA) provides a systematic overview of the environmental impacts of a product or service from its beginning to end, encompassing production, use, and final disposal. This analysis evaluates greenhouse gas emissions, resource consumption, and other environmental aspects, contributing to improving environmental sustainability. Carbon footprint analysis focuses on assessing the

quantity of greenhouse gasses produced by a specific product, service, or organization. This analysis assists in measuring and managing carbon emissions and adjusting business practices to reduce the carbon footprint. The common denominator among these analyses is the emphasis on a comprehensive understanding of the impact of activities on the economy, environment, and social responsibility, enabling informed decisions for sustainable business practices.

The data for production cost analysis (PCA) includes various types of costs that are collected and analyzed throughout the entire life cycle of a product or service. The data structure for PCA analysis typically encompasses the following types of costs: cost of acquisition (costs related to the acquisition of a product or service, such as, purchase price, transportation costs, installation, licensing fees, and similar) and operating costs (costs incurred during the actual use of a product or service, including maintenance costs, repairs, operational expenses (e.g., fuel, electricity, water), labor costs, upgrades, and similar).

Structured data for Life Cycle Assessment (LCA) typically includes information and data describing the environmental aspects of a product or service throughout its entire life cycle. These details are organized to enable a comprehensive assessment of environmental impacts. The data structure for LCA can include the following: lifecycle stages (data concerning individual stages of the life cycle, such as raw material acquisition, production, distribution, use, maintenance, final disposal, recycling, etc.), resource consumption (information about the use of raw materials, energy, water, and other natural resources in each life cycle phase) and emissions (data on emissions of various pollutants in each life cycle phase, such as greenhouse gasses, water, air, and soil emissions, and other pollutants), environmental impact assessment (analysis of the product or service's impact on ecosystems, biodiversity, climate change, and similar).

Data required for carbon footprint analysis includes energy consumption (details about energy use such as electricity, heating fuel, use of engines or machinery, including energy sources), material consumption (including their origin, production, transportation, and final use or disposal), transportation and distribution (data concerning product or service transportation from suppliers to end-users or consumers, including modes of transport, distances, and fuel types), product or service usage (impact of final usage on emissions, such as energy consumption, waste

generation, product sustainability, and duration of use), waste disposal (quantity and type of waste generated, along with emissions of waste treatment or disposal methods), business travel, existing and outgoing production processes, linked business processes and end-of-life product disposal.

Life Cycle Assessment (LCA), production cost analysis (PCA), and carbon dioxide (CO₂) footprint evaluation are closely linked, providing a comprehensive approach to assessing the sustainability and financial aspects of products or services. LCA carefully studies the environmental impact of a product or service from its beginning to end, covering stages like acquiring raw materials, production, distribution, use, maintenance, and end-of-life. This assessment includes detailed information about resource use, emissions, and environmental effects, particularly focusing on CO₂ emissions. Concurrently, PCA looks at the costs associated with the entire life cycle, including acquisition, operation, maintenance, and end-of-life. The financial data reflects the material and energy aspects studied in LCA. Importantly, the production and usage phases, central to PCA, significantly contribute to the carbon footprint, aligning with the emissions evaluation in LCA. In essence, the shared ground among LCA, PCA, and CO₂ emissions lies in their combined role in assessing the overall sustainability of a product or service, where environmental considerations, economic factors, and carbon footprint are intricately connected throughout the entire life cycle.

3 Concepts and learning space

A learning space is a mathematical structure for modeling the process of learning and understanding new concepts. Learning spaces are intended for modeling the intellectual space, knowledge that individuals already possess and can still acquire (Falmange, 2011, Bokal, Jerebic, 2023, Jerebic et al., 2023). In our research, we applied the learning space concept within the framework of mathematical modeling for sustainable process analysis. Table 1 comprises four columns, with the first column outlining variables necessary for the mathematical model. A comprehensive exploration of this topic is presented in the following sections. A brief overview follows, "i" denotes the index of a specific step of the process elaborated upon in the columns, "A_i" denotes the technological matrix utilized at corresponding step in the process, "d_i" serves as the decision vector specifying the desired resource quantities at each step. The "y_i" column represents the state of the world after each

step in relation to the utilized or produced resources. The remaining three columns each pertain to a specific aspect of the central problem we aim to calculate. The "CO₂" column informs us of the emissions generated at each step of the process. "LCA" represents the environmental impact deriving from a chosen process step. Finally, "PCA" encapsulates the economic information about a step in the given process.

Table 1: Table of elements in corresponding model

	CO ₂	LCA	PCA
i	step of production process	step of product life cycle	Step of product manufacture
A_i	Technological matrix of the i -th step		
x_i	Desired amounts to be produced during i -th step of the process		
y_0	Carbon footprint generated by the first step source	Environmental indicator value	Costs of the first step depending on resource consumption, normally zero
y_i $i=1 \dots n$	Carbon footprint generated by the i -th step source	State of resources and products after the i -th step	

4 Mathematical models and algorithms

The base model we apply is a linear cost and linear production model that is also used in a parallel contribution Brun et al., 2023. Aligned with Table 1, the model denotes the state of the world at the i -th step of the process with $y_i \in R^m$. The decision vector of the same step is a m -dimensional vector $x_i \in R^m$, and it specifies all the desiderata of the production process that can be controlled. For simplicity, we may assume all monitored quantities can be controlled, implying x_i and y_i have the same dimension. The dimensions therefore constitute amounts of products, byproducts, pollutants, as well as amount of resources such as (raw) materials, partial products, energy, labor, time, money. The latter are usually reduced in quantity and the former are produced by the vector of change at each step of the process, $A_i x_i$. The (linear) technology producing this change of the state of the world given decision x_i is described by technology matrix A_i . This matrix is a square matrix by assumptions and its coefficients represent specific constants of the process, such as

prices, densities or relative densities and ingredient amounts in products, energy requirements and similar. Having specified the initial state of the world y_0 , the model of the process is then completely described by the following recurrence equation $y_i = A_i x_i + y_{i-1}$. Note that recurrence is elementary: the previous state of the world is linearly augmented by the vector of change produced by multiplying the decision vector with the technology matrix.

This iterative process continues throughout the entire sequence of steps, ensuring that the state vector at each stage comprehensively represents the cumulative effects of decisions and technological processes. Positive and negative values in the result vector respectively denote the creation or acquisition and consumption or utilization of resources, products, or byproducts. The final state vector, y_{final} , encapsulates the overall final state of the system, incorporating products, byproducts, and incurred costs from the entire process.

5 A Domain-Specific Programming Language

A domain-specific language (DSL) is a specialized programming or specification language designed for specific problem domains, representation techniques, or solution approaches, enhancing precision and efficiency in data interpretation for various applications (Fowler, M., 2010). In this section, we describe an innovative idea of a domain specific language for description of longitudinal processes that streamlines the method of sustainable process modeling and life cycle analysis, ensuring users can effortlessly navigate the complexities of mathematical modeling without requiring in-depth knowledge of matrices. Embracing a declarative approach to process definition, users articulate relationships between components without delving into procedural complexities. This abstraction prioritizes readability, making the language accessible to a wider audience by focusing on expressing the "what" rather than the "how" (Fowler, M., 2010).

At the core of the language lies the technological matrix, a dynamic representation of interdependencies within a process. Rows in the matrix correspond to process steps, while columns represent resources, emissions, costs, and other variables. This matrix enables users to analyze resource flows and environmental impacts, with costs and emissions dynamically calculated during the multiplication of the decision vector. This ensures a realistic representation of the environmental and economic

impact of each step in a chosen process, eliminating the need for users to manually delve into matrix calculations.

Users of programming language define objectives using decision vectors expressing desired resource quantities. The language dynamically generates the matrix and vector required by the mathematical model, calculating emissions and costs during the multiplication of the decision vector with the technological matrix. This feature enables the exploration of diverse scenarios, allowing evaluation of decision-making trade-offs, providing a holistic understanding of process impacts.

Facilitating multi-dimensional analysis, the language empowers users to assess the implications of decisions across various dimensions simultaneously. Whether evaluating resource consumption, emissions, energy usage, or economic costs, users gain a comprehensive understanding, crucial for informed decision-making aligned with sustainability goals. For instance, users can clearly see how each step of the chosen process impacts the environment and economic standpoint and take measures to reduce the emissions or cost of a certain step.

The language introduces a dynamic state evolution mechanism that empowers users to simulate the life cycle of processes, capturing temporal variations and system responses to changing conditions. Additionally, it recognizes diverse environmental impacts by enabling the customization of environmental coefficients within the technological matrix at the end of the chosen process. This adaptability ensures alignment with specific sustainability metrics or industry standards, enhancing the relevance and accuracy of the model.

The following image (Figure 1) illustrates a representation of the language syntax.

6 Illustrative example

In this section, we elucidate the practical application of the formula and domain-specific language through a detailed illustrative example, delving into the intricacies of assessing carbon dioxide (CO₂) emissions, life cycle analysis, and production costs. In the following illustrative example, we employ the designed DSL to assess carbon dioxide (CO₂) emissions, life cycle analysis, and life production cost analysis

of a sketch of a pizza-making process. We navigate through four integral phases: production, procurement, baking, and consumption.

Commencing with production, the focus is on evaluating the environmental impact associated with the cultivation and manufacturing of raw ingredients. Shifting to the procurement phase, the focus broadens to encompass both environmental and

```
# Define resources, gases, and variables
resources = ["Pizza", "Flour", "Tomatoes", "Cheese", "Water", "Wood", "Electricity",
            "Time", "Money", "Distance", "CO2", "Methane"]
units = {"Pizza": "Int", "Flour": "kg", "Tomatoes": "kg", "Cheese": "kg", "Water": "l",
        "Wood": "kg", "Electricity": "kWh", "Time": "minutes", "Money": "currency", "Distance": "km",
        "CO2": "kg", "Methane": "g"}

# Specify resource creation and emissions in the first step.
# Specify if the gases are produced or used
create_resources = {
    "Flour": {"quantity": 2, "emissions": {"CO2": 0.8}},
    "Tomatoes": {"quantity": 1, "emissions": {"CO2": 0.6}},
    "Cheese": {"quantity": 1, "emissions": {"CO2": 27.9, "Methane": 20}},
    "Water": {"quantity": 1, "emissions": {"CO2": 0.000298}},
    "Wood": {"quantity": 0.5, "emissions": {"CO2": -21}}
}

# Specify resource acquisition in the second step.
acquire_resources = {
    "Flour": {"quantity": 1, "cost": {"Money": 1.0}},
    "Tomatoes": {"quantity": 2, "cost": {"Money": 2.5}},
    "Cheese": {"quantity": 1, "cost": {"Money": 5.0}},
    "Water": {"quantity": 5, "cost": {"Money": 0.1}},
    "Wood": {"quantity": 2, "cost": {"Money": 1.5}},
    "Distance": {"quantity": 20, "cost": {"Money": 1.68, "CO2": 0.192, "Methane": 0.26}},
    "Time": {"quantity": 85, "cost": {"Money": 7.905}}
}
```

Figure 1: Possible syntax of a domain-specific programming language

financial considerations, incorporating factors like transportation distance, gas expenditure, and worker costs in the overall analysis. Transitioning to the baking stage, further divided into dough preparation, topping addition, and baking, the DSL allows for the specification of the cost of electricity and its corresponding environmental implications at each juncture. Finally, we address the consumption stage, completing the life cycle analysis within the boundaries of interest. Consequently, as a result we get a vector representing the state of the world after the entire pizza-making process. Every phase is represented as a separate entity within the DSL, facilitating a nuanced examination of environmental and cost dimensions across the entire process.

The comprehensive evaluation of the pizza making lifecycle, considering factors from CO₂ production during ingredient growth to vehicular methane emissions, reveals a total emission of 14,5 kg of CO₂ used and 89 g of methane produced. The associated cost amounts to 24 EUR, reflecting the estimated price for an average individual to bake one pizza outside of the regular food production value chains. However, it is important to note that the actual material cost of the pizza excluding individual's work (but accounting for retail rather than wholesale prices) is 5 EUR, rendering it comparable to the actual pizza cost. Within the pizza-making example, the domain-specific language employs matrix calculations to generate vectors at each stage, allowing users to access detailed insights into environmental impact and production costs for every step of the process. Additionally, the DSL facilitates a comprehensive overview by combining these individual vectors, enabling users to obtain the state of the world not only at the conclusion of the entire process but also at every intermediate step throughout the pizza production lifecycle. An in depth analysis of this example including all the data and sources will be covered in a submitted paper Alif et al, 2024.

7 Conclusions and further research

Production cost, life cycle analysis (LCA), and carbon footprint all share common domain in being methods or concepts crucial to various aspects of business operations and sustainable development. Despite serving different purposes, they exhibit a common mathematical model implying several common characteristics. All three concepts are pivotal for sustainable business practices in assessing a company's impact on the environment and society. Production cost, LCA, and carbon footprint all involve measuring or assessing a company's impact on the environment. Production cost focuses on determining the actual production costs, LCA assesses the overall environmental impact of a product or service throughout its life cycle, while carbon footprint evaluates greenhouse gas emissions across the entire supply and use chain of a product or service. All three concepts are also crucial in sustainability reporting for companies, enabling the evaluation and reporting of the environmental impact of their operations, products, or services. While each concept employs different approaches, all are indispensable for sustainable business practices and improving companies' environmental footprint.

As we delve into the realm of environmental sustainability and corporate responsibility, there remain promising avenues for further research in this dynamic field. Future investigations could explore the refinement and expansion of the formulated approach and domain-specific language (DSL) to accommodate evolving industry standards, emerging technologies, and shifting global priorities. Additionally, researchers might delve into comparative studies assessing the effectiveness of the DSL in diverse sectors and industries, providing valuable insights into its adaptability and scalability. Another approach could also focus on the development of standardized metrics and benchmarks within the DSL, fostering a common language for companies to benchmark their environmental performance against industry peers. Exploring the integration of artificial intelligence and machine learning algorithms within the DSL could enhance predictive capabilities, enabling companies to proactively identify potential environmental impacts and optimize resource usage. Collaborative efforts between academia, industry stakeholders, and policymakers could contribute to the creation of a robust and universally accepted framework, fostering a more sustainable and resilient global business landscape. Continued exploration of these aspects is essential for advancing our understanding of the interplay between business operations, environmental impact, and sustainable development, paving the way for informed decision-making and significant contributions to a sustainable future.

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STATISTICAL ANALYSIS OF DEMOGRAPHIC DATA AND STUDENT PERFORMANCE IN THE COURSES OF THE BACHELOR'S DEGREE PROGRAM AT THE DEPARTMENT OF COMPUTER, INFORMATICS AND TELECOMMUNICATIONS ENGINEERING - INTERNATIONAL HELLENIC UNIVERSITY WITH ORACLE APEX STATISTICS

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Undoubtedly, statistical analysis is a powerful tool for understanding, examining and interpreting complex phenomena and data in academic institutions and drawing also valuable conclusions. In the context of this work, the main characteristics and data related to the undergraduate study program of International Hellenic University (IHU) Department of Computer, Informatics and Telecommunications Engineering (CITE) were analyzed, using the tools provided by Oracle APEX. The aim is to explore trends, learner profiles, academic outcomes and other aspects of the curriculum. This work provides important results regarding the demographic data and performance of the students of the IHU department. ORACLE APEX tools helped us to easily transform and clean the data, group them, and display the results online. This analysis provides the impetus to improve the weaknesses identified in the curriculum courses and increase its effectiveness.

Keywords:

Oracle
APEX,
statistical
analysis,
student's
performance,
demographics,
statistical
reports

1 Introduction

In contemporary society, statistical analysis constitutes a powerful tool for comprehending and interpreting data, enabling the extraction of reliable conclusions. It is a distinguished scientific field that forms the basis for taking correct decisions in various domains, from economics and business to health and education. Regarding the educational process, an increasing number of educational institutions and entities acknowledge the contribution of statistical analysis [Ferrandino, 2016]. This is because the insights it can provide are invaluable and contribute to understanding the behavior and performance of students.

A progressively increasing number of statistical research studies are being conducted by educational institutions at all levels, focusing on the characteristics and daily lives of students, aiming to explain or even predict their performance. Various factors are examined, such as socioeconomic background, gender, or even the use of mobile phones [Lepp, Barkley, Karpinski, 2014], and how these correlates with school or academic performance [Farooq, Chaudhry, Shafiq and Berhanu, 2011].

Such studies [Angeioplastis, Tsimpiris, Varsamis, Baggia, & Leskovar, 2023], served as the catalyst for a statistical analysis of the characteristics of undergraduate students in the Department of Computer, Informatics, and Telecommunications Engineering at IHU. This analysis was tailored to meet the requirements of Greek educational institutions, with a primary focus on the profiles through which students were admitted to this specific undergraduate program.

2 Dataset

The final Oracle APEX database used consists of 9097 records, forming the complete set of 60 courses offered in the undergraduate program of the Department of Computer, Informatics, and Telecommunications Engineering at IHU. It includes all grades and efforts from 383 students, both active and inactive, throughout all years of the program's operation, along with other information crucial for statistical analysis, such as place of origin, gender, method of admission to the department, year of enrollment, and more. The data were processed anonymously with respect to the personal information of all students.

3 Oracle Application Express (APEX)

Oracle Application Express (APEX) offers several benefits for creating statistics and managing web-based information systems. Here are some key insights:

1. **Rapid Application Development:** APEX is known for its rapid application development capabilities, allowing users to create rich web applications quickly, based on data within the Oracle database [Austwick, 2013].
2. **Efficiency and Productivity:** APEX enhances developer productivity by providing tools like the Application Synopsis tool, which includes various features for analyzing applications, thereby minimizing efficiency lags [Srinivas, Biswas, & Srinivasan, 2010].
3. **Web-Based Information System Advantages:** The platform offers significant advantages for web-based information systems, such as ease of use, integration of components, fundamental concepts, and a structured framework for development [Liu Hong-xing, 2008].
4. **Low-Code Development:** APEX assists in developing applications with little or no code, making it ideal for creating modern data-driven applications quickly and efficiently [Veerasamy, 2022].
5. **Global Deployment and Customization:** APEX is suited for developing applications that can be deployed globally, respecting linguistic and cultural differences, and allows customization to meet specific application needs [Scott, Buytaert, Cannell, et al., 2011].

4 Methodology

At first, we focused on the process of data extraction from the Department's database from 2019 until current's season data. The next step involved cleaning, processing and encoding the data, having as a main goal the categorization of the data based on their characteristics. Creating a database in the Oracle APEX environment helped to consolidate all the individual tables and avoid redundancy in the data. Oracle APEX tools then helped in creating graphs and descriptive statistical analysis of the results. This was followed by conducting statistical tests, which were performed using the open-source software Jamovi and its libraries [Jr Miller and G. Rupert, 1997], [The jamovi project, 2023]. The statistical tests conducted included the Independent Samples t-test for 2 independent samples [J. Fox and S. Weisberg,

2018] and a continuous variable, followed by Analysis of Variance (ANOVA) [R Core Team, 2013].

5 Results

5.1 Descriptive Statistics

In the Department of Computer, Informatics and Telecommunications Engineering – IHU a total of 383 students have been enrolled from 2019 until the time of the research. Their distribution based on their biological gender is 60 females (15.67%) and 323 males (84.33%), indicating a overwhelming preference of males in choosing this specific department.

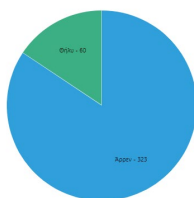


Figure 1: Distribution of biological gender of all students

Θηλες (Green color) → females

Source: Own

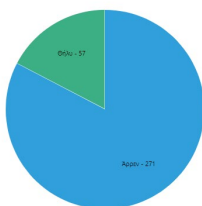


Figure 2: Distribution of biological gender of all active students

Μαλες (Blue color) → males

Source: Own

admitted through placement exams or other categories (5%, athletes, foreigners, minorities, transfers) constitute 3% each.

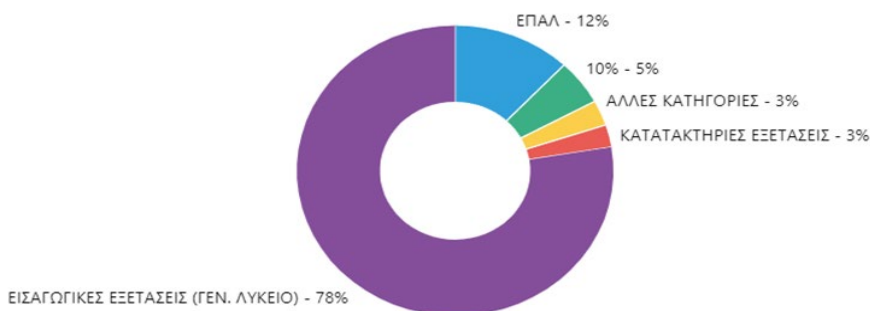


Figure4: Percentages of students according to the method of admission

Source: Own

- ΕΙΣΑΓΩΓΙΚΕΣ ΕΞΕΤΑΣΕΙΣ (ΓΕΝ. ΛΥΚΕΙΟ) → General High School
- ΕΠΑΛ → Vocational High School
- ΚΑΤΑΤΑΚΤΗΡΙΕΣ ΕΞΕΤΑΣΕΙΣ → Placement exams
- ΑΛΛΕΣ ΚΑΤΗΓΟΡΙΕΣ → Other categories

5.2 Students' Performance

5.2.1 Success percentages for academic courses

The analysis of student performance constitutes the most significant part of this study. In Figure 4, the success rates of students for each course offered in the department are detailed. With blue color we can see the total number of students that have passed the course, while with green we can see the number of students that have passed the course with their first attempt.

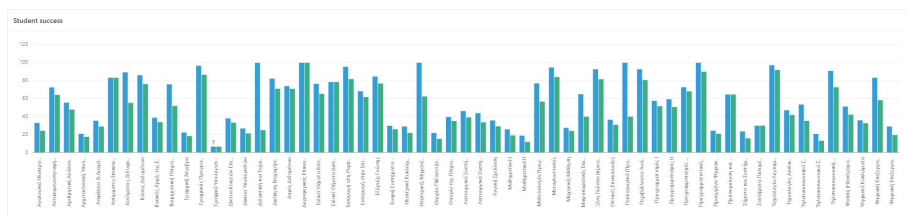


Figure 5: Students' success percentages for each academic course

Source: Own

The overall success rates of students in each course were examined, as well as the percentage of students who manage to pass each course "on the first attempt", meaning during the semester in which the course is scheduled in the curriculum. The results highlight the courses with the lowest and highest success rates, where deeper reasons for students' failure to succeed in certain courses should be investigated in a future research.

5.2.2 Correlation between students' grades and biological gender

It was deemed appropriate to examine whether there is a correlation between the biological gender of students and the grades they achieve. To draw conclusions, the independent samples t-test was selected. This is a statistical test used to examine whether there are statistically significant differences between two independent groups or two samples measured for a continuous variable.

Table 1: Statistics of biological gender

	Biological gender	Sample size	Mean	Standard deviation
Grade	Male	7306	3.93	2.79
	Females	1686	4.04	2.72

In our case, the independent groups consist of biological genders (Male, Female), and the continuous random variable is the grade, which takes values in the continuous interval [0,10]. The results are shown in Tables 1 and 2. The field F refers to the value of the F-test conducted using the Levene method [Schultz, 1985]. The Levene F-test is a statistical test used to assess whether the variances (differences)

among multiple groups are statistically significant. The mean grade for females is 4.04, slightly higher than that of males, which is 3.94, while the standard deviation differs by approximately 0.07 between the two groups. The null hypothesis is defined as the assumption that there are no statistically significant differences in the means of grades between males and females with a significance level of 5%.

Table 2: Independent samples t-test

		F	Sig.	t	df	Sig.(2-tailed)
Grade	Equal variances assumed	3.06	0.08	-1.36	8990	0.174
	Equal variances not assumed		-1.38	1.38	2570.15	0.167

Because the significance level of the test (referred to as p-value and denoted as Sig. in the tables) is $0.17 > 0.05$, this means that there is insufficient evidence to reject the null hypothesis. Therefore, there is no statistically significant difference in the mean grades between males and females.

5.2.3 Correlation between students' grades and method of admission

It was considered important to investigate whether the method students were admitted to the Department of Computer, Informatics and Telecommunications - IHU affects their performance. The statistical test used for drawing conclusions was the Analysis of Variance (ANOVA) with the Bonferroni method [Nakagawa, 2004]. The ANOVA (Analysis of Variance) statistical test allows the assessment among multiple groups simultaneously and is particularly useful when determining if there are significant differences between many conditions or experiments. The Bonferroni method is an adjustment method for significance levels in multiple comparisons between groups. If the p-value of each comparison is less than the corresponding adjusted significance level, then the null hypothesis is rejected, and it is concluded that there is statistical significance.

Table 3: Descriptives statistics for the comparison between grade - method of admission

	N	Mean	Standard deviation	Typical error	95% Confidence Interval for the Mean Value		Minimum	Maximum
					Lower Bound	Upper Bound		
GHS	7489	4.00	2.76	0.03	3.94	4.06	0.00	10.00
VHS	854	3.36	2.75	0.09	3.18	3.55	0.0000	10.00
GHS 10%	366	4.04	2.90	0.15	3.74	4.34	0.0000	10.00
Other	283	4.37	3.06	0.18	4.01	4.73	0.0000	10.00
Total	8992	3.95	2.78	0.02	3.90	4.01	0.0000	10.00

Students were divided in 4 categories. These categories are:

- GHS → General High school nationwide exams
- VHS → Vocational High school nationwide exams
- GHS 10% → General High school with the method of 10%
- Other → Other categories included (5%, athletes, foreigners, minorities, transfers)

Table 3 presents basic statistics for these four categories. Of significant importance is the "Mean" field, displaying the average grades of students in each admission category. It is observed that the mean grade for students coming from vocational high schools is approximately 3.37, noticeably lower than the other average scores.

This is confirmed by the Bonferroni test in Table 4. The null hypothesis of the test is that there are no statistically significant differences in students' grades based on their method of admission, with a significance level of 5%. It is observed that the p-value < 0.001 for all comparisons in the "Vocational High School" category compared to the other categories. This means that the null hypothesis "there are no statistically significant differences in students' grades based on their method of admission" is rejected, and the conclusion is drawn that the grades of students coming from vocational high schools are lower compared to the grades of other students. In the remaining categories, the p-value is greater than 0.05, indicating that there are no statistically significant differences in the grades of students between these specific categories.

Table 4: Bonferroni method for the correlation between grade - method of admission

(I) Method of admission	(J) Method of admission	Διαφορά Μέσων τιμών (I-J)	Τυπικό σφάλμα	Sig.	95% Διάστημα Εμπιστοσύνης Κάτω φράγμα	Άνω φράγμα
GHS	VHS	0.6352	0.1003	<0.001	0.3704	0.9000
	GHS 10%	-0.0391	0.1487	1.000	-0.4316	0.3532
	Other	-0.3692	0.1682	0.169	-0.8131	0.0747
VHS	GHS	-0.6352	0.1003	<0.001	-0.9000	-0.3704
	GHS 10%	-0.6744	0.1735	<0.001	-1.1324	-0.2164
	Other	-1.0044	0.1905	<0.001	-1.5073	-0.5016
GHS 10%	GHS	0.0391	0.1487	1.000	-0.3532	0.4316
	VHS	0.6744	0.1735	<0.001	0.2164	1.1324
	Other	-0.3300	0.2199	0.801	-0.9103	0.2502
Other	GHS	0.3692	0.1682	0.169	-0.0747	0.8131
	VHS	1.0044	0.1905	<0.001	0.5016	1.5073
	GHS 10%	0.3300	0.2199	0.801	-0.2502	0.9103

6 Conclusion

In the Department of Computer, Informatics and Telecommunications Engineering at IHU., there are a total of 324 active students, with the distribution of their biological gender being 55 females (15.67%) and 269 males (83.03%). The majority of students come from the regions of Serres and Thessaloniki (50.94%), while the department mainly attracts students from the central and eastern Macedonia regions with a total percentage of 72.64%. Most of students have been admitted to the department through nationwide exams (76.76%). There is no statistically significant difference in the performance of students based on their biological gender. On the contrary, it is statistically confirmed that students coming from vocational high schools achieve significantly lower performance compared to other students. Further research on the department's statistics, as well as the development of models predicting student behavior, will be presented in future work.

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A OVERVIEW OF ENERGY MODELLING TOOLS RELEVANT FOR ENERGY EFFICIENCY PROJECTIONS

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In order to define an appropriate energy regulatory policy at the state level, encourage energy efficiency, control the level of final energy consumption and select production technologies, it is important to choose an adequate approach to energy modeling. Hence, this paper will focus on the overview of the most important energy modelling tools. Energy models can be developed for efficient forecasting, planning, design, operation and optimization of energy systems. The heterogeneity of applied energy models and the energy scenarios defined in them require specific, technically advanced skills for an adequate assessment of movements in such a multidisciplinary discipline. The paper analyzes crucial differences between tools, giving an useful insight in contemporary research of energy efficiency projections. A overview of these tools is essential for sustainable energy development and efficient business of energy companies. A comparative comparison of energy modelling tools is also shown, with the intention of pointing out the importance of all models and their differences, in order to indicate which area of investigation is especially significant for a particular model.

Keywords:

energy
economics,
energy
modelling,
energy
efficiency,
top-down
modelling,
bottom-up
modelling

1 Introduction

In order to define an appropriate energy regulatory policy at the state level, encourage energy efficiency, control the level of final energy consumption and select production technologies, it is important to choose an adequate approach to energy modeling (Sanchez-Escobar et al., 2021). Energy models can be developed for effective prediction, planning, design, operation and optimization of energy systems (Kondili, 2010). Energy modeling can also be described as a process that contains three interrelated activities: model formulation, parameter estimation and model validation (Labys, 1982).

Today, due to the advanced possibilities of using computers and computer programming, the total number of energy models and their complexity are constantly growing. The models differ considerably in terms of structure and scope of application, while the complexity of the obtained results often presents a challenging task for analysts in the mentioned field. It is also significant to point out that “the modern energy economy requires more and more advanced models for realistic assessment of future trends in the energy sector” (Backović et al., 2024, p. 200).

The relevance of energy models is also reflected in the implementation of energy decarbonization strategies. Four main challenges facing modern modeling of energy systems are (Fodstad et al., 2022):

1. time and space for which the model is defined,
2. research into multi-energy systems (optimal coordination between different energy categories, in English MES - Multi-Energy Systems),
3. modeling with a focus on uncertainty,
4. examining the behavior of energy consumers and modeling the energy transition.

Energy planning and scenario creation within the model have two key goals: providing guidance and projections on future energy systems, as well as providing support to decision makers for the development of short-term and long-term energy strategies (Cao et al., 2016). Comprehensive and integrated energy planning should take into account the potential of increasing energy efficiency in order to reduce the

need for investments in new technologies of electricity production and transmission (Wang & Brown, 2014). The same authors add that improvements in knowledge-based energy modeling are of crucial importance for planning the expansion of energy transmission and distribution, as well as for the optimization of the energy regulatory policy support mechanism.

2 Types of energy models relevant for energy efficiency projection

Energy systems are the subject of research primarily within two areas: (1) energy economics and (2) process system engineering (Subramanian et al., 2018). The process systems engineering approach is also based on economic foundations, such as minimizing the life cycle costs of rational investments, assessing the impact of market failures on the adoption of energy efficient technologies, efficient allocation of resources and other economic theses (Sanstad & Howarth, 1994).

The problem of information asymmetry causes the bounded rationality of consumers, which is another challenge for energy modeling. Contemporary macroeconomics also indicates an increasing division in the distribution of information and knowledge, that is, gradual asymmetry. Thus, while some market participants have all the necessary information for decision-making, another market group has none (Jakšić & Prašćević, 2014).

Energy models can guide decision-making on investments in additional capacities for electricity generation by defining different strategies for meeting future energy requirements and environmental protection goals (Heuberger et al., 2017). There is a need to model more efficient final energy consumption at the global level. The development of the model filled the gap between techno-economic and macroeconomic models. "What if" analysis of simulation energy models showed in certain cases a more important contribution than optimal decision modeling.

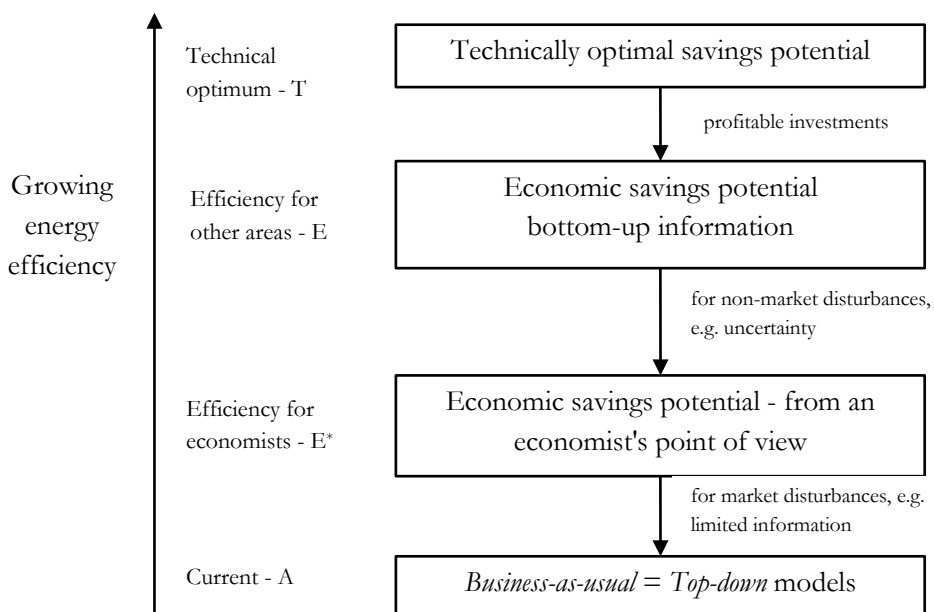


Figure 1: Concepts of energy efficiency

Source: (Koopmans & Te Velde, 2001)

Also important are CGE (Computable General Equilibrium) models, which assume an analysis of a certain market structure and economic dynamics, and then add a certain degree of technological details to the model. One of the first examples of econometric methodologies for forming energy models was the DGEM (Dynamic General Equilibrium Model) model by Berndt and others (Berndt et al., 1981). This model incorporates nine production sectors and an analysis of energy consumption in households according to the defined price formation strategy.

A similar methodology was used for the ZENCAP model of economic development and analysis of capital needs within the energy sector (Codoni et al., 1980). For the regional level, other authors have shown that data envelopment analysis (DEA) can be used to assess with a high degree of certainty whether regions are using their resources efficiently (Martić & Savić, 2001). The DEA method can also be used to investigate the specific impacts of electricity production on the environmental efficiency of the region (Xie et al., 2012).

Regarding the general purpose of creating an energy model, there is first a division into three types of models (Hourcade et al., 2006): (1) models that project future flows of energy with endogenous observation of economic activities using econometric analysis, (2) research into the future of the energy system by forming alternative of scenarios which are then compared with the reference scenario, (3) backcasting – defining the vision of the desired future, and then analyzing the corrections of the current situation for the sake of achieving future goals (also used to evaluate the long-term economic consistency of alternative strategies).

As for the specific purposes, they depend on the research focus of the formed model: (1) energy demand models consider demand as a function that causes changes in the total population, income, energy prices, (2) energy supply models focus on technical aspects and on testing whether the supply can meet the demand for energy, with the inclusion of certain financial indicators, (3) impact models, i.e. impact models caused by the adoption of current energy policy measures, which may lead to changes in economic-financial parameters, social welfare or a change in the protection strategy environment (these models assess the consequences of choosing alternative options) (van Beeck, 1999). Other authors are of the opinion that for integrated energy management it is of particular importance to create a model for managing energy demand (Suganthi & Samuel, 2012).

3 Specification of energy models according to the analytical approach

According to the highlighted, analytical approach, energy models are classified into top-down and bottom-up, that is, process-oriented models (Hourcade et al., 2006; Subramanian et al., 2018; van Beeck, 1999). This basic division gained particular importance during the 1980s and 1990s, due to the emergence of the debate on the energy efficiency gap. Comparisons during the 1990s between the analysis of the long-term general equilibrium in the energy sector through top-down models (with optimal allocation of resources within a perfectly competitive market), on the one hand, and conventional macroeconomic models of short-term dynamic analysis, on the other hand (Grubb et al., 1993). In order to clearly see the difference between the currently available, advanced energy models, the following table shows the basic characteristics of the models according to their type and the methodology they use.

3.1 *Top-down energy modelling tools*

Top-down models use aggregated data to conduct synergy analysis between sectors (Sanchez-Escobar et al., 2021). The mentioned models include the analysis of the entire economy considering ongoing market distortions, money spillovers and income effects for different economic subjects, with pronounced endogeneity of economic activities in the period of the energy crisis (Böhringer & Rutherford, 2008).

Although engineering bottom-up models may underestimate costs by neglecting the technology implementation process, economic top-down models tend to overestimate costs while omitting the potential for structural change and energy efficiency growth resulting from regulatory policy incentives (Grubb et al., 1993). Top-down models are formed with the assumption of efficient allocation of all energy inputs and final goods by a competitive market, and this also applies to CGE models. On the other hand, bottom-up models point to additional opportunities to improve energy efficiency through state support mechanisms (Hourcade et al., 2006). Also, top-down models seek to form a holistic perspective of the economy, but looking at the energy sector in an apparently simplified and aggregated way.

Conventional top-down models have trouble assessing the combined effect of price-based regulatory policies (such as carbon taxes, tradable energy permits) and regulation of specific energy production technologies, given that they register technological change as an abstract, aggregate phenomenon—implicit with aspect of substitution elasticity (Hourcade et al., 2006). Essentially, these models primarily examine the consequences of regulatory policy on public finances, economic competitiveness and employment levels (Hourcade et al., 2006). Some of the advantages of the top-down model are (Vogt, 2020):

1. low costs and quick implementation based on routine collection of available data,
2. easy identification and quantification of the effects of equipment replacement for the energy system,
3. historical data for a time period of only one year is sufficient for modeling,

4. the model quickly recognizes changes in final energy consumption caused by the appearance of unknown factors such as unplanned changes in operating procedures.

There are also certain disadvantages of the mentioned models (Vogt, 2020):

1. if the data collection is not carried out in an appropriate way, a low degree of accuracy of the model can be obtained,
2. if the model shows results that deviate significantly from the expected, it means that the process, technology or piece of equipment that led to the deviation cannot be recognized, but the entire system must be modeled again,
3. specific knowledge in the field of statistics is required, more precisely the description of the statistical validation of the model is difficult to present without prior knowledge of the model.

3.2 *Bottom-up energy modelling tools*

Contrary to top-down energy models, bottom-up models contain more technological details and use an economically driven approach to evaluate the technologies used. The assumptions of the model are defined with reference to technological diffusion, investments and operating costs of power plants (Herbst et al., 2012). Considering that they provide numerous possibilities for clarifying the reasons for the occurrence of certain outcomes within the energy sector and considering that they are based on high program complexity, these models can reliably project the adoption of new energy production technologies, with the aim of informing about new support mechanisms for regulatory energy policy (Adams, 2019).

The failure of certain consumers and companies to minimize the costs of required energy services is often related to the dynamic nature of energy efficiency development and the complexity of the diffusion of efficient technologies (Sanstad & Howarth, 1994). Therefore, the general theory of economic balance can be used to show the outcome of the adaptation of new production technologies to the energy system, but within the same theory, the analysis of the dynamic process that led to their application is neglected.

Given the nature of incremental technology change, the bottom-up approach is likely to overestimate the economic potential of full penetration of energy-saving technologies. According to Grubb and other authors (Grubb et al., 1993), bottom-up studies of practical application suggest the existence of an even greater potential for reducing emissions of harmful gases and total costs compared to the extrapolation of energy demand of the top-down model. In this way, the authors conclude that the application of the model indicates that top-down is not optimal in terms of the available technologies under consideration, but that significant savings in energy consumption can be achieved by creating a different scenario that would represent the engineering optimum. It should be noted that even CGE top-down models often contain only aggregated data without details on technologies, so disintegration is necessary to disaggregate electricity generation into the results of different generation technologies (Truong & Hamasaki, 2021).

Some bottom-up models include macroeconomic feedback, while others estimate microeconomic behavioral parameters for energy production technology selection (Hourcade et al., 2006). The same authors state that certain top-down models have incorporated technological complexity for energy supply sectors. By comparing the deterministic and stochastic models using the TIMES energy model, it is noticeable that the stochastic interpretation is more realistic for approximating the general costs of the energy system, because it requires the presentation of uncertain parameters specific to the model itself (Seljom & Tomasgard, 2015).

Bottom-up models look at energy efficiency through the reduction of energy use of a certain technology or device compared to a reference scenario. In contrast to top-down modeling of energy demand, ex post research on household income elasticity with a combination of economic and structural variables clearly contributes to the identification of energy use per unit of activity.

Three main areas for bottom-up database management research are presented (Koopmans & Te Velde, 2001): (1) projection of demand for energy and energy services, with reference to the trend of replacing technology based on the use of conventional fuels with technology that uses electricity, (2) energy efficiency depends on the realized strategy of energy development: investments in existing technologies or complete replacement with modern technologies, (3) the model may lack an assessment of the speed of adaptation of the current to perfect ex post

efficiency of the energy system, which should be improved in new versions of the model.

4 Conclusion

The existence of two alternative approaches to energy modeling often leads to inconsistency within research and to confusion among analysts when choosing an adequate method. Insufficient availability of information by energy companies is seen as a limiting factor when analyzing energy in a state of market failure. Irreversible investments in energy efficiency that depend on uncertain, future energy prices require the use of high discount rates by investors, especially in case of their aversion to risk (Koopmans & Te Velde, 2001). Dynamic optimization models are used as energy models, which should form the entire structure of the energy sector, taking into account the relevant technological, economic and environmental characteristics of the energy system (Strubegger & Messner, 1987). Hence, the heterogeneity of applied energy models and the energy scenarios defined in them require specific, technically advanced skills for an adequate assessment of movements in such a multidisciplinary discipline (Cao et al., 2016).

The extreme complexity of the choice of technology for the production of electricity and the planning of investments in the energy sector make it a challenge for a detailed analysis. The main reasons for this complexity are the high integration of the energy system, which is shown by the power grid, as well as the variety of technologies for converting resources into final products, i.e. fuel (Kavrakoğlu, 1987).

Directing economic processes towards the stimulation of the development of production technologies that reduce the emission of harmful gases with the greenhouse effect created an additional difference between the aforementioned analytical approaches. Energy policy makers should make decisions about the goals of the energy sector with a view to economic efficiency, environmental effectiveness and political-administrative feasibility of support mechanisms for selected technologies (Hourcade et al., 2006).

For the purpose of forecasting the total demand for energy, the methodological framework of energy models has advanced a lot, especially from the aspect of applicability of the concept of artificial intelligence. Empirical findings point to the fact that there is no one-size-fits-all methodology that would solve all the various challenges faced by business entities in the energy system. Some of the most important model methodologies, the time frame they cover, as well as their advantages and disadvantages indicate their essential importance for the long-term projection of energy efficiency.

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ENVIRONMENTAL DATA ANALYSIS USING ORACLE ANALYTICS CLOUD

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The large amounts of environmental data collected over longer or shorter periods of time are worthless if we do not analyse them and gain an in-depth knowledge of past behaviour and future trends. There are many different tools on the market for data analysis, but only a few of them are offered as a cloud solution. Oracle Analytics Cloud is one of the services offered as part of Oracle Cloud Infrastructure. In the case presented, Oracle Analytics Cloud was used to test the efficiency of the tool and develop a guide for its use based on the environmental data collected by the Municipality of Kranj. The presented case shows the variety of possibilities that Oracle Analytics Cloud offers to both users with no previous experience in data analysis and experienced data analysts.

Keywords:

data
analytics,
environmental
data,
Oracle
Analytics
Cloud,
air
pollution,
municipality of
Kranj,
case
study

1 Introduction

In the era of climate change, many ecosystems are gradually approaching a tipping point that would have a negative impact on the environmental services provided to humanity. As environmental degradation and crises pose a serious threat to humanity, there is an urgent need to monitor the state of ecosystems and pursue sustainable environmental management. However, environmental data is becoming increasingly complex, comprehensive and detailed. Tackling the large, multidisciplinary problems facing today's environmental scientists requires the ability to utilise the available data and information for decision-making. Successfully synthesising heterogeneous data from multiple sources to support holistic analyses and generate new insights requires the application of advanced analytical techniques and data science methods (see e.g. (Gibert et al., 2018; Gupta et al., 2021; Hristopulos et al., 2020)).

The increasing use of data analytics creates a need for a new profile of professionals who understand big data and are able to use a variety of software tools to extract useful information for decision making. To train such professionals, educational institutions need both the infrastructure and the teaching staff familiar with data analysis. These goals are being pursued with the Erasmus+ project Including EVERYone in GREEN Data Analysis (EverGreen, <https://evergreen.fri.uniza.sk/>)¹, which aims to develop innovative teaching materials and make them available to lecturers and students. These outputs will strengthen the digital readiness, resilience and capacity of educators and students and build their digital and sustainability competences.

To illustrate the usefulness of the EverGreen project, this paper presents the results of a case study on the analysis of environmental data on air quality of the Municipality of Kranj (MOK), analysed with Oracle Analytics Cloud (OAC), as one of the most powerful software tools for data analytics. The aim of the paper is to illustrate the main data visualization features of the OAC tool using a real-life example, thus bringing it closer to the students and the professional audience concerned.

¹ Partners of the project are: Žilinská univerzita v Žiline (Slovakia) – leading partner, Veleučilište u Šibeniku (Croatia), Univerzita Pardubice (Czech Republic), Inkubator za nove tehnologije Trokut Šibenik d.o.o. (Croatia), and Univerza v Mariboru (Slovenia).

2 Oracle Platform for Data Analytics

2.1 Oracle Cloud Infrastructure (OCI)

Oracle Cloud Infrastructure (OCI) supports all cloud computing architectures (public, private and hybrid cloud) and all types of cloud services (Infrastructure as a Service - IaaS, Platform as a Service - PaaS and Software as a Service - SaaS). It offers cloud-based solutions that were previously only available on-premise. The solution uses autonomous Oracle services, an integrated security layer, robust features and optimization techniques that provide many benefits when using the included tools. Most importantly, OCI provides an excellent location for an autonomous Oracle database that can be restored, repaired or extended in the cloud without database administrator intervention. By using machine learning to automate routine tasks, an autonomous database provides higher performance, greater security and improved operational efficiency, allowing developers to spend more time developing business applications (Oracle, 2024a). OCI offers a wide range of tools:

- **Oracle Analytics** uses machine learning and artificial intelligence (AI) to help with decision-making. It offers Oracle Analytics Cloud, Oracle Big Data Service, Oracle Big Data SQL Cloud Service, Oracle Data Science and Oracle Cloud Infrastructure Data Flow, among others.
- **Application development environment** including Tools API Gateways, Blockchain, Data Science, Digital Assistants, Oracle MySQL Database Service. Oracle Application Express (APEX) and Visual Builder also stand out among the tools that enable quick and easy development of web applications with SQL, PL/SQL and JavaScript functionalities.
- **Database** which includes autonomous transaction processing, autonomous data warehouse, JSON database, database as a cloud service (virtual computer), Exadata Cloud Service, etc.
- **Integration tools** such as API Gateway, Application Integration, Oracle GoldenGate, Oracle Data Integrator, Oracle Cloud Infrastructure Data Integration, and SOA Cloud Service.
- **Control and management tools** that enable recording, monitoring, notification, resource management, etc.

- **Connectivity and networking tools** such as DNS server, e-mail, FastConnect, health checks, load balancing, and virtual network in the cloud.
- **Storage tools** that enable archiving, block storage, data transfer, file storage, use of local NVMe SSD storage, object storage, etc.

2.2 Oracle Analytics Cloud (OAC)

Oracle Analytics Cloud (OAC) is a data analysis tool included in OCI that uses a graphical interface that allows the analyst to work intuitively and easily with a variety of features. OAC includes a wide range of tools for data visualization, custom analytics, business intelligence and advanced analytics. Connecting to different data sources is very easy, as is preparing and transforming data into the appropriate format. OAC uses machine learning methods for predictive insights (Oracle, 2023). As the name of the tool suggests, OAC is available as a cloud service, which greatly simplifies the use of the tool within the organization and makes it possible to work in the environment using only a browser. Figure 1 shows the dashboard in the OAC environment. The desktop can be personalized and adapted to the user's needs. By default, the latest workbooks, datasets, and data flows are displayed on the dashboard.

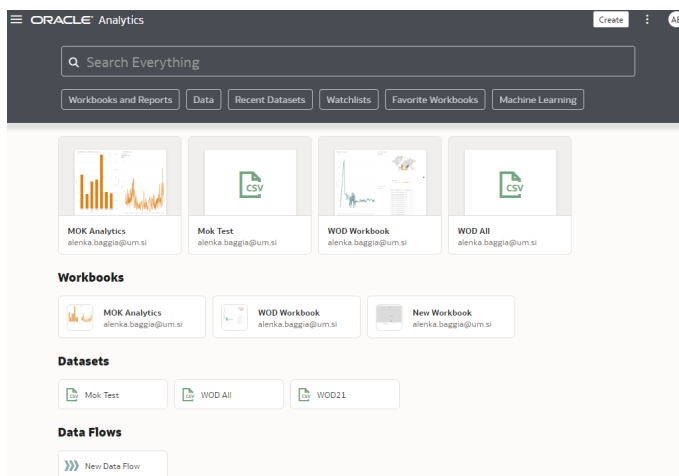


Figure 1: Oracle Analytics Cloud dashboard

Source: Own

As comprehensive cloud-based analysis platform OAC includes all the key functions required for a powerful data analysis tool:

- **Data integration and preparation:** Various data sources can be used and the process of cleansing, shaping and converting raw data into a format suitable for analysis is very intuitive. For example, a column in a dataset can be easily converted from a measure to an attribute, data formats can be changed, specific data formats can be used to visualise locations, etc.
- **Data visualisation:** Users can create interactive and insightful visualisations, dashboards, and reports without any special technical knowledge. In addition, OAC offers special automatic insights feature that uses AI to suggest different visualisations to the user.
- **Self-service versus advanced analytics:** On the one hand, OAC offers business users the ability to explore and analyse data themselves, but on the other hand, it also offers features such as predictive analytics and machine learning.

In addition, integration into the Oracle Ecosystem is one of the benefits of OAC, along with robust security measures and governance features to maintain control over the data. Since OAC is a cloud-native solution, it reduces the IT teams' infrastructure management efforts.

All these benefits led to the decision to use OAC as the primary tool for environmental data analysis in the EverGreen project. Three different cases were prepared to familiarise the user with the basic features of the OAC tool. The first case was that of the Municipality of Kranj, in which real environmental data on air quality was used. The case, the data used in this case and some examples of data analysis are presented in the following chapters.

3 Municipality of Kranj Case Study

In April 2022, Kranj was selected as part of the European Commission's project with the mission of implementation of 100 climate-neutral and smart cities by 2030. This was the result of an important step taken by the Municipality of Kranj in 2018 when it decided to implement environmental monitoring by setting up a smart city network for the Internet of Things (IoT). As part of this initiative,

indicative measuring devices were installed at strategically selected locations to systematically monitor air quality, noise levels and meteorological data. The locations were selected based on the assumption of increased air pollution due to emissions from various sources such as traffic, combustion plants and industrial activities. As part of this project, citizens can access real-time environmental data via their mobile devices and the official website of the Municipality of Kranj, leading to increased awareness and engagement (Mestna občina Kranj, 2023).

Pollutants and meteorological data are measured continuously at individual measuring stations. For our case study, dust particles PM₁₀ and PM_{2.5}, nitrogen oxides, expressed as NO₂, CO, O₃, temperature, humidity, air pressure and noise were included in the analyses.

The environmental regulations in Slovenia (Decree on Ambient Air Quality (Uredba o kakovosti zunanjega zraka, 2011; Uredba o spremembah in dopolnitvah Uredbe o kakovosti zunanjega zraka, 2015; Uredba o spremembah Uredbe o kakovosti zunanjega zraka, 2018) and Environment Protection Act (Zakon o varstvu okolja (ZVO-2), 2022) define the limit and target values that are decisive for the protection of human health. According to this regulation, the distinction between limit and target values is defined as follows below.

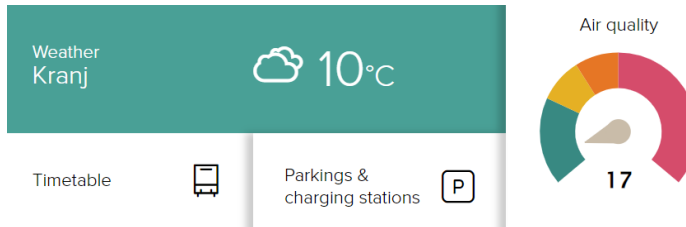
A scientifically based limit value aims to prevent, avoid or reduce harmful effects on human health or the environment. It is set so that it is reached within a certain period of time and may no longer be exceeded once it has been reached. A target value for the prevention, avoidance or reduction of harmful effects on human health or the environment is ideally achieved within a certain period of time. Table 1 provides an overview of the limit and target values for the parameters measured at the monitoring stations in the municipality of Kranj. Limit values have been set for all parameters except ozone, while a target value has been set for ozone.

Table 1: Limit/target values for the parameters observed

Parameter	Unit	Measurement time period	Limit/target value
Nitrogen dioxide (NO₂)	µg/m ³	1 hour	200, max 18 exceedances/year
		Year	40
PM₁₀	µg/m ³	24 hours	50, max 35 exceedances/year
		Year	40
PM_{2.5}	µg/m ³	Year	20
Carbon monoxide (CO)	Mg/m ³	8 hours	10
Ozon (O₃)	µg/m ³	8 hours	120, max 25 exceedances/year

Source: (Mestna občina Kranj, 2023)

Based on these measurements, the Air Quality Index (AQI) is used to display immediate information on current air quality so that they can adjust their activities according to air pollution. An example of an AQI meter is shown in Figure 2.

**Figure 2: Excerpt from the Smart Kranj website**

Source: (Mestna občina Kranj, 2024)

In addition to the environmental data, the sample data also contained noise values. According to the Decree on the Assessment and Management of Environmental Noise (Uredba o ocenjevanju in urejanju hrupa v okolju, 2004; Uredba o spremembah Uredbe o ocenjevanju in urejanju hrupa v okolju, 2019; Uredba o spremembah Uredbe o ocenjevanju in urejanju hrupa v okolju, 2022), there are four levels of noise limits, with levels II and III include residential areas that have a critical noise level of 65 and 80 dBA respectively.

3 Methodology

The input data for the analyses were provided by the MOK in .csv format. The air quality data, the air quality history and the air quality sensors for the period from November 23, 2022, to February 5, 2024, were included in the present analysis.

In order to carry out an efficient data analysis, the data contained in the dataset must be cleansed. The first challenge arose even before the data was imported into the Oracle APEX database tables (Oracle, 2024b). The values of PM10 and PM2.5, which were smaller than 2 were represented with smaller signs and the number 2: <2. This caused major problems when importing the data, as the data was initially treated as text and some values were distorted. To avoid this, we first replaced all strings »<2« with 1 before importing the data into the database.

The .csv files were first uploaded to the Oracle APEX instance in the Oracle Cloud Infrastructure to be cleaned and normalised before analysis. The three empty columns in *air_quality* and one in *air_quality_sensors* were dropped. Figure 3 shows the first three tables created in Oracle APEX.

AIR_QUALITY	
P * ID	NUMBER
SENSOR_ID	NUMBER
NO2	NUMBER
CO	NUMBER
O3	NUMBER
PRESSURE	NUMBER
HUMIDITY	NUMBER
TEMPERATURE	NUMBER
PM10	NUMBER
PM2_5	NUMBER
PM1	NUMBER
SO2	NUMBER
INDEX	NUMBER
NOISE	NUMBER
CREATED_AT	DATE
UPDATED_AT	DATE
AIR_QUALITY_CON (ID)	
AIR_QUALITY_IDX (ID)	

AIR_QUALITY_HISTORY	
P * ID	NUMBER
SENSOR_ID	NUMBER
TIME	VARCHAR2 (50)
DATE_	DATE
INDEX	NUMBER
CREATED_AT	DATE
UPDATED_AT	DATE
AIR_QUALITY_HISTORY_CON (ID)	

AIR_QUALITY_SENSORS	
P * ID	NUMBER
NAME	VARCHAR2 (100)
HARDWARE_ID	VARCHAR2 (255)
LATITUDE	NUMBER
LONGITUDE	NUMBER
CREATED_AT	DATE
UPDATED_AT	DATE
ACTIVE	NUMBER
AIR_QUALITY_SENSORS_CON (ID)	

Figure 3: First tables created in Oracle APEX

Source: Own

When reviewing the data, it became clear that the data is not normalised and many values are missing in the *AIR_QUALITY* table. Not all measurements were carried out at all locations and not all measurements were carried out in the same period. In addition, some measurements (e.g. AQI) are based on moving

averages of other measurements and are therefore only calculated when the required data is available. Since we did not want to lose so much valuable data, we decided to normalise the output. The AQI is available in each row for each ID. Therefore, this measure was included in the AQI table, along with the *sensor_id*, *created_at* and *updated_at* data. All other data was split into individual tables based on the ID and the specific parameter value. The tables were exported from APEX and imported into the OAC dataset. The ID was defined as a join condition for internal links between the individual data sources (Figure 4).



Figure 4: Initial dataset in Oracle Analytics Cloud

Source: Own

The process of data cleansing was continued in the OAC. First, the data was checked and the attributes defined. Based on the initial inputs, most of the imported data were identified as measures, so further steps were required to update the dataset. In addition, based on the expected analyses, the geolocation data (latitude and longitude) were converted to location settings and several conversions based on date data formats (day of the week, month of the year, time of year, time of day, etc.) were performed.

4 Data analysis and visualizations

After cleaning and formatting, the dataset was ready for analysis and visualisation. OAC offers the "Auto-Insights" feature, where visualisations and charts are actively created based on the obtained granularity of the dataset by selecting measures and dimensions and establishing relationships between the data elements. This process leads to a collection of insights from the dataset (Oracle, 2024). Apart from the automated insights, our first goal was to visualise a map of the sensor locations with the average AQI values as a mark diameter (Figure 5).

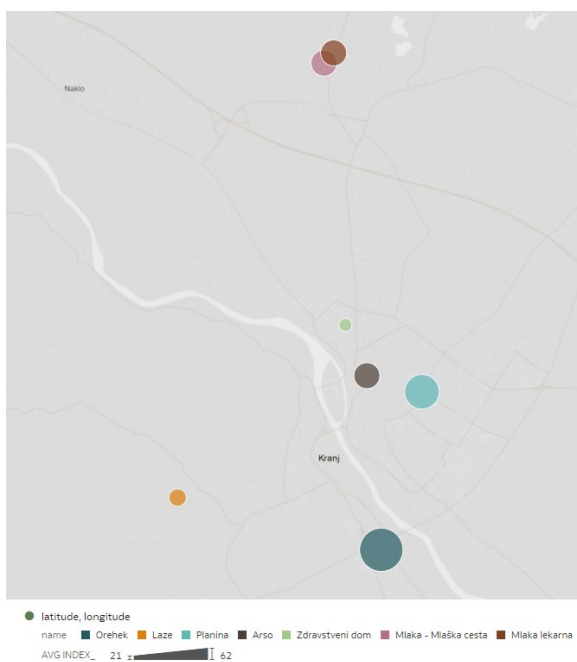


Figure 5: Locations of sensors and corresponding AQI values

Source: Own

From the variety of visualisations suggested by the Auto-Insight tool and our preferences, several visualisations were selected. First, insights into various possible presentations of the average AQI values, as shown in Figure 6.



Figure 6: Different visualizations of average AQI values

Source: Own

Further analyses focused on the noise level, the correlations between the AQI and other measured variables, and the graphical representation of PM2.5 and PM10 (Figure 7).

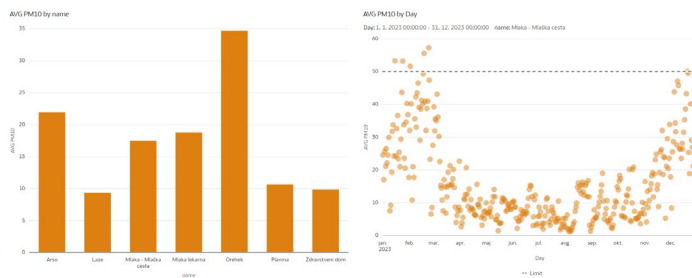


Figure 7: Visualizations of average PM10 values with limits

Source: Own

The selected visualisations presented here show only some of many different possibilities, but due to the limited length of the paper, we cannot present all of them.

5 Conclusions

Oracle Cloud Infrastructure offers a variety of functionalities, of which Oracle Analytics was used to analyse the environmental data recently collected in the Municipality of Kranj. During the development of the presented case, we experienced the flexibility of the platform. Starting with a wide range of input data and different data sources that can be used to define the dataset, to the multiple options for data cleansing and formatting. In addition, a recommendation tool in the dataset offers a variety of suggestions for improving the dataset, e.g. extracting part of the data or reformatting data. When the dataset is prepared, the visualisation tool also offers automatic generation of the most appropriate visualisation based on the type of data selected by the user. With the Auto-Insights tool, data analysis can be viewed from different perspectives and useful visualisations can be easily added to the presentation.

All in all, the OAC has proven to be an effective tool for data analysis, allowing both users with limited knowledge to take advantage of its many features and experienced users to visualise data from a variety of different perspectives. In line with the goals of the Evergreen project, further use cases are currently being developed to test the usability of the OAC, including the open data source of World Ocean data. By using different input data formats and analysis requirements, deeper insights will be gained that will later be shared with students as part of the piloting of the tutorials.

Acknowledgements

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DRUŽBENA ODGOVORNOST KOT ELEMENT IZOBRAŽEVANJA V ZDRAVSTVENI NEGI

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Po definiciji je družbena odgovornost tista osebna odgovornost, ki jo izkazujemo do celotne družbe. Cilj raziskave je ugotoviti razvitost osebne družbene odgovornosti študentov zdravstvene nege ter najti možna področja za razvoj odgovornosti. Metoda: Uporabili smo kvantitativno raziskovalno metodologijo in anketirali študente visokošolskega študijskega programa Zdravstvena nega (VS) na Fakulteti za zdravstvo Angele Boškin. Vzorec obsega 107 oseb. Merski instrument obsega trditve s področja družbeno odgovornega ravnanja ter motivov zanj. Rezultati: Anketiranim je med aktivnostmi družbeno odgovornega ravnanja najpomembnejša pomoč bolnim (71 %). V več kot 90 % pa sami sebe ocenjujejo s trditvami, ki jih lahko pripišemo v pravno in etično dimenzijo osebne družbene odgovornosti. Motivi za družbeno odgovorno ravnanje izhajajo iz notranje motivacije, najvišje je ocenjeno zadovoljstvo s svojim delom (PV = 4,7, SO = 0,6). Razprava: Rezultati so nam dali osnovo za umestitev vsebin osebne in družbene odgovornosti v študijske vsebine, saj izobražujemo in vzgajamo za poklice, kjer je ta zavest še kako pomembna, ravno tako kot je pomembna za prihodnost zdrave družbe.

Ključne besede:

družbena
odgovornost,
izobraževanje,
medicinske
sestre,
vrednote,
zdravstvena
nega

SOCIAL RESPONSIBILITY AS AN ELEMENT OF EDUCATION IN NURSING

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By definition, social responsibility is the personal responsibility that we show towards society as a whole. The aim of the research is to determine the development of personal social responsibility of nursing students and to find possible areas for the development of responsibility. Method: We used a quantitative research methodology and surveyed nursing students at Angela Boškin Faculty of Health Care. The sample consists of 107 persons. The instrument includes statements from the field of socially responsible behavior and motives for it. Results: Helping the sick is the most important among socially responsible behavior (71%). In more than 90%, however, they evaluate themselves with statements that can be attributed to the legal and ethical dimension of personal social responsibility. Motives for socially responsible behavior come from internal motivation, the highest rating is satisfaction with one's work (PV = 4.7, SO = 0.6). Discussion: The results gave us the basis for placing the content of personal and social responsibility in the study content, as we educate and train for professions where this awareness is important, just as it is important for the future of a healthy society.

Keywords:
social
responsibility,
education,
nurses,
values,
nursing

1 Uvod

Družbeno odgovorno delovanje v razvitem svetu se kaže kot zelo pomembno, saj zajema tiste dejavnosti, ki so v skladu s pričakovanji in vrednotami družbe. Temelji družbene odgovornosti v Evropski Uniji so bili zastavljeni v Zeleni knjigi (Green Paper on Promoting a European Framework for CSR - Commission of the European Communities, 2001) iz leta 2001 (Nahtigal, 2018). V samem jedru družbene odgovornosti je prizadevanje za etično delovanje, delovanje za skupno dobro in ustvarjanje blaginje za vse generacije, sedanje in generacije prihodnosti (Drobnič, 2018).

Delovanje, ki temelji na družbeni odgovornosti je povezano z ustrezno vzgojo in izobraževanjem, uveljavitvijo pravne države in večjo odzivnostjo državnih organov. Etično spoštovanje v vsakdanjem življenju je povezano z razvijanjem znanja na tem področju. Postavlja se vprašanje ali bo človeštvo razvilo družbeno odgovornost v vsakodnevni praksi ali pa bo uničilo možnosti obstoja človeštva. Iz tega sledi usmeritev v deset temeljnih zahtev družbene odgovornosti, ki so odgovornost do naravnega okolja, do prihodnjih rodov in za razvoj, do starejših, invalidov in za zdravje, do dela, do podjetništva, družbeno odgovorno korporacijsko upravljanje, družbeno odgovorno upravljanje javnega premoženja, družbeno odgovorno javno upravljanje, družbeno odgovorno zunanjo in varnostno politiko, do zgodovine in kulture (Bohinc & Mulej, 2018).

Družbena odgovornost je sestavni del ekonomske in družbene trajnosti, ki vpliva na kakovost življenja skupnosti. Zato morajo biti izhodišče ljudje, saj sodelujejo pri reševanju problemov družbe. V tem procesu imajo izobraževalne ustanove temeljno vlogo, saj na njih temelji odnos med akademskim svetom in realnostjo in nosijo težo družbenih sprememb. Na ta način se univerzitetna družbena odgovornost pojavi kot politika uspešnosti študentov, profesorjev in menedžerjev in vpliva na zadovoljstvo in dojemanje družbene odgovornosti. V raziskavi pri 120 študentih, starih od 18 do 38 let so Fonseca in sodelavci (2019) izmerili stopnjo družbene odgovornosti in zavzetosti za to področje v izobraževalnem procesu. Rezultati so pokazali, da je stopnja družbene odgovornosti in zavzetosti študentov na splošno visoka, upoštevajoč elemente poklica in delovanja, timskega dela in vpliva v ožjem okolju. Prav tako rezultati kažejo, da zavezanost drugim in okolju, iskanje skupnega dobrega, empatija in služenje drugemu predstavljajo elemente z najnižjo vrednostjo.

V Standardu za družbeno odgovornost ISO26000:2010 (SIST, 2012) je zapisana trenutno najbolj uporabljena definicija družbene odgovornosti: »Družbena odgovornost je odgovornost organizacije za vplive njenih odločitev in dejavnosti na družbo in okolje, da s preglednim in etičnim ravnanjem:

- prispeva k trajnostnemu razvoju, vključno z zdravjem in blaginjo družbe,
- upošteva pričakovanja deležnikov,
- je v skladu z veljavno zakonodajo in mednarodnimi normami delovanja,
- ter je integrirana v celotno organizacijo in jo izvaja v svojih odnosih« (Ekvilib inštitut, n. d.)

Ker je na področje izobraževanja za poklic zdravstvene nege precejšen poudarek na prostovoljnem in humanitarnem delu, ker je velik del kurikuluma namenjen vsebinam etike in ker se pričakuje visok nivo družbene odgovornosti, nas je zanimalo ali je temu res tako.

2 Empirični del

Cilj raziskave je bil ugotoviti razvitost osebne družbene odgovornosti študentov zdravstvene nege, najti možna področja za razvoj odgovornosti ter identificirati potrebe za umestitev v študijske vsebine.

2.1 Raziskovalna metodologija

Uporabili smo kvantitativno raziskovalno metodologijo in s pomočjo spletnega vprašalnika anketirali študente visokošolskega študijskega programa Zdravstvena nege (VS) na Fakulteti za zdravstvo Angele Boškin. Pred začetkom smo pridobili pozitivno mnenje Komisije za znanstveno - raziskovalno in razvojno dejavnost fakultete. Merski instrument je bil sestavljen na podlagi pregleda literature (Davis, et al, 2021, Kim, 2023) in obsega trditve s področja družbeno odgovornega ravnanja, osebnega delovanja v zdravstvu, motivov, ter ravnanja, ki nakazuje na osebno družbeno odgovornost. Uporabili smo spletni vprašalnik v programu 1Ka. Zanesljivost instrumenta je dobra, saj je za posamezne sklope vrednost Cronbach alfa med 0,762 in 0,889.

Populacija študentov v študijskem letu 2023/24 obsega 255 oseb, odgovorilo je 107, torej 41,9 % študentov, od tega 21 % moških in 79 % žensk. Povprečno so bili stari 28,4 (SO = 9,2) let.

Rezultate smo obdelali s programom SPSS, in uporabili uni in bivariatno statistiko, kjer smo za statistično pomembne razlike uporabili stopnjo tveganja na ravni 5 % in manj ($p \leq 0,05$).

3 Rezultati

Anketirance smo prosili, da izmed ponujenih možnosti, opredelijo tri prioritete aktivnosti, ki njim pomenijo družbeno odgovorno ravnanje. Ugotavljamo, da je najpomembnejša **pomoč bolnim** (71 %). Na drugem mestu po prioritetah je **Zagotavljanje zdravega in primernega delovnega okolja za zaposlene** (57,9 %) ter nato na tretjem mestu **Skrb za okolje in ekologijo** (53,3 %).

Zanimalo nas je, kakšni so odgovori študentov, če jih vprašamo o tem, katero vedenje velja za njih. Trditve se nanašajo na več vidikov družbene odgovornosti, kot: etično, filantropsko, okoljsko, pravno in ekonomsko odgovornost (Davis, et al, 2021).

Rezultati kažejo da je nad 90 % sodelujočih študentov označilo tiste trditve, ki jih lahko pripišemo pravni in etični dimenziji osebne družbene odgovornosti. Ostale trditve so izbrane v manjšem deležu, manj je filantropičnih aktivnosti, ekonomske in okoljske odgovornosti, še najmanj pa je sodelovanja v nevladnih organizacijah (28 % anketiranih).

Zanimalo nas je, ali je med študenti zaznati razlike glede na njihove sociodemografske značilnosti. Pomembne razlike smo našli glede na starost študentov, ter glede na to, ali imajo že svoje otroke ali ne.

Tabela 1: Študenti ocenjujejo da velja za njih

Trditvev	n=107	%
Izpolnjujem svoje zakonske / pravne obveznosti.	107	100
Vedno plačam svoje davke.	104	97,2
V naši družini so vsi člani vzgojeni za poštenost do drugih.	101	94,4
Vedno poskušam upoštevati zakonodajo.	100	93,5
Nikoli nisem škodoval drugim, čeprav bi mi to lahko koristilo.	99	92,5
Etika je zame bistvenega pomena, da v življenju delam prav.	97	90,7
Svoje otroke (ali bi jih, če bi jih imel/a) izobražujem o etiki.	97	90,7
V vsakdanjem življenju in porabi sem pozoren na varstvo okolja.	95	88,8
Kupujem izdelke, za katere vem, da jih bom kasneje uporabil.	86	80,4
Trud in denar namenjam pomoči drugim.	79	73,8
Izbiram osebne odločitve, ki vodijo k zmanjševanju onesnaževanja (tudi če so nepraktične/ nadležne).	78	72,9
Ne zapravim več, kot zaslužim.	78	72,9
Svoje prijatelje in družino spodbujam k sodelovanju v dobrodelnih dejavnostih.	76	71
Doniram dobrodelnim organizacijam, ki podpirajo socialne in okoljske namene.	71	66,4
Ne porabim več kot je potrebno.	68	63,6
Podpiram družbene in kulturne aktivnosti z vložkom denarja in časa.	60	56,1
Nekatere izdelke sem prenehal kupovati zaradi okoljskih razlogov.	52	48,6
Ne kupujem izdelkov, ki potencialno škodijo okolju.	51	47,7
Sodelujem z nevladnimi organizacijami.	30	28

Pri spodaj naštetih trditvah so študenti statistično značilno starejši:

- »V vsakdanjem življenju in porabi sem pozoren na varstvo okolja.« (t=2,547, p=0,018 (28,9±9,5 let vs 24,6±4,8 let)).
- »Ne kupujem izdelkov, ki potencialno škodijo okolju.« (t=2,298, p=0,024 (30,5±10,5 let vs 26,5±7,4 let)).
- »Nekatere izdelke sem prenehal kupovati zaradi okoljskih razlogov.« (t=2,641, p=0,010 (30,8±10,4 let vs 26,2±7,2 let)).
- »Svoje otroke (ali bi jih, če bi jih imel/a) izobražujem o etiki.« (t=2,316, p=0,033 (28,8±9,4 let vs 24,6±4,9 let)).

- »Nikoli nisem škodoval drugim, čeprav bi mi to lahko koristilo.« ($t=2,558$, $p=0,022$ ($28,7\pm 9,4$ let vs $24,5\pm 3,8$ let)).
- »Vedno poskušam upoštevati zakonodajo.« ($t=4,661$, $p<0,001$ ($28,8\pm 9,4$ let vs $23,4\pm 1,7$ let)).

S spodnjimi trditvami se tisti študenti, ki imajo svoje otroke statistično bolj strinjajo:

- »Doniram dobrodelnim organizacijam, ki podpirajo socialne in okoljske namene.« (hi-kvadrat=4,539; $p=0,033$).
- »Trud in denar namenjam pomoči drugim.« (hi-kvadrat=4,527; $p=0,033$).

Pri vprašanju o motivih za družbeno odgovorno ravnanje, vezano na delo v zdravstvu, je bilo med ponujenimi možnostmi najvišje ocenjeno **zadovoljstvo s svojim delom** ($PV = 4,7$, $SO = 0,6$), najnižje pa pritiski iz okolja (javnost, učna baza, fakulteta).

4 Razprava

Ugotavljamo, da je skladno s poklicem, ki ga že ali ga še bodo opravljali vključeni študenti, zanje najpomembnejša pomoč bolnim. Ta vidik je znotraj študija zdravstvene nege vpleten v skoraj vse študijske predmete.

Naši rezultati kažejo, da je večina sodelujočih študentov označilo tiste trditve, ki jih lahko pripišemo pravni in etični dimenziji osebne družbene odgovornosti. Kot ugotavlja Warshawski (2023) obstajajo pozitivne povezave med zdravstvenim aktivizmom in družbeno odgovornostjo ter med zdravstvenim aktivizmom ter filantropsko in okoljsko odgovornostjo študentov zdravstvene nege. Ugotavlja tudi, da obstajajo pomembne razlike glede na kulturo študentov in prostovoljnim delom. Tega vidika mi nismo raziskovali.

Filantropsko ravnanje je prisotno v manjši meri, ker sicer opazamo tudi v praksi, ker kljub spodbudam študentov, upada njihova pripravljenost za humanitarno in prostovoljno delo. Deloma to lahko verjetno pripišemo obremenitvam študentov v povezavi s študijem.

Motivacija se začne s kakšnim razlogom ali željo, ki izvira iz posameznikove notranjosti, ali iz njegovega okolja (Lipovec, 1987, str. 109). V raziskavi smo ugotovili, da najvišje ocenjen motiv izhaja iz notranjosti, kot zadovoljstvo s svojim delom, kar se sklada s humanistično usmeritvijo poklicev v zdravstvu, v nasprotju s trditvijo glede pritiskov iz okolice, kot najnižje ocenjeno trditvijo.

Ideja o potrebi za umestitev družbene odgovornosti v študijske vsebine se tako kot drugod tudi na Fakulteti za zdravstvo Angele Boškin že nekaj časa razvija, tako kot trajnostni razvoj, ki sta v zadnjem času ena od odgovorov na pereče probleme družbe. Generacije študentov se spreminjajo in vzgajanje za bodočnost, tako zdravstva, etike, okolja, filantropije kot drugih vidikov, so teme ki jih je potrebno nasloviti.

Priporočljivo je, da vsebina o družbeni odgovornosti prežema celoten kurikulum in da akademski programi ponujajo predmete, ki vključujejo družbene, znanstvene in kulturne dejavnosti, v katerih sodelujejo študenti. Zato je treba v akademskih programih in razredih spodbujati projekte, dejavnosti in veščine, kot so vodenje, ustvarjalnost, strpnost, odgovornost in samospoštovanje. Glede na navedeno mora univerza pripravljati odgovorne strokovnjake z vizijo razvoja svojega neposrednega okolja, gradnje države in globalnega sveta (Fonseca, et al., 2019).

5 Zaključek

V kolikor se zavedamo te odgovornosti in jo razumemo, je lahko izkazan naš prispevek k preprečevanju negativnih pojavov na različnih področjih kot so npr. vojne, bolezni, lakota, revščina, onesnaževanje okolja, energetska izčrpavanje planeta, podnebne spremembe itd.

Rezultati raziskave so nam dali osnovo za umestitev vsebin osebne in družbene odgovornosti v študijske vsebine, posebej pa so dali v razmislek, kako spodbuditi in utrditi aktivnosti na področju prostovoljnega in humanitarnega dela.

V zdravstveni negi izobražujemo in vzgajamo osebe, pri katerih bo oz. je zavest o etiki, filantropiji, ..., sočutju do sočloveka, vseh živih bitij in Zemlje konec koncev še kako pomembna, ravno tako kot je pomembna za prihodnost zdrave družbe.

Zahvala

Hvala študentom, ki so si vzeli čas med intenzivnimi študijskimi obveznostmi in sodelovali v raziskavi.

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LESSONS LEARNED BY ITALIAN NURSE EXECUTIVES DURING PANDEMIC TIME: FINDINGS FROM A QUALITATIVE STUDY

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The experience of the Coronavirus Disease-19 pandemic was an unexpected condition for all healthcare professionals, characterized by unprecedented events, which needed of timely responses and complex decisions, not only in the clinical setting, but also in the organizational one. While there are many studies focused on clinical professionals, those including top managers remain occasional and, in any case, more focused on the frontline setting management. Our study has highlighted those important decisions taken by Executive Nurses regarding the allocation of resources, the quality of care, and the context of care, bringing out the fluctuating emotional implications. The lessons learnt by them may address the future pandemic responses.

Keywords:

nurse
executives,
complex
decisions,
COVID-19
pandemic,
qualitative
study,
clinical
professionals

1 Background

1.1 The pandemics and challenges for healthcare systems

The Coronavirus-19 (COVID-19) pandemic, which spread globally in early 2020 despite the containment and isolation measures, had devastating consequences for economy, healthcare systems and professionals. In fact, the pandemic triggered a series of emerging challenges for organizations (e.g., lack of resources), imposing a stress test over the healthcare systems (Begun and Jiang, 2020). In general, unexpected events, as the pandemic, are characterized by three dimensions: complexity of the causes, the speed of spread, and the unpredictability of the impact (Begun and Jiang, 2020). More significant are these features, the greater the problems may be encountered (Begun and Jiang, 2020). As COVID-19 pandemic reproduced these features, its management was alligned to major emergencies and catastrophes (disaster medicine) (Begun and Jiang, 2020). The pandemic event was described as an epochal crisis and a threat for global public health (Deldar, Froutan and Ebadi, 2021) creating changes in the mental, social and organisational constructs of healthcare systems and in the roles of healthcare profesisonsl (Aydogdu, 2023). In fact, their field of practice has expanded or modified in different settings than the usual one (Jackson and Nowell, 2021). This unexpected experience required timely responses through challenging decisions, not only in the clinical field, but also at the organizational one (Begun and Jiang, 2020), upsetting consolidated routine practices.

However, while several studies on complex decisions taken both frontline professionals and educators have been produced to date, a few have been conducted in the organizational fields.

1.2 Evidence regarding frontline nurses in times of pandemic

To date, studies on complex decisions during the pandemic period focused primarily on the experience of frontline professionals, i.e. nurses and physicians with clinical responsibilities and roles; on the other hand, research that include managers, especially executives, remain occasional and more centered on nurses with roles close to the frontline (middle managers).

During the pandemic, frontline professionals have been documented to be under significant and prolonged stress were asked to respond to the needs imposed by the emergency, in lack of material and human resources, in a context of uncertainty and conflicting communications (Danesh, Garosi and Golmohamadpour, 2021). One of the first measures taken to deal with COVID-19 was the isolation of patients and professionals, distancing from positive assisted persons, avoiding the contact through physical barriers and personal protective equipment (PPE) (Ambrosi et al., 2020) causing a great impact on nurses' practices resulting in important emotional burden. This caused health problems to professionals and the perception of being under pressure on several fronts facilitated the feeling of psychophysical exhaustion (Danesh, Garosi and Golmohamadpour, 2021). The published evidence reports challenging situations or that mostly had an ethical and moral basis.

Together with the team, even clinical nurses found themselves deciding who to take care of. They had to decide what kind of care to provide, whether to take care of everyone even if not optimally or try to assist only a few people well (Ambrosi et al., 2020). For all the reasons above described, their nursing style underwent changes, jeopardizing ethical and professional values. Moreover, the continuous reorganization undermined each work setting; the nursing care delivery model was also changed, and the safety of patients (and that of nurses) negatively influenced triggering several ethical implications.

1.3 Evidence regarding nurse educators in times of pandemic

In the academic context, the complexities emerged to be similar to that found within the healthcare trusts. In fact, albeit in two completely different scenarios, the problems and the issues that the educators had to deal with were similar. The professionals in both contexts faced logistical issues and had to deal with complex decision-making processes. The peculiar purpose in the educational context was the high-quality student training with a student-centered approach (Ion et al., 2021). Faced with a pandemic event of such magnitude, which no one was aware of, nurse educators had to develop flexibility and the ability to adapt to this crisis. Also in this field, lack of planning (Ion et al., 2021) and of a specific blueprint (Farra et al., 2022) were underlined.

Communication (Ion et al., 2021) and students' support (Farra et al., 2022) were described as fundamental. The most complex decisions were centered on safeguarding safety of staff and students, sometimes perceiving this as an ethical dilemma (Farra et al., 2022). The choices related to safety, in particular of the students, have required to balance risks and benefits, while remaining within the framework of professional and academic standards (Ion et al., 2021).

1.4 Executive Nurses

Executive Nurses experienced high levels of anxiety and stress in the attempt to manage these critical matters (Gab Allah, 2021). These issues involved not only purely organizational problems, such as the management of human resources or the coverage of shiftwork, but also compassionate aspects, such as providing support both to patients and families and to overwhelmed professionals (Ozmen and Yurumezoglu, 2022). Also, emotional experience of managers was a critical element. In fact, they experienced feelings of anxiety in not being able to provide appropriate care to the citizens (Ozmen and Yurumezoglu, 2022) and they saw their role completely changed (Kagan et al., 2021; Jackson and Nowell, 2021). Situational uncertainty has been the most important issues documented (Farra et al. 2022) as well as difficulties/challenges to ensure the safety of patients and that of nurses (Freitas et al., 2021). Also management of psychological and emotional health issues (Aydogdu, 2023; Deldar, Froutan and Ebadi, 2021) were described as well as concerns for staff well-being (Joslin and Joslin, 2020). The topic of creating a "ad hoc" training for an unknown pathology (Freitas et al., 2021) or concerns for the support of carers and their families through communication (Kagan et al., 2021) were both also preminent. Moreover, Executive Nurses who confronted themselves with inappropriate practices and inequity issues (Atli Özbaş and Kovancı, 2022) have lived moral distress and ethical dilemmas triggering complex decisions (Jeffs et al., 2020). Nurse manager education (Gab Allah, 2021; Jackson and Nowell, 2021), was found to be inadequate for an effective management of emergency situations.

However, after an initial more emotional reaction to the pandemic, in which the most represented feelings were negative, a vision emerged more aimed at capitalizing on a complex experience and seizing opportunities.

2 Aim of the study

The main aims of the study were (a) to explore which were the three most complex decisions undertaken by Executive Nurses (ENs) during COVID-19 pandemic and in particular during the first and second wave; (b) to identify most complex perceived period for ENs in order to develop strategies and blueprints for the future; and (c) to investigate ENs' emotional and professional experience.

3 Methods

By using a 'Reflection on action' approach (Schon, 1983), a purposeful sampling of ENs who managed the pandemic crisis from its beginning to its conclusion were involved. They worked in healthcare trusts located in one of the most affected regions of Italy, which reported the highest cases and deaths.

A descriptive qualitative study design (Sandelowski, 2010) was performed and reported according to the COnsolidated criteria for REporting Qualitative research (COREQ) guideline (Tong et al., 2007). Semistructured interviews were conducted until data saturation (Patton, 2015), transcribed verbatim and analysed by means of a content analysis framework (Elo & Kyngäs, 2008). The study was approved by the Internal Review Board of the University of Udine, Italy.

4 Findings

14 nurse managers participated in the study (10 female). Their mean age was 59 years (range: 51-63 years) and their mean working experience was of 35 years (range: 26-45 years).

ENs highlighted themes related to more complex period, experience, complex decisions, and suggestions for the future. In particular, the first pandemic wave was described as the most complex period of the COVID-19 era with a focus on emotional response. On the other hand, the second and third waves were characterized by managerial and organizational issues.

Regarding suggestions, a picture of general unpreparedness of health systems in dealing with a pandemic crisis emerged. The need of a pandemic blueprint that includes early actions also emerged. It was suggested to create regional and local networks yet preserving a single control body. Moreover, at a local level a clear definition of roles and responsibilities was recommended as well as skills and resources mapping. Furthermore, the importance of working as a multidisciplinary team was underlined in order to achieve shared objectives through discussion, integration and an effective communication. Communication was meant to involve not only relations among healthcare professionals, but also with community. Finally, an appropriate training programme including also simulation, was considered essential as well as psychological support.

The 39 themes that emerged concerning complex decisions have been aggregated into 3 categories: "Undertaking complex decisions", "Implications of a fluctuating emotional experience" and "An experience of growth".

4.1 Undertaking complex decisions

The first complex decisions concerned the logistics. In particular, hospitals were revolutionized since the beginning to create new intensive care beds or maintain COVID-free facilities. The epidemiological fluctuation made it necessary to constantly reorganize and adjust the results of previous work which aim was to redesign procedures and paths, also redistributing resources and rationing them, especially personal protective equipment.

The spread of the pandemic required the decision regarding who to take care of. ENs in partnership with clinical teams had to decide whether to take care of everyone even if not optimally or to choose urgent conditions to be treated. This was necessary from the moment that COVID-19 patients' treatment attracted all resources. Subsequently, when vaccines were made available, nurse managers had to evaluate the establishment of new strategies functional to the massive vaccination campaign and to decide on an efficient reallocation of the necessary staff, often in lack of the required skills. Staffing shortages were exacerbated when many clinical nurses were positive to the tests, but also when many of them decided to abstain from the vaccine. This has confronted managers with complex decisions regarding the replacement of these resources and the suspension of those that are not aligned

on prophylaxis. Moreover, financial rewards linked to extraordinary activities and shifts coverage, were made available in all companies. This put managers in the difficult position to manage financial resources themselves, impacting the healthcare trusts' budget. Finally, NEs with organizational responsibilities expressed their difficulty in balancing safety and quality of care, having to compromise the latter at times also with limitations to caregivers.

ENs perceived their roles changing and expanding beyond their ordinary responsibilities. This expansion of roles led to the perception of a great sense of responsibility, both professional and in an ethical sense. In addition to the sense of responsibility, nurse leaders, with their decisions, found themselves experiencing a visibility they never had before and suffered a strong and unknown pressure, including the one performed by the social media.

A further element of complexity in the decisions was the total novelty and unpredictability of the situation that led managers to make decisions not always based on the available scientific evidence, often learning only from practical experience.

4.2 Implications of a fluctuating emotional experience

The strongest feeling was uncertainty, caused by a lack of knowledge of what was happening, so exceptional as to generate a sense of amazement and unreality. Faced with such unusual scenarios, many managers had a sense of helplessness and vulnerability. In such an 'alien context', the perception of the end and the management of the deceased were critical elements even for NEs.

There was also a sense of guilt for the choices made and their consequences. All this increased feelings of discomfort, fear and loneliness in choices. This complex emotional system had brought out the feeling of unpreparedness for the situation.

In addition to emotions, two further themes emerged: the need to face ethical dilemmas and the perception of being completely immersed in the pandemic emergency, having with the feeling of wasting precious time for oneself.

4.3 An experience of growth

The pandemic was seen as an extraordinary moment, remembered almost with *détente*. Many participants recognized that they have a great inner strength in facing the situation, strongly believing in their own abilities as leaders. There were also episodes that brought out the satisfaction for one's work, the pride of belonging to the profession and the awareness of having given the best. With respect to the relational network created, issues related to the perception of support by the nursing group with an exceptional sense of belonging to the team emerged.

Finally, participants perceived, despite the difficulties, that they were in a privileged position and that they were lucky to be able to 'live in the moment', while everyone had crystallized their time in the lockdown.

5 Discussion

The crisis caused by COVID-19 pandemic involved health systems at all levels. The topic of complex decisions in the pandemic era, undertaken by nurses with organizational responsibilities, inserts itself in the theoretical frameworks of the "Cognitive Continuum" by Hammond (Bjørk and Hamilton, 2011) and "Decision Making" by Johansen and O'Brien (Johansen and O'Brien, 2016).

First, by considering Hammond's Theory of the "Cognitive Continuum", it is possible to verify how the decision-making process was configured during the pandemic period, similar to an intuitive-interpretative model, of which decision-making processes are used for an undefined activity (Sist and Palese, 2023). Intuition, in fact, is an intrinsic component of decision-making that consists of a complex critical judgement summarizing different knowledges in uncertain, ambiguous scenarios (Johansen and O'Brien, 2016). During the pandemic, the problem of health to be managed was configured as an acute, unstable and unpredictable event that required a constant and up-to-date evaluation of events, with a to be defined in a short time response through an unstructured knowledge, given the few notions circulating on the issue.

It is clear, therefore, that the pandemic event generated a condition of high situational uncertainty and a general unpreparedness of health systems to respond to such powerful events. If, on the other hand, we delve into the modality and process according to which decision making was conducted, Johansen's "Decision Making" model provides us with further explanations.

The occurrence of the pandemic and what characterized it, can be considered the antecedents of decision-making, which were influenced by nurses' experiences with organisational responsibilities, conditioned in turn by external factors (context, such as stress and the reference setting, and internal factors, such as experience and values). Within this scenario, the transition from living a given situation to undertaking a consequent decision took shape.

6 Conclusions

In conclusion, the pandemic is read as an event with an unpredictable, acute development and with a need for rapid responses guided by intuition, in a context influenced by antecedents and contextual factors that affect the final objective, that is the decision, indeed.

The results of this study are relevant to understand where nurses with responsibilities have encountered the greatest difficulties. Findings allow to set up plans that can be exploited in the future, encouraging regional and national knowledge sharing and networking, rather than just local connections. To gather suggestions from experts, specifically NEs, is relevant to systematize future informed choices. Further research should investigate in depth causes and effects of the undertaken decisions and how to implement leaders' education on disaster medicine and pandemics.

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DIGITALNA TRANSFORMACIJA: SPREMEMBE IN PRILOŽNOSTI V KADROVSKI FUNKCIJI

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Zaposleni predstavljajo ključni vir za doseganje ciljev v organizacijah, kadrovska funkcija pa je tista, ki se z njimi ukvarja. V kontekstu digitalne transformacije organizacij se kadrovska funkcija sooča s spremembami, saj upravljanje kadrovskih virov v sodobnih organizacijah vključuje uporabo digitalnih tehnologij. Cilj prispevka je prek pregleda literature prikazati spremembe kadrovske funkcije, ki jih prinaša digitalna transformacija ter identificirati ključne prednosti, izzive in priložnosti uporabe digitalnih tehnologij glede na dosedanje raziskave. Ugotovitve kažejo na široko uporabo digitalnih tehnologij v kadrovski funkciji, kar prinaša optimizacijo kadrovskih procesov in povečanje učinkovitosti upravljanja s kadrovskimi viri. Digitalna transformacija zahteva prilagodljivost in prehod vloge kadrovske funkcije od administrativne k bolj strateški vlogi. Sodobna kadrovska funkcija prek razvoja zmožnosti zaposlenih in uporabe informacij za odločanje prispeva k doseganju ciljev in digitalni transformaciji organizacije. Na podlagi ugotovitev priporočamo organizacijam aktivno vlaganje v digitalne tehnologije za podporo kadrovski funkciji ter razvoj kompetenc zaposlenih za uspešno prilagajanje digitalni dobi.

Ključne besede:

kadrovska funkcija, kadrovski management, upravljanje s kadrovskimi viri, digitalna transformacija, digitalne tehnologije

DIGITAL TRANSFORMATION: CHANGES AND OPPURTUNITIES IN HUMAN RESOURCES FUNCTION

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Employees are a crucial factor in achieving organizational goals, and the human resources (HR) department is the one managing them. Amidst the digital transformation of organizations, HR is facing changes, as modern HR management integrates digital technologies. The aim of this article is to shed light on the changes in HR due to digital transformation and to identify the key benefits, challenges and opportunities of using digital technologies, based on literature review. The findings highlight the widespread use of digital tools in HR, resulting in process optimization and greater efficiency in HR management. Digital transformation requires adaptability and is transforming the role of the HR function from administrative to strategic. By fostering human capital advancement and making informed decisions, the modern HR function contributes to the achievement of goals and successful digital transformation. Based on the findings, organizations are recommended to invest in digital technologies to support HR function and develop employees' skills.

Keywords:

HR function,
personnel
management,
human
resources
management,
digital
transformation,
digital
technologies

1 Uvod

Organizacije se v zadnjih letih spreminjajo v smeri digitalne transformacije, kar prinaša spremembe v nalogah, delu in vlogi kadrovske funkcije. Organizacije sestavljajo različne funkcije, ki skupaj oblikujejo poslovni proces. Kadrovska funkcija je med njimi tista, ki zagotavlja zadostno število ustreznih zaposlenih, da poslovni proces lahko poteka; kadri oziroma zaposleni so ljudje, ki delujejo v organizacijah in so pri tem organizirani; kadrovske viri pa so vsi elementi, povezani z njihovim upravljanjem in izkoriščanjem v organizaciji (nanašajo se na človeški kapital v organizaciji, kar vključuje npr. zmožnosti, sposobnosti, znanja, izkušnje, vrednote, motivacijo, angažiranost in inovativnost zaposlenih, organizacijsko kulturo ipd.) (Ferjan in Bernik, 2022; Rozman, 2017; Bernik, 2017). Kadrovska funkcija (katere nosilci so kadroviki, kadrovske strokovnjaki ali kadrovske managerji oziroma zaposleni, ki opravljajo naloge na področju kadrovske funkcije) v organizacijah izvaja aktivnosti, povezane z organiziranjem in upravljanjem zaposlenih, s ciljem podpore dejavnosti organizacije pri doseganju zastavljenih ciljev (Peljhan idr., 2010). V prejšnjih fazah pojmovanja organizacije je kadrovska funkcija imela vlogo podpore administrativnim funkcijam na področju zaposlenih, današnja kadrovska funkcija pa povezuje vodstvo organizacije in zaposlene ter ima strateško vse bolj pomembno vlogo (Ferjan, 2018). Zadnja leta se kadrovska funkcija sooča s temeljnimi in hitrimi spremembami, povezanimi digitalno transformacijo organizacij. Pojmu digitalna transformacija se v raziskavah in praksi upravljanja v organizacijah posveča vse več pozornosti, saj je pritisk na organizacije, da se digitalizirajo, vse večji. Digitalna transformacija organizacij predstavlja usmerjen pristop k spreminjanju poslovanja z izkoriščanjem digitalnih tehnologij za celovito preoblikovanje organizacij (Rožanec in Lahajnar, 2021; Marolt in Lenart, 2021), kadrovska funkcija pa igra ključno vlogo pri tem procesu, saj omogoča usklajevanje zaposlenih s cilji organizacije (Liu in Su, 2022; Vardarlier, 2019; Ferjan, 2018).

Cilj prispevka je predstaviti nekatere ugotovitve avtorjev o digitalni transformaciji v kadrovske funkciji ter skozi pregled teoretičnih izhodišč opisati spremembe in novo vlogo kadrovske funkcije v organizacijah. Namen proučevanja sprememb kadrovske funkcije in njene nove podobe zaradi vplivov, povezanih s tehnološkimi spremembami in digitalizacijo je pripomoči k razumevanju teh sprememb iz vidika organizacij ter olajšati prihodnje raziskovanje. Prispevek je bil pripravljen s pregledom literature; z metodo deskripcije, kompilacije in sinteze je bila povzeta

literatura o digitalni transformaciji v povezavi s kadrovsko funkcijo, z induktivno metodo so bila oblikovana predstavljena spoznanja. Prispevek se začne s predstavitevjo nekaterih temeljnih spoznanj, povezanih z digitalno transformacijo v organizacijah. V nadaljevanju se osredotoča na spremembe, ki jih klasični kadrovski funkciji prinaša digitalna transformacija. Sledijo nekatere priložnosti in primeri uporabe digitalnih tehnologij v kadrovski funkciji, predstavljene so prednosti digitalne transformacije za kadrovsko funkcijo ter izpostavljeni nekateri izzivi. Sledi razprava o ugotovitvah različnih avtorjev v povezavi s predlogi za uspešno digitalno transformacijo v kadrovski funkciji in ustrezno ravnanje z zaposlenimi ob uvajanju digitalnih tehnologij. V zaključku so povzeta in izpostavljena ključna dejstva glede na pregledano literaturo, ocenjena je njihova uporabnost ter podan razmislek o možnih nadaljnjih raziskavah. Znanstveni doprinos prispevka predstavlja sinteza spoznanj, ki pripeljeva k celostnemu vpogledu v digitalno transformacijo kadrovske funkcije in prinaša izhodišča za nadaljnje raziskave področja. V obstoječi literaturi se te vsebine pogosto obravnavajo fragmentirano po posameznih kadrovskih procesih, tehnologijah, individualnih pristopih ter v različnih kontekstih. Prispevek združuje ugotovitve avtorjev o novi vlogi kadrovske funkcije in ravnanju z zaposlenimi skozi digitalno transformacijo iz različnih perspektiv ter izrisuje širšo sliko digitalne transformacije kadrovske funkcije, s čimer omogoča poglobljeno razumevanje sprememb in njihovih koristi ter možnih izzivov digitalne transformacije kadrovske funkcije ter na podlagi ugotovitev avtorjev podaja praktične smernice, uporabne v praksi, ki predstavljajo praktični doprinos.

2 Digitalna transformacija in spremembe v kadrovski funkciji

Henriette idr. (2015) so v sistematičnem pregledu literature razkrili, da so stranke organizacij vse bolj zahtevne, konkurenca pa vse bolj disruptivna z vse bolj inovativnimi in vse manj tradicionalnimi pristopi k poslovanju na vseh področjih v različnih gospodarskih panogah. Organizacije zato izkoriščajo vse več priložnosti digitalizacije, ki pa ni samo tehnološki premik, ampak zahteva prilagajanje zaposlenih. Trg se vse hitreje spreminja, kar zahteva od organizacij dinamičnost in odzivnost. To za zaposlene v organizacijah pomeni stalno spreminjanje in optimiziranje načina dela, predvsem s pomočjo uvajanja tehnologij v način dela, izdelke in storitve ter način povezovanja znotraj organizacij in izven njih (Marolt in Lenart, 2021; Kljajić Borštinar in Pucihar, 2023; Saldanha, 2019). Rožanec in Lahajnar (2021) opisujeta štiri stebre digitalne transformacije, ki so: poslovni modeli

(inovacije), poslovni procesi, tehnologije in ljudje ter s tem izpostavljata, da digitalna transformacija ni le nov način poslovanja z integracijo tehnologij, temveč stalno spreminjanje strategij in poslovnih modelov ter vodenje s spodbujanjem inovacij in zagotavljanjem stalnega razvoja kompetenc zaposlenih.

Digitalna transformacija se nanaša na spremembe v temeljnem načinu delovanja organizacij. Te spremembe izhajajo iz uporabe digitalnih tehnologij in preoblikujejo poslovne modele, zmožnosti organizacij ter organizacijske odnose zunaj in znotraj organizacij (Pucihar idr., 2021; Gašperlin idr., 2021). Digitalna transformacija predstavlja v organizacijah uporabo tehnoloških inovacij za ustvarjanje novih ali spreminjanje obstoječih poslovnih procesov, kulture in pristopov, da bi se organizacija prilagodila spreminjajočim se tržnim in poslovnim potrebam (Rožanec in Lahajnar, 2021). Digitalna transformacija vpliva na celotno organizacijo, saj zahteva spremembe vseh organizacijskih procesov. Marolt in drugi (2023) na podlagi ugotovitev raziskave o vplivu pandemije Covid-19 na digitalno transformacijo organizacij izpostavljajo, da brez uporabe digitalnih tehnologij poslovanje organizacij v prihodnosti ne bo mogoče. Erjavec idr. (2019) v svoji raziskavi ugotavljajo, da je digitalizacija bolj kot tehnološki izziv, poslovni izziv. Ustrezno naravnana in močna organizacijska kultura je osnova za uspešno digitalno transformacijo, pri čemer je strateško ravnanje z zaposlenimi in njihovimi zmožnostmi ključnega pomena.

2.1 Vpliv digitalne transformacije na kadrovske funkcije

Digitalna transformacija kadrovske funkcije predstavlja pomemben premik v načinu izvajanja kadrovske aktivnosti, s poudarkom na uporabi digitalnih tehnologij, aplikacij in orodij (Vardarlier, 2019). Ta premik spodbuja potreba po enostavnem, hitrem in varnem ravnanju z zaposlenimi, kar omogočajo številne digitalne rešitve, hkrati premik k novemu načinu izvajanja aktivnosti kadrovske funkcije s pomočjo tehnologij prinaša tudi izzive, kot je potreba po pridobivanju novih veščin in kompetenc (Barišić, 2021). Fedorova idr. (2019) predstavljajo pregled študij, ki raziskujejo vpliv uvajanja digitalnih tehnologij v upravljanje z zaposlenimi v Rusiji. Raziskava kaže, da digitalizacija kadrovske funkcije prinaša vse manj rutinskih nalog, manjša tveganja za človeške napake ter sproščanje časa za reševanje bolj pomembnih vprašanj, pri čemer kadrovikom omogoča učinkovitejšo uporabo njihovega znanja in veščin pri reševanju poslovnih problemov. Liu in Su (2022) navajata, da je digitalna transformacija izboljšala kakovost upravljanja z zaposlenimi. Glavne ugotovitve Liu

in Su (2022) so povezane z analizo nekaterih aktivnosti upravljanja z zaposlenimi in izpostavljajo prioritete, prek katerih kadrovska funkcija ustvarja vrednost v organizaciji in prispeva k uspešnosti. Dodajata, da se organizacije skozi digitalno transformacijo morajo osredotočiti ne le na tehnologijo, temveč na zmožnosti in kompetence, motivacijo ter angažiranost za razvoj zaposlenih in organizacijsko vedenje v odnosu z digitalno transformacijo. V ravnanju z zaposlenimi za doseganje ciljev digitalne transformacije in poslovnih ciljev Liu in Su (2022) poudarjata pomen prilagodljivosti organizacije, ustreznega upravljanja z znanjem in talenti ter spodbujanje sprejemanja digitalnih tehnologij med zaposlenimi v odzivu na spremembe v konkurenčnem okolju.

Hemantha (2021) izhajajoč iz rezultatov raziskave ugotavlja, da so izvršni direktorji v letu 2019 v večini organizacij uvedli vsaj eno digitalno tehnologijo. Kadrovska funkcija je pri tem strateški partner vodstva organizacije, ki pomaga usmerjati zaposlene v skladu s poslovno strategijo v digitalno transformacijo. Hemantha (2021) navaja, da je sodobna kadrovska funkcija agent sprememb, ki olajšuje in vodi organizacijo skozi sprejemanje novih tehnologij, je administrativni strokovnjak, ki s pomočjo digitalnih orodij optimizira kadrovske procese, ter zastopnik zaposlenih, ki v digitalni dobi omogoča inovativne in dostopne rešitve za upravljanje z zaposlenimi. Po Deloitte (2017) kadrovska funkcija skozi digitalno transformacijo upravlja digitalno delovno okolje ter pridobiva in razvija digitalne kadrovske vire v organizacijah. Sodobna, digitalna kadrovska funkcija se v organizacijah ukvarja z novimi upravljalnimi praksami, pri katerih uporablja tehnologijo za obvladovanje podatkov, upravljanje fleksibilnih oblik dela (na daljavo), komunikacijo in sodelovanje, krepi kulturo ustvarjalnosti in inovacij ter olajšuje razvoj zmožnosti in talentov v organizaciji.

2.2 Spremembe v kadrovski funkciji zaradi digitalne transformacije

Bernik (2017) opisuje spremembe gospodarskih in družbenih sistemov zaradi tehnološkega razvoja ter ugotavlja, da bodo te vplivale tudi na način ravnanja z zaposlenimi v organizacijah. Hays in Kearney (2001) navajata, da tehnološke inovacije postavljajo klasične načine upravljanja z zaposlenimi v preteklost, saj kadrovske managerji kljub tradicionalnim vrednotam in pogledu na kadrovske funkcije vse več časa posvečajo upravljanju informacij in obvladovanju programske opreme, zlasti sistemov za upravljanje informacij o zaposlenih (kadrovskih

informatijskih sistemov, v nadaljevanju KIS), medtem ko se rutinska kadrovska opravila v vse večjem obsegu izvajajo avtomatsko. Kadrovska funkcija postaja zaradi digitalne tehnologije vse bolj usmerjena k pridobivanju, obdelavi in izkoriščanju informacij, ki morajo biti dostopne, pregledne in enostavne za uporabo za zaposlene v vseh procesih (Sakarina idr., 2022; Tyagi idr., 2020; Fenech idr., 2019; Silva in Lima, 2018; Kassim in Sherah, 2012).

V organizacijah, kjer so že implementirane digitalne tehnologije, so se kadrovske prakse močno spremenile. Narava dela se zaradi razvoja tehnologij spreminja hitreje kot zmožnosti zaposlenih, zato med zmožnostmi zaposlenih ter zahtevami delovnih mest nastaja razkorak. Digitalna transformacija prinaša nove zahteve za kadrovske funkcije, ki mora zagotoviti, da so zmožnosti kadrov usklajene s potrebami digitalne dobe (Sakarina idr., 2022; Fenech idr., 2019; Hays in Kearny, 2001). Chán in Balková (2022) opažata pomanjkanje usposobljenih kandidatov za delovna mesta na trgu dela in s tem povezane potrebe po pridobivanju novih kompetenc obstoječih zaposlenih, kar se odraža v novih pristopih kadrovske funkcije. V skladu s Chán in Balková (2022), Emran in Elhony (2023) o pristopih, usmerjenih k izobraževanju, usposabljanju in razvoju kadrov opažata, da jih digitalna transformacija spreminja, saj bodo le ustrezno usmerjene aktivnosti privedle do sprememb v spretnostih in znanju zaposlenih za doseganje organizacijskih ciljev. Naloga organizacije po Liu in Su (2022) je, da zaposlenim zagotovi digitalna naprave in orodja ter organizacijsko okolje, ki omogoča učinkovito uporabo digitalne tehnologije za opravljanje nalog, sodelovanje in učenje. Liu in Su (2022) izpostavljata, da kadrovska funkcija mora zagotoviti poleg izpopolnjevanja znanja in zmožnosti zaposlenih za delo z digitalno tehnologijo tudi možnosti talentom za stalen razvoj in oblikovati podporno organizacijsko kulturo. Palmer idr. (2017) v kontekstu upravljanja zaposlenih v digitalni dobi poudarjajo, da digitalna transformacija prinaša vse večjo raznolikost zaposlenih in bolj k zaposlenim usmerjeno upravljanje, zato je odgovornost kadrovske funkcije tudi oblikovanje raznolikih in izzivov polnih delovnih mest, ki ohranjajo mlade zaposlene vpete v svoje delo.

3 Priložnosti in primeri uporabe digitalnih tehnologij v kadrovski funkciji

Bernik (2017) v napredni rabi tehnologij vidi priložnosti za bolj učinkovito upravljanje s kadri in strateško planiranje kadrov, kot so na primer uporaba baz podatkov, analiza velikih količin podatkov in uporaba algoritmov umetne inteligence (v nadaljevanju UI) ter sistemov za podporo odločanju pri spremljanju poslovnega okolja in napovedovanju kadrovskih potreb. Raziskava Sakarina idr. (2022) kaže, da digitalna transformacija kadrovske funkcije spodbuja k uporabi vse večjega obsega informacij in odločitvam v širšem obsegu. Digitalna transformacija kadrovske funkcije prinaša različne priložnosti za izboljšanje učinkovitosti. (Fenech idr., 2019). Uporaba sodobnih digitalnih tehnologij v upravljanju zaposlenih lahko izboljša produktivnost dela ter ustvari digitalno okolje za komunikacijo in zbiranje informacij (Bannikov, 2021; Smith idr., 2019). Silva in Lima (2018) ugotavljata, da digitalne tehnologije predstavljajo razbremenitev kadrovcov pri opravljanju administrativnih nalog in regulativnih postopkov, KIS pa podpira vse več kadrovske aktivnosti. Avtomatizacija procesov, kot je obdelava plač in spremljanje prisotnosti, omogoča povečanje učinkovitosti administrativnih nalog (Sankar, 2021). Po Sankar (2021), e-rekrutiranje predstavlja še eno priložnost, ki vključuje uporabo digitalnih platform za avtomatizacijo objav delovnih mest. Vedernikov in soavtorji (2022) so v svoji raziskavi razkrili, da so spletne strani organizacij ter sistem sledenja in obdelave prijav na prosta delovna mesta pomembna elementa zaposlovanja, kar je v skladu s Fenech idr. (2019), ki opisujejo uporabo analitike in UI za oceno učinkovitosti procesov zaposlovanja. Digitalna tehnologija za usposabljanje in razvoj omogoča enostaven dostop do izobraževalnih vsebin ter sledenje in vrednotenje učinkovitosti usposabljanja (Fenech idr., 2019).

Ena od ključnih priložnosti digitalne tehnologije za kadrovske funkcije je uporaba KIS-a, ki omogoča digitalno shranjevanje, upravljanje in analizo podatkov o zaposlenih (Sankar, 2021; Silva in Lima, 2018). KIS postaja ključno orodje za zbiranje in upravljanje informacij ter poročanje in odločanje, kar omogoča boljše upravljanje človeškega kapitala oziroma kadrovske vire v organizaciji (Kassim in Sherah, 2012; Silva in Lima, 2018). Silva in Lima (2018) opisujeta uporabo KIS-a za dolgoročno in kratkoročno planiranje in razporejanje kadrov, obvladovanje tveganj (vključno s trendi absentizma, fluktuacije ter varnosti in zdravja v organizaciji), analizo stroškov kadrov, objektivno ocenjevanje in nagrajevanje ter obvladovanje

odnosov v organizaciji (vključno z delitvijo dela, analiziranjem organizacijske klime in kulture ter doseganjem delovnih ciljev). Področje analitike izkorišča KIS za napovedovanje kadrovskega potreb in identifikacijo ključnih kompetenc zaposlenih (Fenech idr., 2019). Uporaba UI in analitike ob KIS-u prav tako predstavlja priložnost za avtomatizacijo selekcijskih procesov, analizo podatkov o zaposlenih ter boljše razumevanje trendov in potreb zaposlenih (Fenech idr., 2019, Tyagi idr., 2020).

3.1 Prednosti

Po Hemantha (2021) ter Zhang in Chen (2023), prehod od dolgoletnih in tradicionalno uporabljenih virov, orodij in procesov k digitalnim sredstvom shranjevanja informacij prek avtomatizacije rutinskih procesov predstavlja prednosti, povezane z večjo učinkovitostjo in manjšimi administrativnimi obremenitvami kadrovske funkcije. Digitalna transformacija kadrovske funkcije omogoča spremljanje, ocenjevanje in napovedovanje z zaposlenimi povezanih dejavnikov, ki vplivajo na konkurenčnost ter uvajanje pristopov, ki avtomatizirajo ali optimizirajo delo ter povečujejo inovativnost (Vedernikov, 2022), zmanjšujejo stroške in čas dela (Singh in Hess, 2017) ter olajšujejo spremljanje in razvoj zmožnosti zaposlenih (Chán in Balková, 2022; Sakarina idr., 2022; Liu in Su, 2022; Fenech idr., 2019; Hays in Kearny, 2001). Napredne tehnologije omogočajo bolj natančno analizo podatkov o zaposlenih, kar omogoča boljše odločitve in prilagajanje kadrovskega strategij (Sankar, 2021; Tyagi idr., 2020; Fenech idr., 2019; Silva in Lima, 2018; Kassim in Sherah, 2012). Digitalne rešitve omogočajo kadrovske funkciji, da bolje sledi novim delovnim modelom (kot npr. delo na daljavo), kar zagotavlja večjo mobilnost in fleksibilnost zaposlenih ter olajšuje kadrovske funkciji reševanje težav zaposlenih (Betchoo, 2016). Nadeem idr. (2024) so v raziskavi ugotovili, da digitalna transformacija pozitivno vpliva na zadovoljstvo, zavzetost, predanost, odpornost in samo-učinkovitost zaposlenih. Digitalne platforme za sodelovanje in komunikacijo prispevajo k izboljšanju komunikacije in spodbujanju timskih aktivnosti med zaposlenimi (Vedernikov idr., 2022; Sankar, 2021), olajšujejo pa tudi sodelovanje med zaposlenimi in kadrovske službo, kar prispeva k boljšemu upravljanju s kadrovskega viri (Betchoo, 2023; Emran in Elhony, 2023).

3.2 Izzivi

Izzivi, ki jih digitalna transformacija prinaša kadrovske funkciji se med fazami digitalne transformacije razlikujejo. Z digitalizacijo se poveča količina občutljivih podatkov, kar postavlja izzive glede varovanja podatkov in spoštovanja zasebnosti zaposlenih, obstaja tudi možnost tehničnih napak, ki lahko vplivajo na procese dela (Nadeem idr., 2024; Omri idr., 2020; Fedorova idr., 2019). Omri idr. (2020) navaja, da v začetnih fazah predstavlja največji izziv pretvarjanje dokumentov in podatkov na papirju v digitalno obliko; fizične datoteke ter različne formate podatkov je potrebno na ravni organizacije poenotiti in zbrati v integriranem sistemu. V naslednjih fazah digitalne transformacije se uvajajo napredne tehnologije, kot so strojno učenje, napredna analitika, avtomatizacija, uporaba algoritmov in UI (Omri idr., 2020). Izziv v tej fazi predstavljajo predvsem zmožnosti zaposlenih, optimizacijo dela pa zavira pomanjkanje znanja ter celo negativen odnos zaposlenih do sprememb (Omri idr., 2020; Tyagi idr., 2020; Singh in Hess, 2017), zato mora biti ravnanje z zaposlenimi v organizaciji prioriteta (Singh in Hess, 2017). Nepripravljenost za sprejemanje tehnologije je izziv za organizacijsko kulturo, ki glede na Smith idr. (2019) predstavlja največjo oviro za izkoriščanje potenciala digitalne transformacije celo v končnih fazah digitalne transformacije. Spremembe kulture, ki sprejema nove pristope spodbuja razumevanje koristi sprememb (Smith idr., 2019; Palmer, 2017), ob tem pa Birkinshaw (2014) opozarja, da novi pristopi in tehnologije niso vedno pozitivni. Izziv, ki ga opisuje Birkinshaw (2014) predstavlja izbira ustreznih inovacij in sprememb za posamezno organizacijo, saj pritiski na organizacije za stalno spreminjanje predstavljajo tveganje, da spremembe negativno vplivajo na organizacijo. Kadrovska funkcija predstavlja zastopnika zaposlenih v odločitvah vodstva, ki vplivajo na zaposlene, saj razume njihove zmogljivosti in omejitve (Emran in Elhony, 2023).

4 Razprava in predlogi

Digitalna transformacija predstavlja nepreklicen premik v načinu delovanja organizacij, pri čemer se klasične poslovne funkcije, kot je kadrovska funkcija, v organizacijah soočajo z izzivi in priložnostmi nove digitalne dobe. Raziskavi Hemantha (2019) in Deloitte (2017) kažeta široko in množično uporabo digitalnih tehnologij v procesih, povezanih z zaposlenimi. Vardalier (2019) in Fedorova (2019) sta prikazala prehod kadrovske funkcije od tradicionalnih administrativnih

nalog k bolj strateški vlogi, ki vključuje vodenje zaposlenih skozi digitalno transformacijo organizacije, njune ugotovitve pa potrjuje raziskava Hemantha (2021), da uporaba digitalnih orodij in aplikacij v kadrovski funkciji ne le optimizira kadrovske procese, ampak tudi prispeva k ustrežnejšemu ravnanju z ljudmi ob digitalni transformaciji ter doseganje drugih ciljev organizacij. Poleg tega uporaba različnih tehnologij v kadrovski funkciji omogoča boljše upravljanje s podatki, optimizacijo procesov in ustvarjanje učinkovitejših rešitev (Fedorova idr., 2019; Silva & Lima, 2018) ter bolj učinkovito upravljanje in obvladovanje informacij za podporo informiranemu odločanju (Sakarina idr., 2022; Tyagi idr., 2020; Fenech idr., 2019; Silva in Lima, 2018; Kassim in Sherah, 2012). Glede na pregled literature so še nekatere prednosti uporabe digitalnih tehnologij za upravljanje s kadri, ki temeljijo na ugotovitvah avtorjev; večja učinkovitost in manjše administrativne obremenitve (Zhang in Chen, 2023; Hemantha, 2021), zmanjšanje stroškov in časovnih obremenitev (Fedorova idr., 2019; Singh in Hess, 2017), povečanje inovativnosti ter boljše spremljanje in razvoj zmožnosti zaposlenih (Vedernikov, 2022; Chán in Balková, 2022; Sakarina idr., 2022), boljša prilagodljivost delovnih modelov (Betchoo, 2016) ter pozitiven vpliv na zadovoljstvo in učinkovitost zaposlenih (Nadeem idr., 2024).

Da bi organizacije dosegle potencial, ki ga predstavlja digitalna transformacija kadrovske funkcije, naj uvajajo digitalne sisteme za avtomatizacijo rutinskih kadrovskih procesov, kot so obdelava plač, upravljanje prisotnosti in administrativna opravila. To bo v skladu z ugotovitvami Zhang in Chen (2023), Chán in Balková (2022), Sakarina idr. (2022), Hemantha (2021) ter Singh in Hess (2017) zmanjšalo administrativne obremenitve kadrovskega osebja in omogočilo večjo učinkovitost in natančnost pri izvajanju teh nalog. Poleg implementacije digitalnih rešitev za optimizacijo nalog birokratske narave, predlagamo uvedbo aplikacij za upravljanje delovnega časa, platform za deljenje dokumentov ter avtomatizirane sisteme za objavo delovnih mest in izvajanje procesov zaposlovanja in selekcije. Organizacije lahko izkoristijo digitalne platforme, kot so interni socialni mediji in spletni forumi tudi za spodbujanje sodelovanja, komunikacije in izmenjave idej med zaposlenimi ter za izboljšanje korporativne kulture in angažiranosti zaposlenih. Organizacije, ki kadrovskih procesov še ne izvajajo s pomočjo digitalnih orodij in aplikacij, naj razvijejo celovite strategije za implementacijo KIS-a, ki izhajajoč iz Sankar (2021), Tyagi idr. (2020), Fenech idr. (2019), Silva in Lima (2018) ter Kassim in Sherah (2012), omogoča digitalno shranjevanje, upravljanje in analizo podatkov o

zaposlenih. To vključuje izbor ustrezne tehnološke platforme, usposabljanje kadrovskega osebja za učinkovito uporabo sistema ter vzpostavitev jasnih postopkov za zbiranje, shranjevanje in upravljanje podatkov.

Organizacije, ki KIS in preprostejše digitalne rešitve v kadrovskih procesih (npr. avtomatizirane evidence, optimizirana administrativna opravila ipd.) že uporabljajo, naj razvijejo načrte za uvajanje naprednih tehnologij. V skladu z ugotovitvami Sankar (2021), Tyagi idr. (2020), Fenech idr. (2019), Silva in Lima (2018) ter Kassim in Sherah (2012), lahko predlagamo vlaganje v napredne tehnologije za analizo podatkov o zaposlenih, kot so strojno učenje, napredna analitika in algoritmi umetne inteligence ter sistemi za podporo odločanju, kar bo omogočilo boljše odločitve in prilagajanje kadrovskih strategij glede na zbrane podatke o zaposlenih. V povezavi z zbiranjem informacij o zaposlenih je potrebno upoštevati tudi etične vidike digitalne transformacije, zlasti glede zasebnosti in varnosti podatkov zaposlenih (Saldanha, 2019; Gašperlin idr., 2021).

Glede na ugotovitve Fenech idr. (2019) in Betchoo (2016), organizacije lahko izkoristijo analitična orodja ne le za analizo podatkov o zaposlenih, temveč tudi o trendih na trgu dela in notranjih potrebah organizacije, zato ta orodja lahko predlagamo predvsem organizacijam z velikim številom zaposlenih za boljše načrtovanje potreb po kadrih, pravočasno prepoznavanje vrzeli v kompetencah ter boljše upravljanje s talenti v organizaciji. Vsi predlogi, ne glede na kompleksnost digitalnih rešitev, ki jih organizacije lahko uporabljajo v kadrovski funkciji, uvajanje digitalnih tehnologij običajno vključuje partnerstva s ponudniki tehnoloških rešitev, v sodelovanju s katerimi se organizacije lahko odločijo za ustrezen rešitev, glede na njihove specifične in potrebe ter postopno implementacijo teh rešitev v obstoječe kadrovske procese. Henriette idr. (2015) navajajo, da digitalizacija ni le tehnološki premik, ampak zahteva stalno prilagajanje zaposlenih in organizacijskih procesov, kar je v skladu s Kljajić Borštnar in Pucihar (2023), Marolt in Lenart (2021) ter Saldanha (2019). Tudi Rožanec in Lahajnar (2021) opisujeta potrebo po dinamičnosti in odzivnosti organizacij ter spreminjanju načina dela in organizacijske kulture, kar potrjujejo Pucihar idr. (2021), Gašperlin idr. (2021) ter Erjavec (2019), ki prav tako izpostavljajo, da digitalna transformacija pomeni celovito preoblikovanje organizacij. Upoštevajoč njihove ugotovitve, morajo organizacije stalno prilagajati svoje procese in strategije, pri čemer je poleg organizacijskega in tehnološkega vidika ključen človeški vidik (Liu in Su, 2022; Palmer idr., 2017). To

zahteva celostni pristop k spreminjanju procesov, kompetenc in odnosov znotraj organizacije (Liu & Su, 2022), kadrovska funkcija pa mora biti v ravnanju z zaposlenimi odzivna na nove izzive ter aktivna pri zagotavljanju učenja in razvoja zaposlenih (Barišić, 2021) in oblikovanju organizacijskega okolja, ki spodbuja inovativnost (Chán & Balková, 2022).

Po Liu in Su (2022) ima kadrovska funkcija ključno podporno vlogo v preoblikovanju organizacije skozi digitalno transformacijo, pri čemer poudarjata, da je zelo pomembno preoblikovanje organizacijske kulture, kar navajajo tudi Rožanec in Lahajnar (2021), Erjavec (2019) in Deloitte (2017). Po Smith idr. (2019) in Palmer (2017) je organizacijska kultura eden od glavnih ovir za digitalno transformacijo, saj vpliva na sprejemanje tehnologij in percepcijo koristi digitalnih tehnologij med zaposlenimi. Z naraščanjem uporabe tehnologije so povezani tudi izzivi, kot so varovanje podatkov, pomanjkanje usposobljenih kadrov in negativen odnos do tehnologij in nepriljubljenost za spremembe s strani zaposlenih (Omri idr., 2020; Tyagi idr., 2020; Singh in Hess, 2017), ki jih organizacije lahko naslovijo s spodbujanjem ozaveščenosti in ustvarjanjem podpornega okolja za učenje in razvoj novih veščin (Singh & Hess, 2017). Birkinshaw (2014) opozarja na pasti, povezane z naglimi odločitvami o uvajanju novih tehnologij, saj sprejemanje digitalnih tehnologij zahteva ne le tehnično, temveč tudi kulturno in organizacijsko prilagajanje (Saldanha, 2019). Po Hays in Kearney (2001) razumevanje sprememb kadrovske funkcije in novih potreb organizacij po digitalnih kadrovske virih omogoča boljše oblikovanje strategij, ki so v koraku s časom, kar potrjujejo ugotovitve Emran in Elhony (2023), ki opozarjata na potrebo po prilagajanju strategij upravljanja s človeškimi viri v luči digitalne transformacije.

Pomen teh ugotovitev je ključen za prihodnost upravljanja s človeškimi viri in izvajanje aktivnosti kadrovske funkcije. Prednosti, ki jih prinaša digitalna transformacija kadrovske funkcije organizacije lahko dosežejo tako, da izkoristijo priložnosti, ki jih prinašajo digitalne tehnologije. Kadrovska funkcija ima ključno vlogo pri usklajevanju zaposlenih s cilji organizacije in zagotavljanju ustrezne podpore v procesu digitalne transformacije (Nadeem idr., 2024), zato ima ključno vlogo za uspeh organizacij v digitalni dobi. Zagotoviti mora, da so zmožnosti zaposlenih usklajene s potrebami delovnih mest (Chán in Balková, 2022), zato je kritičnega pomena, da organizacije ne le uvajajo nove tehnologije, temveč tudi zagotovijo, da imajo zaposleni ustrezne kompetence. Kadrovska funkcija v sodobnih

organizacijah mora biti proaktivna pri oblikovanju in izvajanju programov izobraževanja, usposabljanja in razvoja zaposlenih (Emran in Elhony, 2023), ki so usmerjeni v pridobivanje novih kompetenc ter zagotavljanje učinkovite uporabe digitalne tehnologije pri delu (Liu in Su, 2022).

Glede na spremembe, ki jih prinaša digitalna transformacije v organizacije na področju ravnanja z zaposlenimi v okviru strateškega delovanja kadrovske funkcije lahko predlagamo, da organizacije vzpostavijo trajen program razvoja kompetenc in strukturiran pristop k upravljanju zaposlenih v digitalni dobi, ki združuje tehnološke in človeške vidike ter poudarja usklajenost zmožnosti zaposlenih s potrebami delovnih mest in je prilagojen potrebam digitalne transformacije. Ta program bi prek različnih pristopov moral sistematično krepiti tako tehnične kot mehke veščine zaposlenih, ki so ključne za uspešno delovanje v digitalnem okolju, vključujoč izobraževanja o novih tehnologijah, razvoj digitalnih veščin, pa tudi razvoj komunikacijskih sposobnosti, timskega dela ter spodbujanje prilagajanja spremembam. S stalnim razvojem kompetenc zaposlenih organizacije ne le zagotovijo, da so pripravljene na izzive digitalne transformacije, temveč tudi spodbujajo inovativnost ter prilagodljivost zaposlenih (Marolt idr., 2023). Poleg tega mora kadrovska funkcija prek pristopov skozi izvajanje programa prispevati k oblikovanju podporne organizacijske kulture, ki spodbuja nenehno učenje, razvoj talentov in raznolikost (Palmer idr., 2017).

Organizacije lahko ustanovijo tudi specializiran oddelek ali skupino za digitalno transformacijo v okviru kadrovskega oddelka, katerega odgovornost bi bila podpora integracije digitalnih tehnologij v obstoječe procese ter izvajanje usposabljanj in spremljanje napredka v digitalni transformaciji. Za spremljanje doseganja ciljev in lažje obvladovanje sprememb predlagamo vzpostavitev jasnih meril uspešnosti digitalne transformacije, kar bi omogočilo organizacijam, da prilagajajo svoje strategije glede na dosežene cilje. Poleg tega bi bilo lahko koristno spremljati tudi vpliv digitalne transformacije na organizacijsko kulturo, klimo in zadovoljstvo zaposlenih, ter informacije o tem upoštevati pri oblikovanju ustreznih delovnih okolij, katerih pomen opisujeta tudi Birkinshaw (2014) in Deloitte (2017).

5 Zaključek

Digitalna transformacija spreminja način poslovanja prek uvajanja novih tehnologij, inovativnih pristopov in strategij ter zahtev, povezanih s kadrovskimi viri, kar v organizacije prinaša spremembe načina dela in vloge kadrovske funkcije ter drugačno upravljanje s kadrovskimi viri za boljše prilagajanje dinamičnemu poslovnemu okolju. Prek uporabe digitalnih tehnologij za avtomatizacijo in optimizacijo je kadrovska funkcija razbremenjena nekaterih administrativnih in rutinskih nalog ter je lahko bolj učinkovita in osredotočena na uporabo informacij za strateško ravnanje s kadrovskimi viri. Uporaba digitalnih tehnologij v kadrovske funkciji predstavlja priložnost za ustvarjanje dodane vrednosti prek bolj učinkovitega obvladovanja kadrovskih virov v organizacijah, saj omogoča analizo podatkov za sprejemanje informiranih odločitev, izboljša kadrovske procese ter komunikacijo in sodelovanje z zaposlenimi. Poleg prednosti, povezanih z boljšim upravljanjem kadrovskih virov s pomočjo digitalne tehnologije pa se kadrovska funkcija skozi digitalno transformacijo sooča tudi z izzivi na področju zmožnosti in znanja zaposlenih, njihovega odnosa do sprememb in sprejemanja tehnologije ter spreminjanjem organizacijske kulture. Kadrovska funkcija kot agent sprememb v organizaciji in strateški partner vodstva mora priložnosti in prednosti digitalne transformacije izkoristiti in približati zaposlenim, jim omogočiti razvoj in zagotavljati podporo, pri čemer mora načrtovati in usklajevati kadrovske potrebe organizacije z vizijo in cilji. Ugotovitve iz pregledane literature v prispevku so lahko v skladu z namenom in cilji uporabne za razumevanje sprememb, priložnosti, prednosti in izzivov digitalne transformacije, podani predlogi pa so lahko aplikativni v organizacijah. Nadaljnje raziskave so možne v smeri odkrivanja nove vloge in opredelitve digitalne kadrovske funkcije prihodnosti, raziskovanja specifičnih priložnosti za različne organizacije, razumevanja in odkrivanja načinov reševanja izzivov, povezanih z zaposlenimi ter razvoja smernic za kadrovske funkcije o kadrovskih strategijah za uspešno digitalno transformacijo in prilagajanje v digitalni dobi.

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ZDRAVJE IN DOBRO POČUTJE ŠTUDENTOV

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V sodobnem izobraževalnem okolju postaja zdravje in dobro počutje študentov ključnega pomena. Prispevek se osredotoča na različne vidike, ki vplivajo na zdravje in dobro počutje študentov, s ciljem zagotoviti pregled trenutnega stanja in predstaviti vlogo izobraževalnih ustanov (univerz, fakultet) pri podpori zdravja in dobrega počutja študentov. Iz literature izhaja, da nezdrave navade, povezane z življenjskim slogom in prekomerna uporaba digitalnih naprav negativno vplivajo na študente, medtem ko kvalitetni medosebni odnosi in socialna podpora izboljšujejo njihovo zdravje in počutje. Prispevek predstavlja ugotovitve predhodnih raziskav o fizičnih, duševnih, socialnih in digitalnih vidikih zdravja, dobrega počutja in navadah študentov ter vlogi izobraževalnih ustanov pri spodbujanju zdravja in dobrega počutja študentov. Skozi sintezo teoretičnih in empiričnih izhodišč prispevek omogoča vpogled v kompleksnost zdravja in dobrega počutja študentov, združuje spoznanja o vlogi izobraževalnih ustanov v spodbujanju zdravega in uravnoveženega življenja študentov ter odpira pot nadaljnjim raziskavam in izboljšavam.

Ključne besede:

dobro
počutje,
študenti,
izobraževalne
ustanove,
zdravje,
izobraževalno
okolje

STUDENTS' HEALTH AND WELL-BEING

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Health and well-being of students are becoming crucial in modern educational environment. Article focuses on various aspects that influence the health and well-being of students, aiming to provide an overview of the current state of students' health and well-being and the role of educational institutions (universities, faculties) in supporting it. According to the literature, habits linked to unhealthy lifestyle and excessive use of digital devices negatively impact students, while quality interpersonal relationships and social support improve their health and well-being. The article presents findings from previous research on the physical, mental, social, and digital aspects of health, well-being, and students' habits, as well as the role of educational institutions in promoting students' health and well-being. Through the synthesis of theoretical and empirical bases, the article offers insight into the complexity of students' health and well-being, consolidates knowledge about the role of educational institutions in promoting a healthy and balanced life for students, and opens the way for further research and improvements.

Keywords:
well-being,
students
educational
institutions,
health,
educational
environment

1 Uvod

V sodobnem svetu, kjer se izobraževalni sistemi nenehno razvijajo in študentsko življenje postaja čedalje bolj stresno, se zdi vprašanje dobrega počutja študentov izjemno pomembno. Obdobje študija je ključno za razvoj in vzpostavitev zdravih življenjskih navad, ki vplivajo na dobro počutje študentov in njihovo dolgoročno zdravje. Ob tem se morajo študentje prilagoditi novemu okolju, iskati osebne strategije za razporejanje časa za študij in druge aktivnosti kar lahko vpliva na njihove navade in vsakodnevne odločitve ter njihovo fizično in duševno zdravje (Deasy idr., 2015). Vse to privede do sprememb v vedenju študentov, ki med drugim povzročajo izzive pri ohranjanju njihovega zdravja in kakovosti življenja (Deasy idr., 2015; Martínez-Riera in drugi, 2018; Chacón-Cuberos, 2019).

Namen prispevka je predstaviti celovito analizo zdravja in dobrega počutja študentov z vidikov, ki vključujejo fizične, duševne, socialne in digitalne faktorje ter, obravnavati prispevek izobraževalnih ustanov, ki v obliki strategij in programov pripomorejo k izbolšanju zdravja in dobrega počutja študentov. Cilj prispevka je osvetliti ključne vidike zdravja in dobrega počutja študentov, pri tem pa zagotoviti celovit pregled trenutnega stanja na tem področju ter predstaviti konkretne predloge in priporočila s strani izobraževalnih ustanov z namenom izboljšanja zdravja in počutja študentov. Na podlagi pregleda obstoječe literature in virov o zdravju in dobrem počutju študentov so v prispevku uporabljene naslednje raziskovalne metode, in sicer metoda deskripcije, metoda kompilacije in komparativna metoda, ter v povezavi s tem induktivna metoda.

V nadaljevanju prispevka so povzete ugotovitve raziskav na področju zdravja in dobrega počutja študentov s fizičnega, duševnega, socialnega in digitalnega vidika. Temu v tretjem delu sledi opis vloge izobraževalnih ustanov pri spodbujanju zdravja in dobrega počutja študentov in v zaključku predlogi za nadaljnja raziskovanja teme.

2 Predhodne raziskave o zdravju in počutju študentov

Študentje se tekom študija soočajo z različnimi zdravstvenimi izzivi, kot so študijski stres, pomanjkanje energije in časa za vzdrževanje zdravih rutin (telesne aktivnosti, prehranjevalnih navad, spanja, druženja, hobijev in kvalitetnega preživljanja prostega časa) ter z omejenim proračunom, ki posledično vpliva na njihove prehranske izbire

(Åsberg idr., 2022; Bennasar-Veny idr., 2020; Chacón-Cuberos, 2019; Martinez-Riera idr., 2018). Na podlagi identifikacije različnih vzorcev življenjskega sloga študentov, kot so njihova telesna aktivnost, prehranjevalne navade, spanje in obvladovanje stresa, Bennasar-Veny in drugi (2020) ugotavljajo, da je življenjski slog med študenti različen, študentsko življenje pa je lahko zelo stresno in zahtevno. Z vidika tega je zdrav življenjski slog ključen za dobro telesno počutje študentov, medtem ko družbene interakcije in duševno zdravje igrajo pomembno vlogo pri njihovem splošnem počutju (Bennasar-Veny idr., 2020). Toda na zdravje in počutje študentov vse bolj vpliva tudi digitalna tehnologija (Braghieri idr., 2021; Alimoradi idr., 2019; Stiglic in Viner, 2019; Radovic idr., 2017; Yang idr., 2016). Skladno s tem so v nadaljevanju predstavljene ugotovitve nekaterih raziskav, ki razkrivajo stanje in pomembne vpogleda o fizičnih, duševnih, socialnih in digitalnih vidikih dobrega počutja študentov.

2.1 Fizični vidiki zdravja in počutja študentov

V življenju študentov sprejem na fakulteto predstavlja kritično obdobje, saj se ti pogosto prvič soočajo z novimi izzivi in odgovornostmi. Ta prehod pogosto vodi do sprememb v njihovem življenjskem slogu, vključno s telesno aktivnostjo, prehranjevalnimi navadami, uživanjem alkohola in kajenjem ter vzorci spanja (Alzahrani, 2019; Alzamil idr., 2019; Gaisina idr., 2019). Za splošno zdravje študentov je ključnega pomena, da so telesno aktivni, vendar Fagaras, Radu in Vanvu (2015) ter Edelman in soavtorji (2022) ugotavljajo, da se raven njihove telesne aktivnosti razlikuje glede na spol, študijsko smer in študijsko obdobje. Podobno menijo Verma, Singh in Patwardhan (2022), ki so ugotovili, da je sicer več kot 40 % študentov telesno aktivnih, delež telesno aktivnih upada z naraščajočo starostjo študentov. Kljub temu, da večina študentov poroča o zmerni telesni aktivnosti, je njihova telesna pripravljenost boljša na univerzah, kjer jim omogočajo športne aktivnosti (Hoke idr., 2023; Hossein Poor, 2019, Al-Hazza idr., 2018; Chen idr., 2010).

Prav tako je ugotovljeno, da večina študentov ne sledi zdravim prehranskim navadam, kar je povezano s pojavom stresa, pomanjkanjem časa in finančnimi omejitvami (Assaf idr. 2019; Sanchez-Ojeda, 2015). Prehranjevalne navade študentov so raznolike in pogosto neustrezne, saj po navadi preskakujejo zajtrk in prekomerno uživajo nezdravo hrano (Sparke idr. 2018; Yahia idr., 2016). Le majhen

delež študentov upošteva priporočila o prehranjevalnih navadah, kot sta število in kvaliteta obrokov (Ramon-Arbues idr., 2021). Med nezdravimi navadami se pri študentih tudi pojavljata uživanje alkohola in kajenje. Tako Nasser in Zhang (2019) ter Mandil in drugi (2019) poročajo o visoki stopnji omenjenih zdravju škodljivih navad, ki posledično negativno vplivajo na študijski uspeh. Obenem pa večja izpostavljenost študijskemu okolju povečuje tveganje za zlorabo alkohola pri študentih (Lorant idr., 2013).

Izjemno pomembno vlogo pri ohranjanju zdravja študentov ima tudi spanje. Schlarb in drugi (2017) ter Forquer in drugi (2008) razkrivajo, da s spanjem povezane navade študentov niso ustrezne. Ob tem opozarjajo, da pomanjkanje spanja negativno vpliva na njihovo duševno zdravje in študijski uspeh. Zato je pomembno, da so študentje ozaveščeni in se vse bolj zavedajo ustreznih navadah, povezanih s spanjem, kar tudi vodi do boljše kakovosti spanja (Brown, Buboltz in Soper, 2002). Izhajajoč iz raziskav opisano stanje, povezano s telesno aktivnostjo, prehranjevalnimi navadami, uživanjem alkohola, kajenjem ter količino in kakovostjo spanja kaže na to, da študentje pogosto ne vzdržujejo zdravega življenjskega sloga. Čeprav so življenjski slogi študentov različni in popolnoma individualni, obstajajo številne možnosti za izboljšanje njihovih navad.

2.2 Duševni vidiki zdravja in počutja študentov

Duševni vidiki zdravja študentov vključujejo čustveno ravnovesje, duševno stabilnost, sposobnost soočanja s stresom, občutek sreče in samospoštovanja, sposobnost vzpostavljanja kvalitetnih medosebnih odnosov, učinkovito obvladovanje čustev ter dobro samopodobo in so kot takšni ključni za njihovo blaginjo ter kakovost življenja (Klanšček idr., 2016; Čuk, 2010). Duševno zdravje študentov namreč ključno vpliva na njihovo splošno počutje, študijski uspeh in zadovoljstvo s študijem (Franzen idr., 2021; Mehrabian idr., 2020). Nekatere ugotovitve kažejo, da se število študentov, ki se soočajo z duševnimi težavami povečuje, kar predstavlja izziv tako za izobraževalne ustanove kot za širšo skupnost (Baik, Larcombe in Brooker, 2019).

Večina študentov, ki se med študijem sooča s stresom in pritiski povezanimi s študijskimi obveznostmi ter s težavami v duševnem zdravju, kot so duševne stiske, anksioznost in depresija (ki nastanejo zaradi prej naštetih dejavnikov), ne prejema

ustreznega zdravljenja, kar kaže na pomanjkanje ustreznih virov in podpore na univerzah (Ebert idr., 2018). V raziskavah (Atorkey idr., 2021; Hanawi idr., 2020; Deasy idr. 2015) so ugotovili obstoj povezanosti med nezdravimi življenjskimi navadami, kot sta nezdrava prehrana in pomanjkanje telesne aktivnosti ter duševnimi težavami med študenti. Zato je ob negativni oceni stanja na področju duševnega zdravja in dobrega počutja študentov nujno potreben celosten pristop k zdravju študentov, ki vključuje tudi izboljšave njihovega fizičnega in duševnega dobrega počutja.

2.3 Socialni vidiki zdravja in počutja študentov

Socialni vidik zdravja študentov obsega kakovost in količino socialnih interakcij ter vpliv teh interakcij na njihovo splošno dobro počutje (Yıldırım in Tanrıverdi, 2021; Alsubaie idr., 2019). Ta vključuje odnose s sošolci, prijatelji, družino in drugimi pomembnimi osebami v življenju študentov (Longfield idr., 2006) ter občutek pripadnosti in vključenosti v študentsko skupnost (Franzen idr., 2021). Poleg tega subjektivni družbeni status študentov vpliva na njihovo družbeno interakcijo in posledično tudi na duševno in socialno zdravje (Rubin idr., 2016). Podobno je ugotovljeno v raziskavah (Hanawi idr., 2020; Baik idr., 2019), in sicer, da družbena podpora in socialni stiki pozitivno vplivajo na duševno zdravje in zadovoljstvo študentov z njihovim življenjem. Tudi kvalitetni medosebni odnosi in močna socialna mreža pozitivno vplivajo na duševno zdravje študentov, zmanjšujejo občutek osamljenosti in stresa ter izboljšujejo splošno zadovoljstvo z življenjem (Sirgy idr., 2007; Mehl in Pennenbaker, 2003).

Na socialno dobro počutje študentov vplivajo različni izzivi, kot so prilagajanje na novo okolje, obvladovanje s študijem povezanih pritiskov in ohranjanje ravnovesja med študijem in družbenim življenjem (Gaisina idr., 2019). Alsubaie in drugi (2019) ugotavljajo, da se duševne težave med študenti povečujejo zaradi s študijem povezanih pritiskov, finančnih pritiskov in stresorjev iz okolja, kar lahko privede do zmanjšanja socialne interakcije in občutka izolacije. Tako so za dobro duševno zdravje študentov izrednega pomena podporni medosebni odnosi, aktivno vključevanje v družabno študentsko življenje in družbena povezanost na univerzah (Franzen idr., 2021).

2.4 Digitalni vidiki zdravja in počutja študentov

Študentje med študijem namenijo veliko časa uporabi digitalnih tehnologij tako za študij, kot za njihove druge aktivnosti (Safranek, 2020; Roberts idr., 2014). Roberts in soavtorji (2014) ugotavljajo, da ameriški študentje dnevno uporabljajo mobilni telefon med 8 in 10 ur, 60 % anketiranih študentov je tudi priznalo, da so od njega odvisni. Podobno je ugotovljeno v raziskavi (Safranek, 2020), ki so jo izvedli na univerzi Stanford, in sicer, da študentje dnevno pred ekrani preživijo 12,4 ur, čas njihovega sedenja pa pogosto presega 8 ur, poleg tega veliko študentov uporablja digitalne tehnologije za zasebne aktivnosti, tudi med predavanji. Čeprav digitalne tehnologije v izobraževanju nudijo prednosti, kot so fleksibilnost in dostopnost učnih gradiv, predstavljajo tudi tveganja, kot so preobremenjenost študentov in njihovo zavračevanje s študijskimi obveznostmi (Hederson idr., 2017; Selwyn, 2016).

Uporaba digitalnih tehnologij vpliva tudi na duševno in telesno zdravje študentov ter njihovo družbeno življenje (Burr idr., 2020; Vanden Abeele in Nyugen, 2020). Prekomerna uporaba digitalnih tehnologij lahko privede do težav, kot so duševne motnje, osamljenost in zmanjšana telesna aktivnost (Alimoradi idr., 2019; Stiglic in Viner, 2019; Yang idr., 2017). Zanimivo je, da ima uporaba spletnih družbenih omrežij dvojni učinek na zdravje in dobro počutje študentov, saj kljub temu, da spodbuja povezovanje, navezovanje stikov, zabavo in dostop do informacij lahko povzroči negativne primerjave s sovrstniki in depresijo (Braghieri idr., 2021; Radovic idr., 2017). Ocene stanja na področju digitalnih vidikov zdravja in dobrega počutja študentov, glede na predstavljene ugotovitve raziskav kažejo, da je potrebno uravnotežiti pozitivno in negativno stran uporabe digitalnih tehnologij.

3 Vloga izobraževalnih ustanov pri spodbujanju zdravja in počutja študentov

Pri spodbujanju zdravja in dobrega počutja študentov tekom njihovega visokošolskega izobraževanja imajo bistveno vlogo tudi izobraževalne ustanove. Še posebej je pomembno, da z razvojem strategij in ciljno usmerjenimi ukrepi ter izobraževalnimi programi spodbujajo izboljšanje zdravja, počutja in življenja študentov ter kakovost študija (Bennasar-Veny idr., 2020; Vaseltsova, 2010). Za zagotavljanje fizičnega dobrega počutja študentov je bistveno, da izobraževalne ustanove ponujajo študentom rekreacijske dejavnosti in izobraževanja o zdravi

prehrani, s čimer pripomorejo k oblikovanju zdravih življenjskih navad. Pri tem je ključno, da izobraževalne ustanove (poleg ponudbe športnih aktivnosti za izboljšanje fizičnega zdravja študentov) pripomorejo tudi k boljšemu duševnemu zdravju študentov in njihovi socializaciji (Hoke idr., 2023; Al-Haza idr., 2018). Namreč kot je ugotovil Nikbakhsh (2022), vključevanje študentov v športne aktivnosti pomembno vpliva na njihovo psihološko blaginjo, zato lahko izobraževalne ustanove s ponudbo športnih aktivnosti in krepijo pozitivnega odnosa do športa izboljšajo zadovoljstvo z življenjem in psihološko blagostanje študentov.

Izobraževalne ustanove imajo pomembno vlogo tudi pri promoviranju zdravega načina prehranjevanja med študenti, kot na primer v obliki zagotavljanja informacij o zdravi prehrani, spodbujanje priprave in kuhanje hrane ter lažjega cenovnega dostopa do zdravih prehranskih izdelkov (Ramon-Arbus idr., 2021). To je še posebej pomembno zato, ker le majhen delež študentov sledi zdravim prehranjevalnim navadam (Ramon-Arbues idr., 2021), oziroma celo obstaja povezanost (Lopez-Moreno in drugi, 2021) med prehranjevalnimi navadami, uživanjem alkohola in študijskim uspehom študentov. Vse to odraža potrebo po univerzitetnih politikah, ki spodbujajo zdravo prehranjevanje in ozaveščanjem o tveganjih, povezanih z nezdravimi navadami (Lopez-Moreno idr., 2021).

Poleg navedenega lahko univerze z vključevanjem študentom v izobraževanja in programe pomembno vplivajo na izboljšanje spalnih navad študentov (Brown idr., 2016). Forquer (2008) in Brown ter drugi (2006) so ugotovili, da večina študentov trpi zaradi pomanjkanja spanja, kar negativno vpliva na njihovo študijsko uspešnost in duševno zdravje. Z naraščanjem težav z dušenim zdravjem študentov je potrebno na strani izobraževalnih ustanov zagotavljati njihovo podporno vlogo, kot na primer skozi ponudbo storitev za krepitev duševnega zdravja, in z delavnicami za obvladovanje stresa (Baik, Larcombe in Brooker, 2019; Ebert idr., 2018). Pri tem naj spodbujajo tudi socialno ustvarjanje varnih prostorov za učenje, rekreacijo in druženje (Baik, Larcombe in Brooker, 2019; Ebert idr., 2018). S socialnega vidika, medsebojnih odnosov med študijem in pomena pripadnosti študentov univerzi je ključno, da izobraževalne ustanove spodbujajo socialno povezanost in medsebojno pripadnost študentov v obliki organizacije skupnih dogodkov, spodbujajo družabne dejavnosti pa tudi krepijo mentorstvo in podporne mreže (Ahn in Davis, 2023).

S pojavom dvojnega učinka digitalnih tehnologij na študente in sam študijski proces (Yot-Domínguez in Marcelo, 2017; Selwyn, 2016) ter vpliva družbenih omrežij na samopodobo in življenjski slog študentov (Pop idr., 2021) je smiselno, da izobraževalne ustanove z različnimi programi in izobraževanji o digitalnih navadah, s spodbujanjem zdrave uporabe digitalnih tehnologij in z zagotavljanjem alternativnih načinov učenja pomagajo študentom uravnovežiti uporabo digitalnih tehnologij.

5 Zaključek

Prispevek ponuja vpogled v ugotovitve raziskav o vplivu različnih vidikov na zdravje in dobro počutje študentov, pri čemer imajo pomembno vlogo tudi izobraževalne ustanove. Kljub pogostim in različnim izzivom, s katerimi se študentje srečujejo tekom študija, obstajajo številni načini za izboljšanje njihovega zdravja in dobrega počutja. Zdrav življenjski slog, ki vključuje uravnoteženo prehrano, redno telesno aktivnost in ustrezne navade povezane s spanjem ter izogibanje nezdravim navadam pozitivno vplivajo na fizično in psihično zdravje študentov. S socialnimi interakcijami, vključevanjem v skupine in ohranjanje stikov s prijatelji ter družino se pripomore k socialnemu dobremu počutju študentov. Za duševno dobro počutje študentov je pomembno, da študentje razvijejo strategije za obvladovanje stresa, poiščejo pomoč strokovnjakov, ko je to potrebno in oblikujejo odnose, ki jim zagotavljajo medsebojno podporo. Z množično uporabo digitalnih tehnologij je še toliko bolj pomembno, da se študente ozavešča o ustreznih digitalnih navadah in digitalnem stresu ter se jih spodbuja, da uravnovežijo njihovo uporabo.

Na podlagi povzetih ugotovitev raziskav predpostavljamo, da je življenjski slog študentov kompleksen in večplasten, pri čemer vsak obravnavan vidik pomembno vpliva na njihovo zdravje in dobro počutje. Ravno zato je ključno razumevanje stanja študentov in prepoznavanje pojavnosti različnih izzivov na področju njihovega zdravja in dobrega počutja. Z vidika spodbujanja zdravega življenjskega sloga študentov in njihovega duševnega, socialnega in digitalnega dobrega počutja, kakovostne izvedbe študija ter tudi oblikovanja boljšega študijskega okolja, menimo, da je potreben celostni pristop in medsebojno sodelovanje vseh vključenih deležnikov, tako študentov kot tudi izobraževalnih ustanov.

V prihodnjih raziskavah bi bilo zanimivo proučiti, kateri dejavniki vplivajo na različne vidike zdravja in dobrega počutja študentov ter katere aktivnosti bi lahko podpirale študente pri soočanju z izzivi sodobnega študentskega življenja. Prav tako bi bilo smiselno raziskati možnosti in dolgoročne učinke intervencij izobraževalnih ustanov za krepitev zdravja in dobrega počutja študentov na akademsko uspešnost in počutje, zdravje ter splošno zadovoljstvo študentov s študijem in življenjem.

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A SYSTEMATIC LITERATURE REVIEW ON OPEN GOVERNMENT DATA USE IN SMALL AND MEDIUM SIZED ENTERPRISES

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The concept of open data has evolved significantly over the past decade, in line with increasing government policies and initiatives, the quality, volume and accessibility of public data has increased as well. As a result, expectations that open data will help create value, innovation, and a range of economic, social, and environmental transformations are very high. Despite the great potential and high expectations, little is known about the use of open data, especially in enterprises. The overall research goal is to assess the use of open data in Slovene small and medium sized enterprises. To address this problem, we first conducted a systematic literature review to 1) understand the open data field through a historic lens, 2) identify key areas of research, and 3) identify research gaps. Based on the findings we will develop a research agenda.

Keywords:

open data, open government data, open data use, open data maturity assessment, maturity multi-criteria decision model, DEX

1 Introduction

In the last decade the paradigm of open data (OD) has evolved significantly, driven by the interest exhibited by governments and civic society. This evolution is particularly noteworthy in the light of increased emphasis on transparency and accountability of governmental expenditure and public fund allocations. In addition to the above, significant economic benefits deriving from open data are anticipated. In this literature review we will focus on what previous research on the utilization of OD has addressed.

The initiatives of opening the government data to public in European Union (EU) started in 2003 when a *Directive 2003/98/EC of the European Parliament and of the Council of 17 November 2003 on the re-use of public sector information* (European parliament, 2003) was issued, displaying intent to make public information available to anyone interested. The EU directive was revised several times until it was replaced in 2019 by a new version the *Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information* (European parliament, 2019), Slovenia followed shortly after when in 2003 the Public information access act (ZDIJZ, 2003) was accepted. It was not until 2009, after US president Barack Obama, only one day after his inauguration, supported the idea of open government data with its open data initiative signing the Memorandum of (Transparency and Open Government, 2009), when concrete academic interest started.

Governments worldwide have implemented the concept of open government data (OGD) to a varying extent. A significant challenge has emerged: when releasing extensive volumes of data, it becomes ineffectual if mechanisms for meaningful comparison, visualization, analysis and other essential applications are lacking (Jamieson et al., 2019). Recognizing this, the academic community started extensive research on how to enhance the utility of open data for civic society, economic applications and the researchers themselves.

To understand the influence of OD on different groups of users, such as economical, civil society, entrepreneurs or other, we must first assess the extent of their knowledge about open data, the current state of its usage and their available infrastructure to extract and transform the vast volumes of data into usable

information (Lassinantti et al., 2019). In essence, an assessment of maturity level of distinct societal groups needs to be done.

2 Methodology

We conducted a systematic literature review to scrutinize prior research focus and conclusions. A literature review provides an insight into the current state of research in the research domain, an insight into the most common methodologies used and the related research areas.

A systematic literature review procedure follows the four main steps, according to (Attard et al., 2015):

1. Define search terms,
2. Select sources (digital libraries),
3. Application of search terms on sources and
4. Selection of primary studies by application of inclusion and exclusion criteria on search results.

To define the right keywords, we first defined the research question, indicating the exact extent of our review. The question was defined as follows:

RQ: What is the maturity level of small and medium sized enterprises (SME-s) for open government data use?

After a preliminary study, based on the research question, the best keywords to answer our research question were defined:

- Open data
- Open government data
- Open data use
- Open data maturity assessment
- Maturity multi-criteria decision model
- DEX
- Slovene enterprises.

In order to access the most relevant results, we surveyed digital libraries Web of Science, Scopus and ProQuest, using specific combinations of keywords. Google Scholar was initially included in the libraries examined; however, it was later excluded due to excessive output and low relevance of the results. Another abundant source of literature were the references of the results gained from the chosen digital libraries.

The primary search term “Open data” returned an unmanageably large number of results, so we narrowed the term down with its expansion to “Open government data”. That resulted in fewer outcomes, however the correlation of those results to our research question was still low.

To obtain results that corresponded with our research theme we excluded publications that:

- Did not focus on open data, it was only mentioned,
- Focuses on other keywords but does not relate to open data,
- The language was not English.

Applying other keywords and exclusion criteria in the end resulted in 71 related articles that represented the base of our literature review.

3 Results

The literature review included 71 articles that provided a thorough insight into what academic society has found essential for better understanding and increasing the utilization of open data. The authors of these articles have predominantly concentrated on one or more of the following topics: users, quality, policies, research categorization, drivers and barriers, impact and/or maturity. The synthesis of these articles reveals a diverse knowledge about the topic of the research. In the next sections we will overview these main topics.

3.1 Users

Key focus that seems to prevail others in academic view is identifying user types. The most elemental division is into two categories the providers and the consumers of the open data. On the provider side, the main question revolves around the

methods and measures that need to be undertaken to ensure the highest quality of the data, provided in a way that ensures uncomplicated usability for the end users. On the consumer side, the main objective is to identify the users by understanding their primary motivation for open data use.

Numerous researchers seek factors that predict the use of open data. Some have focused on established theories of human behavior to understand the motivations for open data use. A study by (Saxena & Janssen, 2017; Shao, 2023; Talukder et al., 2019; Zuiderwijk et al., 2015) employed an adjusted Unified Theory of Acceptance and Use of Technology (UTAUT). (Khurshid et al., 2022) explored the factors that influence citizens' intention to use OGD using Information Systems Theory (IST), (Lassinantti et al., 2019) used the Relevant Social Groups (RSG) theory to establish what motivates users to utilize OGD and explain for what purpose they are using it. Surveys integrating an extended Technology Acceptance Model (TAM) to clarify the user's intent in OGD adoption were conducted by (Weerakkody et al., 2017; Wirtz et al., 2019).

To determine what motivates employees in organizations (H. J. Wang & Lo, 2020) use the socio-technical perspective to develop a model, on which a survey was based and (Zhou et al., 2023) investigated how leadership style affects the OGD utilization among employees based on Organizational Commitment Theory. Another survey based on the Social Cognitive Theory, highlighted the factors that impact the intention of individual user innovators to adopt OGD (H.-J. Wang, 2020). How OGD can be used to generate business intelligence for the identification of market opportunities and strategy formulation was the objective of (Gottfried et al., 2021) research. Regarding business owners and their intent to use OD (Alawadhi et al., 2021) conducted a study to determine whether they have sufficient knowledge about the concept of OD and their willingness to use it for service improvement. Alexopoulos et al. (2023) proposed a model where four groups of users were identified: *beginners*, *followers*, *fast trackers* and *trendsetters*, depending on their level of OD adoption maturity. The motive (legitimacy-seeking or realizing OD value creation potential) to invest in OD technologies in public and private organizations was investigated by (Temiz et al., 2022).

Action-based research in which civil servants' and citizens' initiatives collaborated to find solutions for public problems using an open data platform from a provider's standpoint was conducted (Ruijter et al., 2020). The results of actual OGD use were examined in a survey of 266 government agencies. (Mustapa et al., 2022) and (Shepherd et al., 2019) focused on the roles and responsibilities of IT professionals who enable the delivery of OGD to citizens.

In the literature it has been observed that the motivation driving users' intent to adopt OGD is multifaceted, tied to the social aspect of the individual and their distinct requirements. Individual's position significantly influences their willingness to utilize the available OGD. Additionally, an important aspect of the OGD adoption from a user's standpoint is its usefulness which can only be determined if the data is provided with tools for its interpretation, analysis and visualization.

3.2 Impact

The concept of impact stands out as one of the most important aspects of OD, as noted by (Attard et al., 2016a, str. 10) "The main challenge in releasing social and commercial value is that open data has no value in itself, yet it becomes valuable when it is used." Various authors and institutions have researched how open data is impacting or is impacted by society.

To identify the impact of OGD numerous research has been done gaining insights into the OD use. A systematic literature review has been conducted by (Ruijter & Martinius, 2017) to present expected and found impact of OGD on democratic processes. Case studies of OD actual use have been conducted (Apanasevic, 2021; Coutinho & Freitas, 2021; De La Cruz & Lee, 2015; McBride et al., 2019; Shao, 2023). Ferencek (2021) Proposed an automated impact assessment model. How value is created from OGD and what processes exist to create value from it were the main objectives of (Attard et al., 2016b; Magalhaes & Roseira, 2020). The types of open data that are currently in use and the prevalent industries that exploit OGD were identified (Magalhaes & Roseira, 2020) and a literature review conducted by Attard et al. (2016b) revealed what processes exist to create value from OD. To what extent OD drives innovation was the main objective of Huber et al. (2022).

Wieczorkowski (2019b) demonstrated the business opportunities of sharing OGD from the perspective of product and organizational innovation. To understand social-economic effects experienced by a municipality upon opening its data (Apanasevic, 2021) studied the main perceived benefits, the main challenges, issues and risks associated with the publication of the data and (Wilson & Cong, 2021) studied the effects regarding the use and impact of municipal OGD. McBride et al. (2019) and a better understanding of the societal value that OGD can generate (Coutinho & Freitas, 2021). Factors that influence the adoption of OGD for commercial service in cities explored Maccani (2016).

How the use of OGD can attribute to innovative solutions that can generate social and economic value was the focus of Jetzek et al. (2014). The actual use and impact of OGD in private sector was examined by (Ruijter & Meijer, 2020), (Hope et al., 2022) who found positive correlation between government transparency and operational efficiency, and (De La Cruz & Lee, 2015) in a review of 30 interviews with CEOs of companies that use the OGD.

Research has been done about perceived benefits and possibilities of OD by (Jamieson et al., 2019) where three main benefits are questioned. The author argues that without clear empirical evidence the level of the recognized benefits realization cannot be established.

3.3 Policies

Governmental strategy for definition of content and dissemination guidelines regarding OD is proposed through policies. To determine the maturity level of various governments policies to enable publication and reuse of OD (Attard et al., 2015) conducted a literature review, classifying it according to 4 key criteria: *Fiscal transparency*, *Access to information*, *Income and asset disclosures* and *Citizen engagement*. (Ruijter, et al., 2020) developed an analytical framework for studying the politics of OGD.

The interest in what makes the data genuinely open and what policies should have been accepted to maximize the adoption and impact of OD, has been observed in the literature repeatedly. How macro policies were formed to effectively use OD in social services was investigated by (McLoughlin et al., 2019). Concerning the

openness of data (Attard et al., 2015) reviewed existing models for assessing that aspect, such as the Five-star scheme by (Berners-Lee, 2009), 8 government data principles by (O'Reilly & Malamud, 2007), W3C eGov Interest group. In their examination of OD utilization in shared economies (Lee & Wan, 2021) recommended a policy for managing the OD including technological standards, legal framework and managing policies.

What strategies can help advance the OGD ecosystem in countries that are just beginning to develop OGD policies was the objective of (Van Loenen et al., 2020) and (Zhou, Wang, Huang, et al., 2023) surveyed 10-year panel data from 477 Chinese listed firms, to understand the actual impact of OGD policies on firm performance.

Various countries adopt different policies regarding OD, yielding diverse results. While some governments adhere to legal requirements by making data publicly available, they may not prioritize its practical use. An example would be data published in formats that do not enable its reuse (e.g. .pdf format), or the data is released in formats that require licensed software (e.g. .xlsx format) so that its reuse is limited. A framework for comparison OD policies, their implementation and their impact, has been developed by (Zuiderwijk & Janssen, 2014). For the assessment of how countries implement OD policies various benchmarks exist. The authors (Zuiderwijk et al., 2021) addressed the challenge of divergent results among various benchmarks by conducting comparison of the most relevant benchmarks.

The OGD initiative supposedly enabled numerous benefits including “Increasing transparency and accountability, stimulating innovation, improving and supporting decision-making, stimulating data reuse, counteracting corruption and providing new services and products” according to (Zuiderwijk et al., 2019, str. 647-648). The objective of their survey was to investigate how OGD initiative objectives are achieved and what impact do they generate while (Hossain et al., 2021) identified the factors affecting OGD initiative performance.

3.4 Drivers and barriers

The initial incentive for OD use emerged primarily from global directives and legislation adopted by governments worldwide. The European Union directive (European parliament, 2003) and particularly the US presidents Barack Obama

initiative (Transparency and Open Government, 2009) advanced the adoption, promotion and research of OD. Subsequently it was upon government agencies, academic society, civil representatives, enterprises and individuals to use the OD and advocate its further utilization.

To enable a more comprehensive use and to expedite the utilization of OD the European Commission issued a report (Granell et al., 2022) of a series of experiments identifying potential application of emerging technologies and tools for data-driven innovation.

However, the focus of the research was primarily on the lack of the use of OD and the barriers for its adoption. Çaldağ & Gökalp (2022) conducted a literature review to highlight organizational barriers of OGD use and (Wieczorkowski, 2019a) researched the Central Repositories for Public Information of Poland, USA, the UK and Germany to identify barriers to the implementation of OGD-based solutions. Technological, organizational and legal barriers of OGD use were addressed in (Crusoe & Melin, 2018). Identification of potential risks that might emerge at various stages of OGD lifecycle (Wang et al., 2019) led to construction of a taxonomy model for them. An analysis of barriers, namely: 1. *OD acquisition and assimilation barrier*, that derives from *Difficulties in identifying sources and usefulness*; 2. *OD acquisition and assimilation capability*, that is a construct of *Ability to develop organizational culture for open data OI* and *Ability to engage with OD publishers*; and 3. *OD acquisition and assimilation benefit*, that is a construct of *Proprietary data substitution* and *Access to new, previously unavailable data*, and the main capabilities needed to overcome them to successfully manage OD in SMEs has been done by Huber et al. (2020). barriers limiting open data about water resources from realizing its full potential, e.g. *improved transparency, citizen participation, innovation and water resource decision making* has been researched by (Sugg, 2022).

Various user groups experience the drivers and barriers of OD implementation in different ways. (Mutambik et al., 2021) describe the issue from a government official and technological experts' perspective.

3.5 Quality

In the conducted literature review the aspect of quality was questioned notably often. The emphasis on data quality is understandable, since the quality of data is crucial for enabling its meaningful use. The accuracy of the data, considering the parameter value as well as the accuracy of the meta-data giving it context, is essential since any inaccuracies can lead to misleading outcomes, when applied.

Researchers have focused on different aspects of the quality of data, highlighting the issues involving implementation, maintenance and governance of OGD as in the (Bachtiar et al., 2020; Schultz & Kempton, 2022) study or analyzing the quality of available OD like (Ham et al., 2019; Krasikov et al., 2020).

The issue of low-quality OD was further addressed. Based on decision-making trial and evaluation laboratory (DEMATEL) technique, (Moradi et al., 2022) have formed a comprehensive method for improving the quality of OGD and increasing citizens willingness to use the data. Increasing the quality of OD was also one of the objectives in a study by (Zuiderwijk et al., 2014), where they reviewed the main elements of OD ecosystems, that would facilitate a straightforward process for the publication of OD and its use.

Governments globally are making substantial investments into making their data accessible to the public, reflecting a commitment to transparency. However, solely the act of publication is futile if the data provided is of insufficient quality.

3.6 Research categorization

Given the growing volume of research on OD, that has been increasing since the concept of OD has appeared, required its categorization. Authors (Ansari et al., 2022; Cruz & Lee, 2016; Ferencek et al., 2022; Safarov et al., 2017; Saxena, 2018) proposed categorization groups based on literature reviews. While (Ansari et al., 2022) summarized the academic research about OD tools for visualization, (Cruz & Lee, 2016) conducted a research based on a socio-technical model and proposed a framework for future categorization of OGD research. (Safarov et al., 2017) analyzed 101 academic studies about OGD that discussed at least one of the four identified factors of OGD utilization: *OGD types*, *OGD conditions*, *OGD effects* or *OGD*

users. (Ferenček et al., 2022) took a more quantitative approach implementing hierarchical clustering and found that the authors are generally focusing on one of two directions: one that summarizes *government policies, initiatives and portals for OGD sharing* or the other that summarizes *regional use cases, adoption of OGD, platforms and barriers for OGD implementation*.

Further, the empirical research for the categorization was conducted by (Wirtz et al., 2022) who developed a framework for theoretical review of antecedents, decisions and outcomes and found that the empirical research can be categorized into six groups, namely 1. *OGD theory: General / conceptual development*; 2. *OGD antecedents: Drivers / barriers*; 3 *OGD decisions: Adoption / usage / implementation*; 4. *OGD outcomes: Success / performance/ value*; 5. *OGD impacts: Acceptance / satisfaction / trust in government*; and 6. *OGD governance: Policies / regulation / law*.

3.7 Maturity

The readiness of companies to adopt OD is another concept that interested the academic society. OD maturity level serves as an indicator of how well-prepared organizations are for the integration of OD.

Institutes globally are assessing countries for the adoption of OGD. These evaluations analyze accepted policies, the accessibility of OD for consumption, what tools they are offered along with the data etc. (Susha et al., 2015) compared the 5 benchmarks of OGD maturity levels (Open Data Readiness Assessment, Open Data Barometer, Open Data Index, Public Sector Information (PSI) Scoreboard and Open Data Economy benchmarking research) based on its meta-data, meta-methods and meta-theories. Later (Zuiderwijk et al., 2021) reviewed those benchmarks and expanded the selection of benchmarks based on newer research, adding Open data maturity in Europe, World Justice project Open Government Index, OGD Report, Open Data Inventory and OGD by The Economist Intelligence Unit, and excluding PSI Scoreboard

To measure the maturity level for OGD adoption, a theoretically supported model needs to be defined. (Dodds & Newman, 2015) created a model to assess the OD maturity level of an organization in which levels of maturity were divided in 5 sections along with the definition of corresponding activities that need to be

undertaken to achieve a certain level. (Solar et al., 2012) proposed a maturity model that consisted of 3 level hierarchical structure with 33 weighted critical variables to assess the OD maturity level of an organization. In a quality assessment of maturity models Çaldağ & Gökalp (2022) identified, based on predefined criteria: unambiguity, comparability, repeatability, completeness and objectivity, found that there are a limited number of OD maturity models and none of them fully satisfies the requirements.

4 Discussion

To understand the concept of open data, what has been researched by academic society, and what is its practical use in enterprises, we reviewed 72 academic articles from the Web of Science, Scopus and ProQuest. In a review of existing literature, we noticed that some key concepts, such as users, quality, policies, impact, drivers and barriers, research categorization and maturity, predominate others and its aspects surveyed more frequently.

The examination of user perspectives highlighted that the focus was in identifying predictors, that could explain the motivation driving users to utilize OD. Using various existing theories, such as UTAUT, TAM, RSG, etc., different authors derived various results. The motivation of individuals to adopt OD differs from the motivation driving employees in an organization or a public administration. Based on the findings in the literature review the most significant factor in an organization is top management support and competitive pressure, while at individuals the social factor seems to outweigh others. A distribution into groups *beginners*, *followers*, *fast trackers* and *trendsetters* was proposed in the literature concerning the level of adoption of OD where any individual, organization or country can be categorized.

The quality of OD emerged as a crucial aspect in investigating the OD agenda, since any meaningful use depends on it. Studies focused on several aspects of the quality of data throughout the life cycle of OD. Most studies revealed low quality of available OD, which was in consequence followed by propositions on how to increase the quality of OD. According to our literature review the issue of quality data should be the next objective to achieve higher levels of adoption among any user group.

The next major aspect of OD observed in the literature review was the implementation policies. Policies play a pivotal role in defining the publication of OD regarding its quality, usefulness, accessibility, actual openness etc. In the review conducted considerable classification of policies was done, managing framework and implementation guidelines were proposed and existing benchmarks were examined and improved. Only with the implementation of adequate policies governments can achieve a truly open society.

A critical aspect of OD is its impact. Academic society has explored of the perceived benefits, challenges, issues associated with the publication of OD and the main insight that can be extracted is that the open data's value is conditioned with its utilization by individuals, civil society or organizations.

Initial drivers of OD were government directives, after that, public institutions, organizations and individuals advocated for its further opening and adoption. In addition to the drivers, researchers focused on barriers of OD use, examining why the use of OD is not as widespread as it was initially envisioned. Barriers vary from technical, organizational, environmental to legal causes and to achieve higher utilization rates they will have to be addressed.

The growing amount of research indicated the need to categorize the literature itself, to identify the current state and propose future directions for research. With the use of various tools, models and quantitative methods researchers have proposed categorizations into groups.

The maturity level of enterprises for adoption of OD has also been one of the key objectives investigated by the academic community and the global institutes covering the OD agenda. The need for a theoretically supported model has been exposed and several models have been defined.

5 Conclusion

In conclusion, this literature review offers an in-depth analysis of the versatility of the concept of open data. Identifying and addressing the challenges, such as the need for improved data quality and the necessity of appropriate supporting policies, will be essential for further adoption and success in realization of the OD full potential.

Our review highlighted a lack of empirical research on how small and medium-sized enterprises use OD, what incentives could encourage its adoption and which policies would promote its long-term use. Addressing this research gap is essential to enable policymakers to introduce effective strategies for promotion of OD use and help SMEs use OD for innovation and economic growth.

Further research on open data quality, barriers for its adoption and, most of all, its impact are necessary to achieve the open society and economic growth envisaged in the first OD initiatives.

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VLOGA ELEKTROENERGETIKE V DRUŽBI

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Družba, z njo pa tudi elektroenergetika, ki jo kot civilnodružbena organizacija zastopa združenje CIGRE-CIRED, se je znašla v turbulentnih časih, v katerih se zdijo posledice odločitev nepredvidljive. Zaradi tega pogosto niti strokovne razlage procesov, ki do posledic pripeljejo, niso preverljive. Za osvetlitev navedenih procesov je nastal pričujoči zapis poudarkov okrogle mize s 16. Konference slovenskih elektroenergetikov CIGRE-CIRED, na kateri so govorniki v treh sklopih osvetlili pogled na vlogo elektroenergetike v družbi. Kot konkretno zapaščino okrogle mize govorniki predlagajo tri sklepe, ki so povzeti v naslednjih iztočnicah: 1. Električna življenjsko pomembna dobrina in ne zgolj tržno blago, zato zahteva premišljeno upravljanje procesov elektroenergetičnega sistema. 2. Združenje je pripravljeno sodelovati z vsemi dobronamernimi družbenimi deležniki, ki se trudijo, da se električna dojava kot temelj družbene blaginje, ne kot vir konfliktov. 3. Zavezani so k spodbujanju izobraževanja o bazičnih zakonitostih elektroenergetike v sodelovanju z izobraževalnimi institucijami.

Glavne besede:

elektroenergetika,
zelena
transformacija,
odločanje,
družba,
proces



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THE ROLE OF ELECTRO-ENERGETICS IN SOCIETY

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The society, along with the electro-energetics represented by the association CIGRE-CIRED as a civil society organization, has found itself in turbulent times where the consequences of decisions seem unpredictable. As a result, often even the expert explanations of the processes leading to these consequences are not verifiable. To shed light on these processes, the present summary of the round table discussions at the 16th Conference of Slovenian Electro-Energeticists CIGRE-CIRED has been created, where speakers illuminated the role of electro-energetics in society in three segments. As a concrete legacy of the round table, the speakers propose three conclusions summarized in the following key points: 1. Electricity is a vital necessity and not just a market commodity, therefore requiring thoughtful management of electro-energetic system processes. 2. The association is ready to collaborate with all well-intentioned social stakeholders striving to perceive electricity as the foundation of societal well-being, not as a source of conflicts. 3. They are committed to promoting education on the fundamental principles of electro-energetics in collaboration with educational institutions.

Keywords:

Electro-energetics, green transformation, decision making, society, processes

1 Uvod

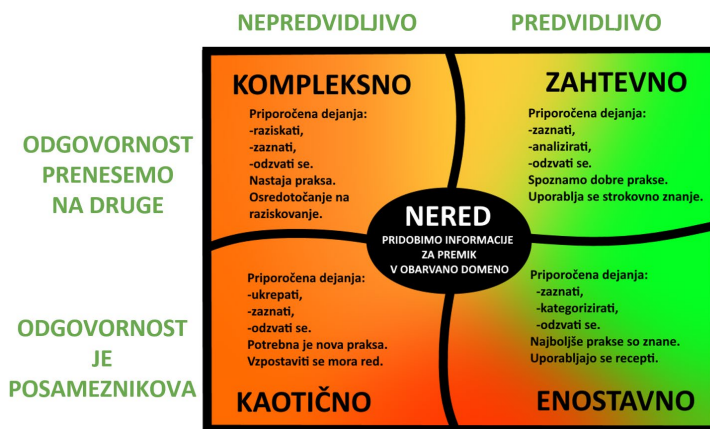
Prilagajanje dinamičnim okoliščinam vsakodnevnega življenja terja preiščen, zahteven, ob tem pa čim bolj transparenten in učinkovit odločevalski proces. Javnost ima glede sprejemanja zanj pomembnih odločitev pogosto deljena mnenja, se pa zaveda pomena argumentiranja mnenj in zato išče informacije, ki pa so lahko za laika težko razumljive. V okviru strokovnega združenja CIGRE-CIRED, katerega člani smo pripravili pričujoči prispevek, je stroka pripravljena z javnostjo komunicirati, predstavljati strokovne argumente, jih usklajevati z družbenimi interesi in iskati skupnosti koristne poti do rešitev. Te rešitve bodo morale naslavljati energetske in podnebne cilje, ki si jih je družba zadala in so v skladu z Evropskim zelenim dogovorom, ki v veliki meri zadeva elektroenergetiko (Evropska komisija, 2019), ter v skladu s Strategijo prilagajanja EU podnebnim spremembam, sprejeto februarja 2021, katere glavni cilji je pametnejše, hitrejše, bolj sistemsko in mednarodno usklajeno prilagajanje na podnebne spremembe (EU Adaptation Strategy, 2021). Če je vsem skupno okolje in z njim povezano podnebje prvo pomembno z elektroenergetiko povezano področje, je drugo pomembno gonilo sprememb v elektroenergetiki digitalizacija. Za uspešno rabo tehnologij, ki omogočajo zbiranje in obvladovanje podatkov o procesih, njihovo avtomatizirano obdelavo v realnem času in njihovo uporabo za upravljanje procesov, za vodenje lastnih poslovnih procesov, je potrebno pridobiti nova znanja, zbirati in ustrezno deliti nove podatke in prilagoditi poslovne procese, da bodo omogočali in postopoma vključevali najprej podatkovno gnano preverjanje intuitivnega odločanja in kasneje intuitivno preverjanje podatkovno gnanega odločanja. Tudi na tem področju so v teku regulatorne spremembe, med njimi najpomembnejša Strategija enotnega digitalnega trga iz leta 2015 (Evropska komisija, 2015) ter uredbe GDPR, ki je stopila v veljavo leta 2018 in poskrbela, da se danes na skoraj vsaki spletni strani izvemo, da funkcionalnosti uporabljajo piškotke (Evropska komisija, 2018). Domača regulativa sledi evropski, s ključnima dokumentoma zelenega prehoda: Strateški okvir prilagajanja podnebnim spremembam (2016) in Resolucija o dolgoročni podnebni strategiji Slovenije do 2050 (2021). Cilji vključujejo zmanjšanje izpostavljenosti vplivom podnebnih sprememb in povečanje odpornosti Slovenije (Ministrstvo RS za okolje, podnebje in energijo, 2021). Nacionalni program varstva okolja za obdobje 2020 – 2030 (2020), določa šest ukrepov za doseganje ciljev prilagajanja podnebnim spremembam, ki temeljijo na zagotavljanju ustreznih podatkov, pripravi ocen ranljivosti po občinah in sektorjih in pripravi strategij prilagajanja in akcijskih načrtov

(Državni zbor RS, 2020). Po uredbi EU 2018/1999 o upravljanju energetske unije in podnebnih ukrepov je bil februarja 2020 v Sloveniji sprejet nacionalni energetska podnebni načrt (NEPN), ki državo zavezuje, da bo do leta 2050 podnebno nevtralna, kar bo dosegla s pomočjo zastavljenih energetskih in podnebnih ciljev, politik in ukrepov do leta 2030, s perspektivo do leta 2040. V vmesnem času so bili sprejeti ambicioznejši cilji EU, med njimi je npr. zmanjšanje toplogrednih plinov za najmanj 55 % do 2030 v primerjavi z ravno iz leta 1990 (Ministrstvo za okolje, podnebje in energijo, 2020).

V uvodnih poglavjih avtorji umestijo elektroenergetiko v širok družbeni kontekst kompleksnega odločanja in evlucijskega razvoja znanja, v nadaljevanju osvetlijo trenutno dogajanje v elektroenergetiki, v zaključnih poglavjih pa osvetlijo dolgoročen razvoj elektroenergetike in njene vloge v družbi.

2 Kategorizacija odločanja

Navedeni politični in gospodarski procesi so povezani z vrstami odločitev skupnosti, institucij in posameznikov s težko- ali ne-predvidljivimi posledicami. Kljub temu si prizadevamo za stabilnost in varnost v družbi. Taksonomijo kontekstov odločanja je uvedel Snowden (2007) kot pomoč pri soočanju z odločitvenimi konteksti različne predvidljivosti posledic in stopnje znanja in jo poimenoval Cynefin. Po modelu Cynefin so odločitveni konteksti razdeljeni v pet domen (Snowden, 2007, French, 2017, Fic Žagar et al, 2021), ki segajo od enostavnih do kompleksnih in kaotičnih kontekstov. Slika 1 ilustrira navedeno delitev in hkrati opiše predloge soočanja z odločitvami v odločitvenem kontekstu dane kompleksnosti. Predloge je Snowden utemeljil na raziskavah teorij sistemov, kompleksnosti in učenja (Snowden, 2007).



Slika 1: Cynefin model odločitvenih kontekstov

Vir: Bokal, Chimani, Vegi Kalamar, 2023

3 Odločanje v evlucijskem - inovativnem kontekstu

Opisana kategorizacija poskuša v dinamični proces odločanja vnesti nekaj reda. Miselni eksperiment, povzet po (Hoffman et al., 2015) odločanje postavi v kontekst evolucije in nam pove, da ni pomembno le razumevanje posledic odločitev, ampak tudi učinkovitost njihovega sprejemanja. Rezultat eksperimenta pokaže, da se v tekmovanju med hitrimi nenatančnimi osebkami in natančnimi, a počasnejšimi osebkami ob podanih predpostavkah hitra vrsta evlucijsko lahko prilagodi tako, da bo izpodrinila natančno vrsto, ne glede na potrebno energijo za razmišljanje, ki jo potroši natančna vrsta. Natančnost v teh razmerah torej ni evlucijska prednost.

Hrana v prejšnjem eksperimentu je monoton vir: več hrane pomeni bolj uspešen razvoj vrste. Razmislak z energijo, ki ni monoton vir, pokaže še bolj presenetljive rezultate. Tu tekmujeta veristična in utilitaristična vrsta. Veristična vrsta loči premalo energije, ustrezno mnogo energije in preveč energije, utilitaristična vrsta pa loči ugodno mnogo energije, znosno mnogo energije (nekoliko preveč oz. premalo) in škodljivo mnogo energije (bistveno preveč oz. premalo). Veristična vrsta torej pozna pravo strukturo sveta, ima občutek (sicer ne natančen) za količino energije. Utilitaristična vrsta pa sledi zgolj maksimalni prilagojenosti na okolje. V teh okoliščinah vrsti nimata časovne prednosti in naključno enkrat ena, enkrat druga prva izbere. Izkaže se, da tudi v teh okoliščinah utilitaristična vrsta izpodrine

veristično in Hoffman iz tega zaključí, da je poznavanje natančne strukture sveta evolucijsko nekonkurenčno poznavanju koristnosti zaznane strukture sveta.

Eksperiment (Fic Žagar, Bokal, 2020) raziskuje, kako vrsta s sposobnostjo ločevanja med presežkom in pomanjkanjem vira lahko prevlada nad vrsto brez te sposobnosti. Ugotovitve kažejo, dak veristična vrsta razvije prilagoditev (recimo ji inovativna vrsta), ki omogoča učinkovito upravljanje z energijo. V okoliščinah preobilja energijo shrani, s čemer zmanjšuje obremenitev okolja, medtem ko v okoliščinah pomanjkanja uporabi zaloge. Kljub temu, da utilitaristična vrsta izbira prva, lahko inovativna vrsta v evolucijski tekmi premaga utilitaristično vrsto.

A cikla evolucijske tekme tu ni konec. Zamislimo si utilitaristično inovativno vrsto, ki razvije zaznavo koristnosti kletke, ki hkrati upošteva tako količino energije v kletki kot v zalogah energije. Taka vrsta torej kombinira lastnosti inovativne vrste in vpliva na koristnost okolja s skladiščenjem odvečne oz. dopolnjevanjem manjkajoče energije, obenem pa ima lastnost neposrednega uvida v koristnost okoliščin in izbira na podlagi te koristnosti. Ta vrsta evolucijsko izpodrine preostale.

Navedeni miselni eksperiment argumentira interpretacijo, da v času izobilja in posledično šibkejšega evolucijskega pritiska poleg utilitarističnih lahko preživijo tudi veristične vrste. Če postanejo inovativne, lahko izpodrinejo utilitaristične vrste, dokler njih samih ne izpodrinejo inovativne utilitaristične vrste. Blaginja je tako evolucijska podlaga inovativnosti, pomanjkanje virov pa spodbuja njihovo utilitaristično, avtokratsko izkoriščanje.

Oglejmo si koncept blaginje. Idealne razmere lahko v vrstah spodbudijo supernormalni dražljaj, evolucijsko razvito a pogubno zaznavo, ki v spremenjenem okolju privede do ogroženosti populacije. Posebno obliko supernormalnega dražljaja predstavlja izobilje, t.j. okoliščine, v katerih se organizmi lahko prekomerno namnožijo. V realnem okolju izobilje ob prekomerni namnožitvi privede do pomanjkanja vira, ki je posledica prekomerne porabe, zato so okoliščine trajnega izobilja redke. Izobilje kot supernormalni dražljaj se torej samo ukine. Več eksperimentov trajnega izobilja je izvedel Calhoun, med njimi izpostavimo eksperiment "Universe 25" (Calhoun, 1962), s katerim je obrazložil reproduktivno smrt populacije. Ker je tekom eksperimenta zagotovil trajno optimalne pogoje, se je s časoma porušil evolucijsko vzpostavljen red; izobilje kot supernormalni dražljaj je

pozornost preusmerilo z aktivnosti, ki zagotavljajo ohranjanje populacije, na ohranjanje prostora, ki je zaradi prenaseljenosti postal redek vir. Preusmeritev pozornosti je preprečila prenos osnovnih bioloških in socialnih kompetenc v naslednjo generacijo in posledično povzročila smrt populacije kljub izjemni dolgoživosti posameznih osebkov.

Navedeni eksperimenti pokažejo dvojno vlogo izobilja. Lahko omogoča inoviranje, odkrivanje novih pristopov k upravljanju virov in s tem učinkovito spreminjanje funkcije vrednotenja koristnosti stanja okolja. Lahko pa izobilje kot supernormalni dražljaj povzroči pomanjkanje virov in posledično poruši evlucijsko vzpostavljen red.

Evolucijsko vlogo pozornosti opredeljuje delo, ki ga definiramo kot opravljanje aktivnosti, ki prispevajo k preživetju osebkov in populacije. Materialni rezultati dela so fizična podlaga preživetju, počutje, ki ga ob delu doživljajo, pa vpliva na vedenjske vzorce osebkov. Kot optimalno izkušnjo počutja pri delu je Csikszentmihalyi opredelil zanos, počutje zlitja z aktivnostjo, ki posamezniku omogoča usmerjanje celotne pozornosti v aktivnost, ki ga hkrati zanima in se počuti zanj ustrezno usposobljen. Če posamezniku aktivnost ne predstavlja izziva, jo opravlja sproščeno; če mu predstavlja izziv a ni dovolj usposobljen, občuti tesnobo, če pa mu niti ne predstavlja izziva, niti ni usposobljen zanj, bo občutil apatijo.

Bokal in Steinbacher (2019) sta raziskovala vpliv omejene pozornosti na občutke posameznika. V njunem modelu so ključni dejavniki stopnja napredka, strasti in vztrajnosti. Pri nizki stopnji napredka prevladuje apatija, ki se lahko ob dvigu napredka spremeni v sproščenost in nato v zanos. Bokal in Tertinek (2019) sta enak model uporabila za preučevanje vpliva števila nalog na počutje in ugotovila podoben vzorec: pri velikem številu nalog je prevladovala apatija, ki je ob zmanjšanju nalog prešla v sproščenost in nato v zanos.

Model je mogoče v naslednjem miselnem eksperimentu uporabiti tudi pri evlucijskem tekmovanju verističnih in utilitarističnih strategij zaznavanja okolja iz prejšnjega miselnega eksperimenta. Evlucijsko uspešna utilitaristična vrsta zagotovi izobilje, ki omogoča preživetje tudi veristične vrste. Slednja odkrije inovacijo, s katero nadvlada utilitaristično strategijo in se razširi, dokler se ne razvije naprednejša utilitaristična strategija, ki zaznava z okoljem usklajeno koristnost inovacije in

prevlada nad veristično vrsto. Novo izobilje vodi do nove inovacije in proces se nadaljuje. Upravljanje novih inovacij pa zahteva vedno bolj kompleksno zaznavanje in odločanje, kar lahko privede do redkega vira - pozornosti osebka - ki posledično povzroči nezmožnost obvladovanja vseh zaznav in učinkovitega odločanja; osebek zdrсне v apatijo in preneha opravljati svojo evlucijsko pogojeno vlogo.

Cilj navedenih eksperimentov je opozoriti na redke vire, ki so relevantni v evlucijskih inovativnih procesih, kot sta pozornost in počutje posameznika

Krog naših razmislekov je s tem sklenjen. V kaotičnih, tekmovalnih razmerah odločanja se organizmi učijo z (evlucijskim) eksperimentiranjem. Evlucija vzpostavi stabilne vloge v populaciji, ki zagotavljajo preživetje in blaginjo. Ta proces vodi do kompleksnega odločanja, kjer se osebki učijo inovacij, ki postanejo temelj za učinkovito uporabo vrednot, in predsodkov pri intuitivnem odločanju s kategorizacijo okoliščin in sledenjem receptom.

Bowles (1998) današnje družbo okarakterizira s tremi vrednotami: učinkovitostjo, ki ima podlago v evlucijskem preživetju, odprtostjo za inovacije, ki omogoča družbeni napredek, in prostovoljnim sodelovanjem, s katerim posamezniki opravljajo svojo vlogo v družbi. Na osnovi teoretičnih mikroekonomskih dognanj in behaviorističnih eksperimentov ugotavlja, da sistem, recept nagrajevanja, ki bi spodbujal vse tri vrednote hkrati, ni mogoč. Primer tega protislovja je matematični izziv, ki ga je leta 1999 objavil Ian Stewart, in ki hkrati ilustrira razvoj odločanja od kaotičnega preko kompleksnega, zahtevnega pa do enostavnega.

Razmislek opozarja na še en primer supernormalnega dražljaja, ki ga lahko predstavlja racionalnost obnašanja oz. zanašanje na pravila. Če se ne upošteva namena, s katerim so bila pravila vzpostavljena ali inovacije odkrite - doseganje učinkovitega odločanja, doseganje blaginje ob predpostavkah učinkovitosti, odprtosti in prostovoljnega sodelovanja, se lahko pravila izrodijo in podpirajo nasprotje namena: pravila zdrsnajo v rigidno birokracijo, blaginja se lahko prelevi v smrt populacije, ki izhaja iz prezasičenosti pozornosti in posledično umika iz prostovoljnega sodelovanja pri evlucijsko utemeljenih vlogah.

Navedeni razmisleki so deloma utemeljeni na in vivo eksperimentih, deloma na evolucijski teoriji iger, deloma na in silico eksperimentih in deloma na logičnem sklepanju. Zaradi raznoliknega izvora kot argumenti nimajo trdne, enovite teoretične znanstvene osnove. Kljub temu pa nakazujejo na kaotičnost konteksta odločanja, ki ga naslavljamo z inovativnimi pristopi, in (p)odpirajo nabor tveganj, ki jih je smiselno upoštevati pri inoviranju bistvenih sprememb elektroenergetskega sistema, kot sta njegova digitalizacija in zelena transformacija, katere bistveni del v elektroenergetiki je defosilizacija. Naj ta tveganja izpostavimo:

- Podnebje, katerega spremembe so motivacija za zeleno transformacijo, je kaotičen sistem, v katerem posledice odločitev niso predvidljive na enak način kot pri preprostih fizikalnih sistemih statike ali dinamike. Transparentnost modelov in podatkov je zato nujna podlaga kakršnekoli regulative tega področja; prav tako je nepredvidljivost posledic odločitev podlaga za razvoj nove oblike prava, ki vrednoti namene in vedenje namesto zavez in predvidenih posledic.
- Inovacije so podlaga napredka, a le v primeru, če izkažejo svojo koristnost. V idealiziranem primeru nadomestijo preteklo znanje ob hkratni zaznavi koristnosti. To nakazuje, da je smiselno z vsako inovacijo razvijati tudi njeno analizo upravičenosti, kar kliče po transparentnosti podatkov, ki izhajajo iz uporabe inovacije.
- Obvladovanje navedenih podatkov terja pozornost, ki je posamezniki pogosto ne morejo posvetiti. Dodaten motiv za transparentnost podatkov in metodologij je zato zagotavljanje zaupanja v izdelane analize upravičenosti, stroškov in koristi.
- Evolucijska tekma lahko favorizira hitro, površinsko, nenatančno odločanje. To se v naravi odraža skozi eksperimente - mutacije kot naključne spremembe evolucijskega programa in prekrivanja kot načrtovane izmenjave evolucijskega programa, ki v omejenem obsegu ne morejo bistveno poseči v populacijo, v primeru izkazane koristnosti pa pripeljejo do postopne zamenjave obstoječega reda. Tovrstno eksperimentiranje v omejenem obsegu je zato smiselno vpeljati tudi v regulacijo procesov.
- Za široko sprejemljivost inovacije je pogosto potrebno poenostaviti sporočilo svoje koristnosti. Na ta način se uveljavijo, kar omogoči natančnejše preverjanje njihove upravičenosti. Z uveljavitvijo pa so

povezani investicijski stroški, ki vodijo v pritisk prikrivanja posledic, kar je smiselno regulatorno nasloviti in iskati ravnovesje med prostovoljnim sodelovanjem v tveganem investicijskem procesu in regulatornimi ovirami, ki jih morajo inovacije preseči, da uspejo na konkurenčnem - evolucijskem trgu.

- Pestrost strategij v evolucijski tekmi celotno populacijo bogati in jo dela stabilnejšo, bolj odporno na spremembe v okolju. Redki viri pa nasprotujejo pestrosti populacije in favorizirajo tiste strategije, ki so na dostopne vire najbolj prilagojene. Redkost virov tako vodi v avtoritarnost, poudarjanje učinkovitega odločanja in upravljanja; blaginja je podlaga svobode in pestrosti.
- Med redke vire sodi tudi pozornost, potrebna za uporabo in upravljanje inovacij. Ilustracija je navedeni prispevek. Za poskus konsistentne obravnave odločanja v kaotičnem, evolucijskem ekosistmu znanja terja informacije iz pestrega nabora ved, tako znanosti kot strok. Obvladovanje informacijskega ekosistema je zato porazdeljeno, kar odpira tveganje neuskklajenih, partikularnih interesov in njihovega optimiranja v korist enih in škodo drugih delov populacije. Navedeno je podlaga nezaupanja, ki ga je treba nasloviti skozi uveljavljanje in preverjanje praks, skozi dopuščanje možnosti nenamernih napačnih odločitev ob nezavedanju celovitosti posledic odločitev, ki so bile sprejete v kaotičnih in kompleksnih miljejih odločanja.
- Pestrost lahko, če ni usklajena in podprta z zaupanjem, vodi tudi v siromašenje. Nezaupanje med tekmujočimi vodi v spopad za redke vire, ki v ilustriranih primerih vodi do naslednjega zaporedja redkih virov (sodelovanje v pridobivanju osnovnih virov, kot sta hrana, materialni viri - njihovo izobilje vodi v prenaseljenost, pomanjkanje prostora; usklajevanje, dogovarjanje v upravljanju prostora - njegovo izobilje vodi v kompleksno upravljanje podatkov, pomanjkanje pozornosti, dogovarjanje v upravljanju pozornosti, preprosta pravila usklajevanja in odkrivanja - izobilje pozornosti zaradi razpršenega upravljanja omejenega obsega podatkov vodi v strah pred zavajanjem, pomanjkanje zaupanja, zaupanje v dogovorjen sistem, mehanizem, v navedenem kontekstu lahko smatramo tudi kot naivnost, odsotnost pripravljenosti na dinamično prilagajanje spremembam kaotične realnosti, ki je bila v osnovi podlaga za pomanjkanje hrane).

Navedeno odpira nekatera, nikakor pa ne vsa tveganja v opisanem procesu. Za izhodišče pregleda tveganj bi lahko vzeli nabor vrednot in pravil, ki so jih razvile zgodovinske kulture in vsakega od njih pretehtali s stališča pomena tveganja za družbo. Taka raziskava bi bila podlaga minimalnemu naboru tveganj, ki jih mora upoštevati posameznik ali skupnost. Skupnosti bi tako ponudile osmišljanje delovanja posameznikov skozi pozornost, ki jo le-ti lahko posvečajo inovacijam in pravilom njihovega upravljanja.

Ob zavedanju navedenega nabora tveganj se v nadaljevanju posvetimo elektroenergetskemu sistemu, njegovim procesom in inoviranju teh procesov v zelenem in digitalnem prehodu.

4 Državotvorna vloga in regulatorne omejitve elektroenergetskega sistema

Električna energija je podlaga za zeleno transformacijo in defosilizacijo energetskih tokov, pri čemer Evropska unija igra vodilno vlogo v vzpostavljanju regulativnih zahtev za defosilizacijo. Tovrstna regulativa omejuje dostop do lastnih virov tistim družbam, ki proizvajajo na fosilno vezanem ogljiku osnovane vire in daje prednost družbam, ki so sposobne energijo zagotavljati iz alternativnih, obnovljivih virov. S tem lahko družbe, ki energije iz obnovljivih virov ne zmorejo pridobiti, postavlja v odvisen položaj od tistih, ki jih lahko. Tako se vzpostavlja okoliščine, ki bi ob prehitrem ugašanju na fosiliziranem ogljiku osnovanih virov lahko vodile do pomanjkanja energije kot ključnega družbenega vira. V takih okoliščinah pravila prostega globalnega trga diktirajo visoke cene, pravila omejene suverenosti in omejenega vpliva na trg omejujejo vpliv lokalnih regulativ na ceno električne energije in posledično lahko ogrozijo konkurenčnost lokalnih gospodarstev ter zapiranje najbolj izpostavljenih podjetij.

Model za razumevanje in razrešitev navedenega zapleta predstavlja koncept ustavne pluralnosti (Jaklič, 2014). Po tem konceptu se regulatorna infrastruktura deli med širšo družbo in nacionalne družbe, kar predstavlja pluralnost sestavnih delov evropske regulative. Navedene regulative niso v hierarhičnem odnosu, ampak so v procesu dinamičnega usklajevanja s skupnim ciljem trajnega zagotavljanja blaginje vseh delov družbe.

Na primeru konkretnega cilja vsaj 55% zmanjšanja izpustov toplogrednih plinov glede na leto 1990 do leta 2030 razmislimo, kako navedena struktura regulative vpliva na procese defosilizacije družbe in kakšno vlogo elektroenergetski sistem lahko odigra v teh procesih. Z vzpostavitvijo družbenega (in posledično regulatornega) cilja defosilizacije se skupnost (samo)omejuje pri uporabi določenih virov za proizvodnjo elektrike. Države se bodo morale dolgoročno odpovedati določenim virom energije oziroma jih drugače nevtralizirati.

Za ilustracijo predpostavimo, da imajo članice na voljo naslednje ukrepe za doseganje 55% zmanjšanja izpustov toplogrednih plinov: zapiranje ogljičnih virov energije, nadomeščanje z neogljivi viri energije, ustvarjanje ponorov toplogrednih plinov od drugih držav, ki emisije ogljičnih virov vzame iz okolja, kupovanje energije od drugih držav, kupovanje ponorov toplogrednih plinov od drugih držav. Ukrepe lahko razdelimo v dve skupini: po prvi skupini države članice same poskrbijo za svoj delež odgovornosti doseganja usklajenega skupnega cilja, po drugi pa skrb za doseganje ciljev prevajajo na druge in jih za to skrb finančno kompenzirajo. Skupna regulativa ne predpisuje, na kakšen način bodo članice dosegle svoje zaveze, ampak ta del - v skladu z ustavno pluralnostjo - prepušča regulativam posameznih članic. Ustavna pluralnost jim tako omogoča, da razvijejo sebi lastne prilagoditve za doseganje zastavljenega cilja. Regulativa skupnosti ima v prvi vrsti nalogo usmerjanja in usklajevanja skupnih ciljev in prevzame odgovornost, da ti skupni cilji zagotavljajo blaginjo članic. Vzporedno s to odgovornostjo pa imajo posamezne članice odgovornost za svoj prispevek k dogovorjenemu skupnemu cilju, ki ga dosežejo na sebi lasten način.

Navedene okoliščine lahko peljejo do dveh bistveno različnih scenarijev. Po prvem bo cilj uspešno dosežen: skupnost kot celota bo proizvedla dovolj brezogljivične energije in dovolj ponorov toplogrednih plinov, da bo ob doseženem cilju energije na trgu dovolj. V tem primeru se bodo ohranile obstoječe okoliščine blaginje in družbeni procesi se bodo lahko odvijali po znanem, ustaljenem redu. Do drugega scenarija pa pride, če cilj ne bo dosežen. Ta scenarij lahko vodi do pomanjkanja energije. V skladu s tržnimi mehanizmi bi energija ali postala draga, kar bi lahko vodilo do nekonkurenčne ekonomije, ali pa bi bilo potrebno omejevati njeno porabo. Dolgoročno bi oboje predstavljalo padec življenjskega standarda. V skladu z odgovornostjo posameznih članic za prispevek k skupnemu cilju, po ustavnem pluralizmu, se končni scenarij lahko razlikuje tudi po posameznih državah članicah.

Za trajno blaginjo skupnosti in posameznih držav članic je ključno, da proces usklajevanja definira dosegljiv skupni cilj. Države članice morajo prevzeti odgovornost in vključiti intelektualne in druge procese za učinkovito doseganje cilja. Neizpolnitev ciljev lahko vodi do razpada skupnosti ali podrejenega odnosa članic, kar ogroža pluralnost in intelektualni potencial skupnosti, dolgoročno pa tudi samo blaginjo. Sklenemo lahko, da ima stabilen, zmogljiv elektroenergetski sistem, ki pokriva potrebe članice po energiji, tudi državotvorno vlogo, saj članici omogoča, da odgovorno izpolnjuje svoj delež zavez skupnosti.

5 Učinkovito inoviranje v elektroenergetskem sistemu

V tem poglavju naslavljamo inoviranje za potrebe zelene transformacije in defosilizacije elektroenergetike s strani predlagateljev inovacij, ki morajo tovrstne spremembe uveljaviti, kot primer dobre prakse na področju inoviranja pa izpostavljam v družbi ELES razvito rešitev *konceptov*.

Izzivi, kot so razpršena proizvodnja električne energije iz obnovljivih virov, shranjevanje energije ter spremembe energentov na področju prometa in ogrevanja, zahtevajo prilagajanje na vseh ravneh odločanja, vključno s posamezniki, distribucijskimi operaterji, prenosnimi operaterji, regulatorji in zakonodajalci. Prevzem električne energije v prihodnjih elektroenergetskih sistemih bo sledil razpoložljivosti proizvodnih zmogljivosti, kar velja tudi za promet in ogrevanje. Strokovno mnenje nakazuje, da sistem prehaja iz izobilja ogljičnih virov v njihovo pomanjkanje, ki bo trajalo do prilagoditve novim čistim virom energije.

Za prilagajanje navedenim izzivom lahko slovenski elektroenergetski sistem ponudi uvodoma omenjeno razvito rešitev *konceptov*, ki celovito in predvsem kvalitativno analizirajo možnosti učinkovitejše rabe energije iz obnovljivih virov s strani različnih uporabnikov omrežja. Ti koncepti predstavljajo orodje, ki usmerja pozornost deležnikov k vmeščanju inovacij v elektroenergetski sistem. Uporabniki omrežja in povezani sektorji lahko s temi koncepti ocenijo, uvajajo, prilagajajo in izboljšujejo učinkovito rabo energije iz obnovljivih virov ter spremljajo usklajevanje z dolgoročnimi cilji zelene transformacije (ELES 2023).

5.1 Koncept celostnega razvoja infrastrukture za masovno polnjenje e-vozil E8 in globoka elektrifikacija

S tem konceptom družba ELES izpostavlja problematiko (ne)načrtovanja polnilnic za električna vozila, ki bi delovale kot pametne polnilnice in bi pomagale elektroenergetskemu sistemu kot dejavnik stabilnosti

Pomembno je, da regulatorji pripravijo podlage, s katerimi bodo hitre polnilnice uravnotežene z ustrežno količino pametnih polnilnic, kar bo zagotavljalo medsebojno stabiliziranje. To bi dosegli s spodbujanjem sistematičnega postavljanja pametnih polnilnic na dolgotrajnih parkiriščih, v prvi fazi predvsem pred objekti, kjer zaposleni parkirajo vozila med službenim časom. Industrijski standard morajo predstavljati odprti standardi, po zgledu koncepta in demonstracijskega projekta E8, ki sta ga ELES in Telekom Slovenije izvedla leta 2021. Glede na velikost flote osebnih vozil v Sloveniji in predvidene dinamike uvajanja e-mobilnosti, bi v Sloveniji do leta 2030 morali postaviti, opremiti in v sisteme vodenja vključiti vsaj 100.000 pametnih polnilnic. V prihodnosti bi vsako vozilo moralo imeti možnost pametnega polnjenja kjerkoli je dlje časa parkirano.

Eles s konceptom E8 vzpostavlja tudi praktični poligon za učinkovit in hiter preboj rešitev globoke elektrifikacije. Globoka elektrifikacija namreč pomeni vertikalno povezovanje uporabnikov in sistemov, obravnava povezavo uporabnikov do distribucijskih operaterjev, agregatorjev in systemskega operaterja. Uporabnik torej postane aktivni udeleženec v zelo kompleksnem medsebojno odvisnem sistemu (ELES 2023).

5.2 Koncept Pentlja

Poslovna vozila, ki so v rabi ves dan, ne morejo slediti rešitvi vodenega polnjenja na mestih daljšega postanka (po zgledu E8). Zaradi potrebe po stalni razpoložljivosti poslovnih vozil je nujno vzpostaviti razvejano omrežje hitrih polnilnic. Zaradi potrebe po kratkih časih polnjenja in zmogljivejših baterijah, so za polnjenje teh vozil potrebne večje moči kot pri osebnih vozilih, kar zahteva visoko kakovost storitev zelo velikemu številu uporabnikov in razpoložljivo priključno moč med 20 do 50 MW (po Elesovih analizah) na lokacijah, ki morajo biti izbrane v bližini

prenosnega omrežja in avtocest, zagotavljajoč hkratno hitro polnjenje vsaj 50 osebnih vozil ter 20 poslovnih vozil in tovornjakov.

Prihod e-mobilnosti se ob povečani ponudbi in večji konkurenčnosti ponudbe električnih prevoznih sredstev lahko hitro spremeni v velik izziv za zagotavljanje primerne hitre polnilne infrastrukture. Na drugi strani postopki izgradnje podporne infrastrukture lahko trajajo dolgo časa, še posebej zaradi upoštevanja zahtevne omejitve umeščanja v prostor. Sistemski operater mora pravočasno in s pravilnimi ter strateško dolgoročno usmerjenimi ukrepi zagotoviti trajnostno širjenje elektromobilnosti.

Slovenija dolgoročno potrebuje od 10 do 15 tovrstnih vozlišč, k tem pa lahko na drugih, manj primernih lokacijah dodamo še manjše hitre polnilnice, ki bodo imele do 20 polnilnih mest za osebna vozila (ELES 2023).

5.3 Koncept KODO

V okviru analize potreb po medsektorskem povezovanju toplote je Eles ugotovil, da se daljinski sistemi ogrevanja s toplo vodo, kot del koncepta KODO, lahko izkažejo za ključne za zanesljivo in cenovno ugodno oskrbo s toplotno energijo. Pri vzpostavitvi teh sistemov v Sloveniji je odjemalcem potrebno zagotoviti hkraten priklop na različne vire energije, vključno z biomaso, elektriko, vodikom, geotermalno in sončno energijo. Odjemalcem se mora zagotoviti enostavno in hitro (od tri do pet mesecev) spremembo centralne ogrevalne naprave in s tem vira energije toplotnega sistema. Lokacijo centralnega vira energije daljinskega sistema je treba določiti z vidika prožnosti preklopov med viri energije in statičnosti daljinskega sistema ogrevanja. Investitorji morajo prednostno obravnavati bližino priključka za električno energijo od centralnega kurišča in prostora za uporabo biomase ali vodika ter upoštevati vse prednosti četrte generacije sistemov ogrevanja. Pri odločitvi za energente je treba predvideti tveganja ne-dobave ali izkrivljanja lokalne konkurence posameznega energenta ali dobavitelja.

Koncept KODO temelji na tržnem dostopu do energenta in v povezavi z daljinskimi sistemi ogrevanja Eles spodbuja različne vidike krožnega gospodarstva. Njegove smernice bodo uveljavljane z vključevanjem v projektiranje prenove daljinskih sistemov ogrevanja in v izgradnjo novih sistemov na lokalni ravni. S tem

pospešujemo defosilizacijo ogrevanja in z medsektorskimi rešitvami zagotavljamo dolgoročno vzdržnost sistemov ogrevanja v odnosu do elektroenergetskega sistema (ELES 2023).

5.4 Koncepti pasivnega in aktivnega prodjemalca ter agregatorja

Podlaga za več navedenih konceptov sta koncept pasivnega in aktivnega prodjemalca, ki po svojih zmožnostih sodelujeta v procesu zelenega prehoda in defosilizacije. Prvi se zaveda omejenosti svoje pozornosti, ki jo lahko posveti proučevanju tehnologij, a bodisi zaradi zelenega idealizma ali zaradi neposredno zaznanih koristi sodeluje v procesu npr. s postavitvijo sončne elektrarne, domače baterije, nakupom električnega avtomobila. Aktivni prodjemalec pa ima na voljo pozornost, ki jo posveti proučevanju tehnologij, lahko aktivno sodeluje pri njihovi promociji in uvajanju lahko v te procese uvaja svoje vire ob realnem pričakovanju, da bo investirane vire dobil povrnjene. Slednje zagotovi mu lahko ponudi digitalizacija procesov in njihovo spremljanje. Aktivni prodjemalec tako multiplicira učinke svojih dejavnosti s pridobivanjem pasivnih prodjemalcev, ki na osnovi svojega zaupanja aktivnemu prodjemalcu sledijo njegovim predlogom.

Agregator je institucionaliziran aktivni prodjemalec, katerega osnovna dejavnost je agregiranje vloge manjših prodjemalcev na elektroenergetskem trgu. Ima vse potrebne kompetence za predvidljivo sodelovanje v trgu in sodeluje v procesih ravnotežja med proizvodnjo in porabo. Agregator je tisti, ki prevzame odgovornost za predvidljivo obnašanje malih, razpršenih učinkov posameznih inovacij v celotnem elektroenergetskem sistemu.

5.5 Koncept Utemeljena sprejetost

Zrelostni modeli, znani tudi kot modeli stopenj rasti, stopenjski modeli ali stopenjske teorije (Prananto 2003) so modeli, ki z uporabo nivojev opisujejo rast subjektov. Modeli temeljijo na predpostavki predvidljivosti vzorcev rasti in opisujejo pričakovane ali zaželene nivoje rasti (Pöppelbuß & Röglinger 2011). Za upravljanje narativa in usmerjanje virov pri uveljavljanju v predhodnih razdelkih opisanih inovacijskih konceptov vpeljemo koncept Utemeljena sprejetost - širitveni model strokovno utemeljenega koncepta oz. zrelostni model razširjenosti strokovno utemeljenega koncepta, ki kategorizira napredek uveljavljanja inovacijskih

konceptov. Model se osredotoča na strokovno utemeljene koncepte, ki najprej nagovarjajo ozko skupino in se širijo v strokovno javnost ter končno do najširše populacije. Razvoj koncepta zajema zgodnje faze snovalnega razmišljanja in kasnejše stopnje zrelosti tehnologij, kar pripomore k razumevanju sprejetosti in razširjenosti koncepta v družbi. Predlagamo naslednje stopnje sprejetosti koncepta: Zasnova, snovanje, testiranje, sprejem, usklajevanje, uporaba, sprejem v javnosti, testiranje v javnosti, uporaba v javnosti.

Sprejetost koncepta se začne pri zasnovi, kjer kateri posameznik ali skupina znanstvenikov, inovatorjev, razvijalcev oblikuje koncept iz osnovnih gradnikov, kot so strateška usmeritev, misija, kriteriji odločanja, uporabniški model ter kratkoročne in dolgoročne rešitve. Razumevanje ciljne publike in vpogled v navedene stopnje sprejetosti pokaže, katere korake bo koncept moral preiti do končne faze sprejetosti in posledično, katere gradnike je smiselno zbrati v zasnovo koncepta. Konča pa se pri uporabi v javnosti, ko se koncept v prvi usklajeni različici implementira v procese, kjer jih nepoučena javnost uporablja. Intenziteta pozornosti konceptu se z oblikovanjem in usklajevanjem prenese na uporabo v odločanju in preverjanje rezultatov, ki jih prinaša. Periodično se lahko s konceptom povezana priporočila preoblikuje v skladu z izkušnjami, ki jih je najširša uporaba prinesla.

6 Opolnomočenje odjemalcev in prodjemalcev za sodelovanje v zeleni in digitalni transformaciji elektroenergetskega sistema

Sodelovanja odjemalcev in prodjemalcev v zeleni in digitalni transformaciji elektroenergetskega sistema smo se dotaknili že v razdelku 5.4, kjer smo omenili koncepte pasivnega in aktivnega prodjemalca ter agregatorja.

Opolnomočenje prodjemalcev za določeno dejavnost v elektroenergetskem sistemu je tesno povezano z najširšo družbeno uveljavitvijo konceptov, ki so bili predstavljeni v prejšnjem razdelku. Izzivi, na katere pri tem naletimo, odražajo vso kompleksnost problematike zelene transformacije. Za uveljavitev določenega vidika zelene transformacije je najprej potrebna promocija v ciljni javnosti. Ko se ciljna javnost odzove, je potrebno njen odziv usklajevati s fizikalnimi zmožnostmi omrežja. Slednje lahko onemogočajo rentabilnost določenih investicij, kar pošilja nekonsistentna sporočila ciljni javnosti in odvrta predvsem pasivne prodjemalce od

sodelovanja, saj zaradi kaotičnega miljeja odločanja ne zmorejo vložiti potrebne pozornosti, da bi razumeli kompleksno problematiko.

Rešitev problema je moč iskati v koordiniranju dela agregatorjev in pasivnih ter aktivnih prodjemalcev. Agregatorji v sodelovanju z upravljalci distribucijskih in/ali prenosnega omrežja preverijo obseg zmožnosti in priložnosti, ki jih ponujajo fizikalne danosti znotraj izbranega dela omrežja. Nato pripravijo razpis ali natečaj za prodjemalce, ki ponudijo bolj ali manj ugodne pogoje za razpoložljive kapacitete lokalnega omrežja. V prvi fazi se na natečaj prijavijo aktivni prodjemalci, ki sledijo problematiki in so dovolj poučeni, da prepoznajo priložnost. V kolikor še ostajajo proste kapacitete, se razpis lahko ponovi tako, da se upošteva fizikalno realnost, ki je nastala po zaključeni prvi fazi sodelovanja. V drugi fazi lahko aktivni prodjemalci izkoristijo dodatne proste kapacitete oz. k sodelovanju pritegnejo pasivne prodjemalce. Skozi tak proces se prodjemalci seznanjajo s priložnostjo in s tem opolnomočijo. Inovacije pa tudi omogočajo večjo prilagojenost tehnologije nižam posameznih prodjemalcev, kar širi doseg posameznih novih tehnologij.

Praktične primere opisanega sodelovanja prodjemalcev z elektroenergetskim sistemom omogoča Uredba o samooskrbi iz obnovljivih virov energije (Ministrstvo za infrastrukturo, 2019). Elektro Gorenjska je februarja 2019 v distribucijsko omrežje priključilo prvo napravo za skupinsko samooskrbo na strehi večstanovanjske hiše na Jesenicah. Naprava, ki je investicija podjetja GEN-I Sonce, ima nazivno navidezno moč 21,7 kVA in je namenjena za proizvodnjo električne energije za potrebe 23 stanovanj s priključno močjo po 8 kW. Napravo dopolnjuje sončna elektrarna za individualno samooskrbo nazivne navidezne moči 15 KVA, ki zagotavlja električno energijo za toplotno postajo. Predvidena letna proizvodnja električne energije je 37.000 kilovatnih ur, predvideva se letni prihranek 17 ton emisijah ogljikovega dioksida in 4.500 EUR pri stroških električne energije. Predvideva se, da se bo 36.400 evrov vredna naložba v celoti povrnila v sedmih letih.

7 Strateška podpora inovacijam in razvoju kadrov za zeleni in digitalni prehod

Pri obsežnih spremembah, kot jih napoveduje zeleni prehod, je ključno učinkovito inoviranje in prilagajanje, ki smo ga utemeljili v dosedanem prispevku. Nujna pa je tudi široka kadrovska podpora. Slednjo ob zahtevi po tako visokotehnoloških

znanjih zagotavljajo predvsem Univerze. V primeru inoviranja se jim pridružijo tudi inštituti, ki imajo razvojno-raziskovalno poslanstvo in podjetja, ki morajo inovirati, da ostanejo konkurenčna na trgu.

Ključne spremembe, ki se obetajo na tem področju, stremijo k enostavnejšemu povezovanju v inoviranje in razvoj kadrov vpletenih deležnikov. Temu je namenjena nova Javna agencija za znanstvenoraziskovalno in inovacijsko dejavnost RS (ARIS), ki prevzema nasledstvo prejšnje Javne agencije za raziskovalno dejavnost RS (ARRS), obenem pa bo opravljala tudi nekatere dejavnosti nekdanje Javne agencije za tehnološki razvoj RS (TIA). Tako bodo v eni agenciji združeni podporni mehanizmi za vse razvojno-raziskovalne dejavnosti na vseh nekomercialnih stopnjah tehnološke zrelosti (prim. razdelek 5.4 o zrelostnih modelih).

V podporo navedenim inovacijskim ciljem je tudi Nacionalni energetske in podnebni načrt. V njem so opredeljeni naslednji ključni cilji do leta 2030:

- zmanjšanje skupnih emisij toplogrednih plinov za 36 %, od tega za 20 % v sektorju ne-ETS (kar je 5 odstotnih točk nad sprejeto zavezo Slovenije);
- vsaj 35 % izboljšanje energetske učinkovitosti (višje od cilja na ravni EU, 32,5 %);
- vsaj 27 % obnovljivih virov energije, kjer je Slovenija zaradi relevantnih nacionalnih okoliščin morala pristati na nižji cilj od cilja na ravni EU (32 %) s prizadevanjem, da se ambicija zviša pri naslednji posodobitvi NEPN (2023/24),
- 3 % BDP za vlaganja v raziskave in razvoj, od tega 1 % BDP javnih sredstev.

8 Zaključek

Družba, z njo pa tudi elektroenergetika, ki jo kot civilnodružbena organizacija zastopa združenje CIGRE-CIRED se v zadnjih letih spopada s situacijami, za katere se zdijo posledice rešitev nepredvidljive. Nepredvidljivi odločitveni konteksti so po Cynefinu sestavljeni iz kompleksnih ali kaotičnih kontekstov odločanja. Oboji lahko pripeljejo do situacij, v katerih niti strokovne razlage procesov, ki do posledic pripeljejo, niso preverljive. Prispevek, ki predstavlja poudarke okrogle mize s 16. Konference slovenskih elektroenergetikov CIGRE-CIRED, osvetli in pojasni zgoraj omenjene procese, vlogo

elektroenergetike za širšo družbo, trenutno stanje v elektroenergetiki ter strateški načrt za prihodnost.

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ZAVEDANJE POTROŠNIKOV O VARNOSTI IN ZASEBNOSTI PRI SPLETNEM NAKUPOVANJU

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Spletno nakupovanje je za kupce, ki se ne marajo sprehajati po natrpanih trgovinah, ali stati v dolgih vrstah, alternativa nakupovalnim centrom. V zadnjih letih je ta oblika nakupovanja postala še bolj priročna zaradi mobilnih aplikacij. Z rastjo deleža spletnih nakupov narašča tudi delež spletnih prevar, zato se morajo spletni kupci zavedati tveganj, povezanih s spletnimi nakupi. Varovanje podatkov kreditnih kartic ni edina skrb glede zasebnosti, saj je potrebno poskrbeti tudi za druge osebne podatke. Kljub temu, da obstajajo splošne usmeritve, kako zaščititi in ohraniti zasebnost in varnost pri spletnem nakupovanju, je še vedno malo znanega o tem, v kakšni meri se jih kupci zavedajo in o obstoju razlik med starostnimi skupinami in spoloma. Da bi raziskali trenutno stanje, smo spomladi 2023 izvedli raziskavo med slovenskimi potrošniki. V prispevku predstavljamo rezultate naše raziskave.

Ključne besede:

spletni
nakup,
varnost,
zasebnost,
potrošniki,
raziskava

SECURITY AND PRIVACY ISSUES WHEN SHOPPING ONLINE

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Online shopping is the alternative to shopping centres for customers who do not prefer walking through crowded stores or standing in long queues. Online shopping has become more convenient in recent years due to mobile apps. As the proportion of online purchases increases, so does online fraud, which is why online shoppers need to be aware of the risks associated with online purchases. Credit card data protection is not the only concern, as other personal data also need to be protected. Although there are general guidelines for protecting and maintaining privacy and security when shopping online, little is known about the extent to which shoppers are aware of these guidelines and whether there are differences between age groups and genders. To investigate this, we have conducted a survey among Slovenian consumers in spring of 2023. In this paper, we present the results of our survey.

Keywords:

online shopping, security, privacy, consumer perspective, survey

1 Uvod

Število uporabnikov pametnih telefonov po vsem svetu je več kot 6,93 milijarde (Turner, 2023), po napovedih pa naj bi njihovo število do leta 2025 doseglo 7,5 milijard (Statista, 2023). Uporabniki pametnih telefonov shranjujejo informacije in brskajo po spletu ter s tem zbirajo in delijo velike količine podatkov. Za milijarde ljudi po vsem svetu je pametni telefon postal nepogrešljiv vsakodnevni spremljevalec. Za mnoge je naprava na dosegu roke tudi med spanjem. Zaradi neprekinjene uporabe lahko pametni telefoni spremljajo vedenje uporabnika, gibanje, dejavnosti na spletu in zunaj njega, dejavnost v družabnih omrežjih, itd. (Barth et al., 2019; Huang et al., 2023). Vendar večine teh podatkov končni uporabnik ne deli prostovoljno ali zavestno, temveč jih sprožijo poslovni modeli, ki temeljijo na ustvarjanju podatkov (Payton & Claypoole, 2023).

S tehničnega vidika so tveganja za varnost in zasebnost, povezana s spletno trgovino, že dolgo zaskrbljujoča. Mobilne aplikacije in spletne trgovine lahko nudijo tretjim osebam občutljive podatke, saj velikokrat zahtevajo nepotrebna in ohlapno opredeljena soglasja (Payton & Claypoole, 2023). Večina uporabnikov se groženj glede lastnih osebnih podatkov ne zaveda ali ne razume vseh tehničnih mehanizmov (Ahnert et al., 2022). Čeprav uporabniki nimajo prijetnega občutka pri izmenjavi podatkov na spletu, vse pogosteje uporabljajo spletno trgovino in mobilne aplikacije v zameno za prilagojene storitve in finančne koristi (Tang et al., 2022).

Relativno nejasna zakonodaja organizacijam omogoča razpolaganje s podatki o potrošnikih, da bi zmanjšale stroške, povečale donosnost oglaševanja in ponudile prilagojene izdelke in storitve. Zakonitost praks ravnanja s podatki, ki jih izvajajo številne organizacije, velja za sivo področje (Ke & Sudhir, 2023). Z javnim deljenjem podatkov na internetu uporabniki sami zabrišejo mejo med zakonitostjo in posegom v zasebnost. To pa ne pomeni, da so uporabniki s trenutnim stanjem zadovoljni. Nasprotno, na splošno se večina uporabnikov strinja z izmenjavo podatkov le, če so zavestno vključeni v postopek izmenjave podatkov ali če se jim zdi obseg obdelave njihovih osebnih podatkov sprejemljiv (Spiekermann et al., 2015). Kljub temu je mogoče opaziti, da so k izmenjavi informacij bolj nagnjeni zlasti tisti uporabniki, ki so slabo seznanjeni z varnostjo in zasebnostjo podatkov.

Skrb za zasebnost ali nepripravljenost razkritja osebnih podatkov je eden pomembnejših dejavnikov, ki vpliva na spletno nakupovanje potrošnikov (Chouk & Mani, 2022). Skrb glede zasebnosti pri spletnem nakupovanju je lahko odvisna od značilnosti potrošnikov, kot so spol, starost in izobrazba (Riquelme & Román, 2014). Kljub skrbi za zasebnost pa podatki kažejo, da delež spletnega nakupovanja raste. Ena od razlag za večje zaupanje potrošnikov je, da so potrošniki, kljub skrbi za zasebnost, vse bolj ozaveščeni glede tega. Poleg skrbi za zasebnost pa na spletno nakupovanje potrošnikov vpliva tudi varnost podatkov. Varnost se ukvarja z odkrivanjem vrzeli v varnostnem sistemu in odkrivanjem ustreznih rešitev za obvladovanje tveganja tehnološke napake ali vdora v podatke potrošnikov (Andreu, 2020). Organizacije morajo zaščititi podatke pred kakršnimkoli nepooblaščenim dostopom, saj le tako lahko pridobijo zaupanje potrošnikov.

Obstoječe raziskave se usmerjajo bodisi na individualne potrošnike, organizacije, ali pa raziskujejo zasebnost in varnost na nacionalni ravni. V tej raziskavi se osredotočamo na raven posameznikov, torej na ozaveščenost posameznikov glede varnosti in zasebnosti pri spletnem nakupu. S tem želimo ugotoviti, kakšno je trenutno stanje med slovenskimi potrošniki in ali obstajajo pomembne statistične razlike med različnimi starostnimi skupinami in spoloma. Rezultati lahko pripomorejo k boljšemu poznavanju skrbi, ki jih imajo potrošniki glede varnosti in zasebnosti in tako pomagajo organizacijam, ki skušajo zagotoviti varnost in zasebnost podatkov, da izboljšajo potrošniške izkušnje.

2 Metodologija

Cilj raziskave je ugotoviti, v kolikšni meri se kupci pri spletnem nakupovanju zavedajo varnosti in zasebnosti. Da bi dosegli čim širši krog potrošnikov, smo se odločili, da izvedemo raziskavo med slovenskimi potrošniki. Najprej smo pripravili vprašalnik. Pri pripravi vprašalnika smo izhajali iz raziskave, ki jo je izvedlo podjetje Axway leta 2021 med ameriško populacijo (Axway, 2023), dodali pa smo tudi nekaj trditev iz raziskave, ki sta jo izvedla Gurung & Raja (2016). Poleg vprašanj iz omenjenih raziskav smo v vprašalnik dodali demografska podatka, natančneje spol in starost, saj nas je zanimalo, če obstajajo statistično pomembne razlike, ki jih izpostavljajo nekatere raziskave.

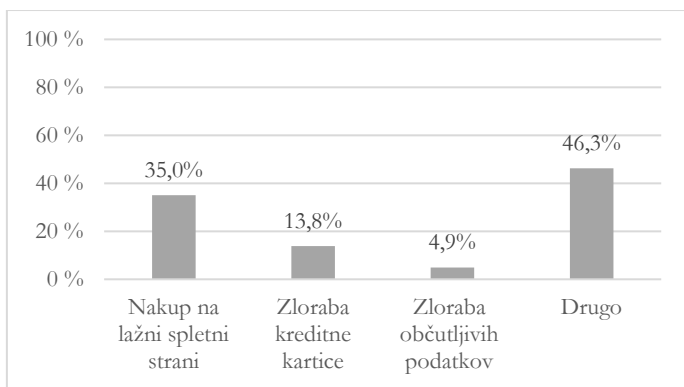
Vprašalnik smo pripravili v spletnem okolju za anketiranje, 1KA. Anketo smo delili preko družbenih omrežij (Facebook ter Instagram), uporabili smo metodo snežene kepe. To pomeni, da smo anketo delili s prijatelji/znanci in jih prosili, da jo delijo naprej svojim prijateljem/znancem. Raziskavo smo izvedli spomladi 2023. Podatke, ki smo jih pridobili preko ankete, smo naprej izvozili iz orodja 1KA. Nato smo s programom Excel pripravili opisno statistiko. Z orodjem SPSS smo preverili, ali obstajajo statistično pomembne razlike med spremenljivkami.

V raziskavi je sodelovalo 264 potrošnikov. Od tega je bilo kar 75 % žensk. Povprečna starost anketirancev je bila 40,4 let, s standardnim odklonom 14,6 let. Najmlajši anketiranec je bil star 16 let, najstarejši pa 81 let. Največji delež anketirancev (26,6 %) je bilo starih med 46 in 55 let.

3 Rezultati

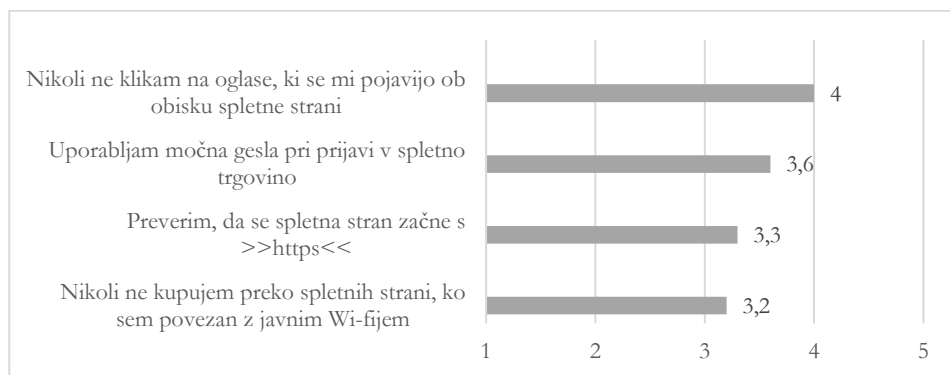
Naša analiza je pokazala, da več kot polovica anketirancev (56,3 %) nakupuje na spletu manj kot enkrat mesečno. Dobra tretjina anketirancev (35,7 %) nakupuje na spletu en- do trikrat mesečno, le 3,4 % anketirancev nikoli ne nakupuje na spletu. Več kot enkrat tedensko na spletu nakupuje 2,9 % anketirancev. Najmanjši delež anketirancev (1,7 %) nakupuje na spletu enkrat tedensko. Večina anketirancev (74,9 %) se še nikoli ni srečala z zlorabami ali prevarami pri spletnem nakupovanju, dobra četrtina (25,1 %) pa trdi, da se je. 35 % anketirancev, ki so se srečali z zlorabo ali prevaro, je nakup opravilo na lažni spletni strani, pri 13,8 % anketirancev je šlo za zlorabo kreditne kartice, pri 4,9 % pa za zlorabe drugih osebnih podatkov (Slika 1). Kar 46,3 % anketirancev, ki so se srečali s prevaro na spletu, je označilo, da naročeno blago ni bilo skladno z opisom, da paket ni prispel, ali pa jim pri vračilu denar ni bil vrnjen.

Anketiranci so med spletnim nakupovanjem pozorni predvsem na to, da nikoli ne klikajo na oglase, ki se jim pojavijo ob obisku spletne strani in da uporabljajo močna gesla pri prijavi v spletno trgovino. V povprečju se anketiranci niti ne strinjajo, niti strinjajo s trditvama, da preverijo, če se spletna stran začne s »https« in da nikoli ne kupujejo preko spletnih strani, ko so povezani z javnim brezžičnim omrežjem (Slika 2).



Slika 1: Vrste zlorab ali prevar pri spletnem nakupovanju

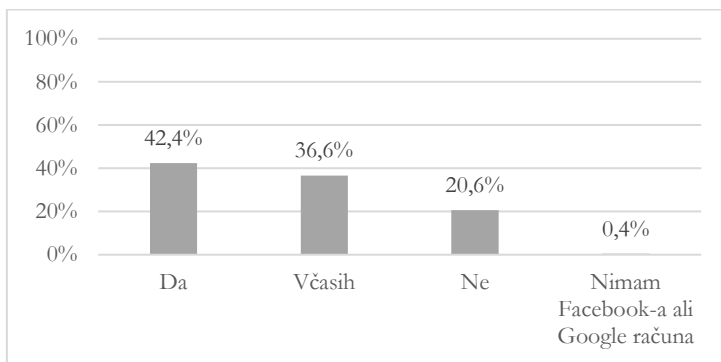
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Slika 2: Strinjanje s trditvami o pozornosti pri spletnem nakupovanju

Vir: lastni

Če natančneje pogledamo njihovo uporabo gesel pri prijavi v spletno trgovino, lahko iz prikaza na sliki 3 vidimo, da 42,4 % anketirancev vedno uporablja za prijavo Google ali Facebook račun, 36,6 % včasih, 20,6 % pa nikoli. Samo 0,4 % anketirancev nima Google ali Facebook računa.



Slika 3: Uporaba Facebook in Google za prijavo v spletne trgovine

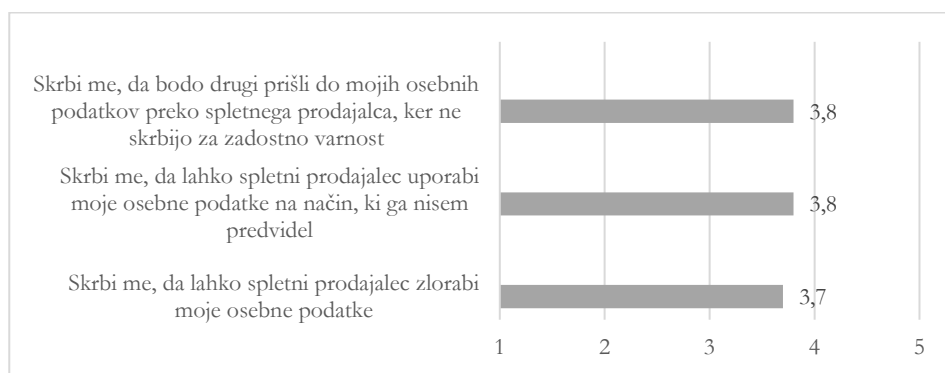
Vir: lastni

Večina anketirancev (56,9 %) ve, da s posodabljanjem aplikacij nadgradijo tudi varnost. Kar 85,3 % vseh anketirancev se strinja, da bi morali oglaševalci in mobilne aplikacije pridobiti dovoljenje za sledenje dejavnosti, ki jih opravljajo kot potrošniki v različnih aplikacijah in na spletnih straneh. 10,5 % anketirancev o tem ni prepričanih, le 4,2 % se ni strinjalo, da bi morali oglaševalci in mobilne aplikacije pridobiti dovoljenja za sledenje dejavnosti. Podobno so odgovorili tudi na trditev glede prikazovanja oglasov v mobilnih aplikacijah.

Večina anketirancev (89,1 %) trdi, da jih slabo zagotavljanje varnosti v spletni trgovini odvrne od nakupovanja. Podobno je glede dovoljevanja dostopa do osebnih podatkov. Anketiranci so na 5-stopenjski lestvici Likertovega tipa označili strinjanje s trditvijo »Podjetjem je vredno dati dostop do mojih osebnih podatkov, če to zame pomeni boljše uporabniško izkušnjo.« V povprečju se anketiranci s trditvijo sploh ne strinjajo ($\bar{x}=1,3$; $s=1,17$). Če natančneje pogledamo podatke, vidimo, da je odgovor »sploh se ne strinjam« izbral največji delež anketirancev (30,7 %), medtem ko se 27,3 % anketirancev s trditvijo niti ne strinja, niti strinja. Odgovor »se ne strinjam« je izbralo 24,8% anketirancev.

Zanimivo pa je, da le 28,6 % anketirancev skoraj vedno prebere pogoje in določila pri spletnem nakupovanju, preden jih sprejme, nekoliko manjši delež anketirancev (28,2 %) je odgovorilo, da to storijo občasno, 16,4 % vedno, 13 % nikoli, 11,3 % pa komaj kdaj. 2,5 % anketirancev je odgovorilo, da ne vedo.

V povezavi s skrbmi, ki jih imajo potrošniki glede zasebnosti, se anketiranci v povprečju najbolj strinjajo, da jih skrbi, da bodo drugi prišli do njihovih osebnih podatkov preko spletnih prodajalcev, ki ne skrbijo za zadostno varnost ($\bar{x}=3,8$; $s=1,07$) in da spletni prodajalci uporabljajo podatke na način, ki ga niso predvidevali ($\bar{x}=3,8$; $s=1,03$). Nekoliko manj se strinjajo, da jih skrbi, da spletni prodajalec zlorablja njihove osebne podatke ($\bar{x}=3,7$; $s=1,05$) (Slika 4). Statistično pomembne razlike med starostnimi skupinami obstajajo le pri prvi trditvi »Skrbi me, da finančne transakcije pri spletnem nakupovanju niso varne.« S trditvijo se najbolj strinjajo anketiranci, stari 66 let ali več, najmanj pa tisti, ki so stari 25 let ali manj. Statistično pomembnih razlik med spoloma ni.

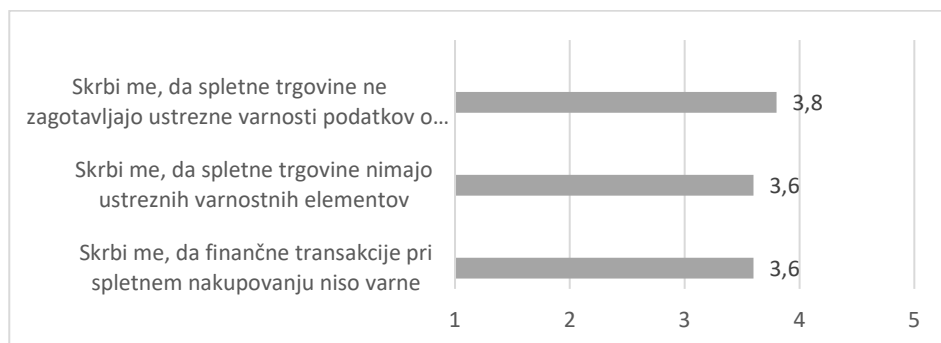


Slika 4: Strinjanje s trditvami, ki se navezujejo na zasebnost pri spletnem nakupovanju

Vir: lastni

V povezavi s skrbmi, ki jih imajo potrošniki glede varnosti, se anketiranci v povprečju najbolj strinjajo, da jih skrbi, da spletne trgovine ne zagotavljajo ustrezne varnosti podatkov o kreditnih karticah ($\bar{x}=3,8$; $s=1,01$). Nekoliko manj se strinjajo s trditvama, da spletne trgovine nimajo ustreznih varnostnih elementov ($\bar{x}=3,6$; $s=1,01$) in da finančne transakcije pri spletnem nakupovanju niso varne ($\bar{x}=3,6$; $s=1,13$) (Slika 5). Statistično pomembne razlike med starostnimi skupinami obstajajo le pri zadnjih dveh trditvah; »Skrbi me, da lahko spletni prodajalec uporabi moje osebne podatke na način, ki ga nisem predvidel.« in »Skrbi me, da bodo drugi prišli do mojih osebnih podatkov preko spletnega prodajalca, ker ne skrbijo za zadostno varnost.« S trditvijo »Skrbi me, da lahko spletni prodajalec uporabi moje osebne podatke na način, ki ga nisem predvidel.« se najbolj strinjajo anketiranci, stari 56-65

let, najmanj pa tisti, ki so stari 26-35 let. S trditvijo »Skrbi me, da bodo drugi prišli do mojih osebnih podatkov preko spletnega prodajalca, ker ne skrbijo za zadostno varnost.« pa se najbolj strinjajo anketiranci, stari 46-55 let, najmanj pa tisti, ki so stari 26-35 let. Statistično pomembne razlike med spoloma obstajajo le pri prvi trditvi »Skrbi me, da finančne transakcije pri spletnem nakupovanju niso varne.« S to trditvijo se bolj strinjajo ženske.



Slika 5: Strinjanje s trditvami, ki se navezujejo na varnost pri spletnem nakupovanju

Vir: lastni

4 Zaključek

Spletno nakupovanje postaja vsakdanjik, saj izdelke lahko naročimo kar preko svojega mobilne telefona v udobju doma. Kljub temu, da slabih 75% anketirancev trdi, da še niso bili žrtve spletnih prevar, naše analize kažejo, da so pri nekaterih aktivnostih na spletu dokaj brezskrbni, predvsem mlajši potrošniki, čeprav pri nekaterih trditvah ne ugotavljamo statistično pomembnih razlik med spoloma in starostnimi skupinami. Kljub temu, da anketirance skrbi varnost in zasebnost osebnih podatkov, velikokrat uporabljajo za registracijo v spletno trgovino kar Facebook ali Google račun. Poleg tega so premalo pozorni, če se nahajajo na varni spletni strani prodajalca in če kupujejo medtem, ko uporabljajo javno brezžično (odprto) omrežje. Prav tako slaba polovica anketirancev ne ve, da z rednim posodabljanjem aplikacij poskrbijo tudi za varnost svojih naprav. Na tem mestu velja omeniti, da so naše analize pokazale statistično pomembne razlike med spoloma le pri finančnih transakcijah. Nekoliko več statistično pomembnih razlik glede varnosti in zasebnosti pri spletnem nakupovanju pa smo ugotovili med starostnimi skupinami. Rezultati kažejo, da so starejše generacije bolj previdne v primerjavi z

mlajšimi. Ena izmed razlag je lahko ta, da so starejše generacije manj večje pri izrabi informacijske in komunikacijske tehnologije in so slabše seznanjeni z varnostjo in zasebnostjo podatkov. Druga razlaga pa je lahko, da je mlajša generacija veliko bolj brezskrbna glede varnosti in zasebnosti.

Kljub temu, da raziskava podaja zanimive ugotovitve, bi na tem mestu izpostavili tudi nekaj omejitev. Razlike smo analizirali le za nekatere trditve, zato bi bilo v bodoče smiselno preveriti, če obstajajo statistično pomembne razlike tudi pri ostalih trditvah. Smiselno bi bilo preveriti vpliv zasebnosti in varnosti na spletno nakupovanje in ali tu obstajajo statistične razlike med spoloma in med starostnimi skupinami. Poleg nadaljnjih analiz obstoječih podatkov priložnosti vidimo tudi v nadaljnjih raziskavah na tem področju. Predvsem bi bilo potrebno dopolniti vprašalnik, da bi zajeli vse vidike varnosti in zasebnosti ter druge aktivnosti pri spletnem nakupovanju. Poleg tega bi bilo potrebno pridobiti večji vzorec in bolj enakomerno zajeti vse starostne skupine in oba spola.

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ODVISNOST UPORABE KLIMATSKIH NAPRAV OD TEMPERATURE IN BDP

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Klimatske naprave so postale pomemben del življenja v številnih državah po vsem svetu. Uporabljajo se za hlajenje in ogrevanje prostorov, kar zagotavlja udobje in dobro počutje uporabnikom. Vendar pa ima uporaba klimatskih naprav tudi negativen vpliv na okolje. Klimatske naprave so namreč vse bolj pomemben dejavnik pri porabi električne energije in emisijah toplogrednih plinov. V tem članku bomo preučili porabo električne energije zaradi vse večje uporabe klimatskih naprav. Izvedli bomo primerjavo uporabe klimatskih naprav po državah, BDP v posamezni državi in povprečni poletni temperaturi.

Ključne besede:

klimatska naprava, toplogredni plini, BDP, poraba električne energije, hlajenje

AIR CONDITION UNITS USAGE ACCORDING TO TEMPERATURES OR GDP

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Keywords:

air
conditioner,
cooling
electricity
consumption,
greenhouse
gases,
gross
domestic
product

Air conditioners have become an important part of life in many countries around the world. They are used to cool and heat spaces, providing comfort and well-being to users. However, the use of air conditioners also has a negative impact on the environment. Air conditioners are increasingly becoming a major factor in electricity consumption and greenhouse gas emissions. In this article, we will examine electricity consumption due to the increasing use of air conditioners. Comparison of usage of air conditioners across countries will be made, also correlation of GDP in each country and average summer temperature will be presented.

1 Uvod

Množična uporaba klimatskih naprav se je začela v 20. stoletju, ko so se začele izboljševati tehnologije in zmanjševati stroški (Basile, 2016). Prva komercialna klimatska naprava je bila razvita leta 1902 v Združenih državah Amerike. Vendar pa so bile te naprave zelo drage in so jih lahko uporabljali le bogati. V 1920-ih letih so se začele razvijati nove tehnologije, ki so omogočile izdelavo cenejših in učinkovitejših klimatskih naprav. To je privedlo do povečanja povpraševanja po klimatskih napravah, ki so jih začeli uporabljati tudi v komercialnih prostorih. V 1950-ih letih so se klimatske naprave začele množično uporabljati tudi v gospodinjstvih. To je bilo posledica več dejavnikov, med drugimi:

- Naraščajočega prebivalstva: Večje število ljudi je živelo v urbanih območjih, kjer so poletja lahko zelo vroča in vlažna.
- Naraščajočega standarda bivanja: Ljudje so začeli bolj ceniti udobje in so bili pripravljeni plačati več za klimatske naprave.

V zadnjih desetletjih se je uporaba klimatskih naprav še naprej povečevala. To je posledica več dejavnikov, med drugimi:

- Prihajajoče podnebne krize (Lynas, 2008) (Polya, 2020): Podnebne spremembe povzročajo, da so poletja v mnogih delih sveta toplejša in vlažnejša. To povečuje povpraševanje po klimatskih napravah, ki zagotavljajo udobno notranjo temperaturo.
- Zmanjšanje stroškov klimatskih naprav: Klimatske naprave so v zadnjih letih cenejše. To jih je naredilo bolj dostopne in je prispevalo k povečanju povpraševanja.
- Razvoj novih tehnologij: Razvoj novih tehnologij, kot so inverterske klimatske naprave, je povečal energetske učinkovitost klimatskih naprav. To je prispevalo k zmanjšanju njihovega negativnega vpliva na okolje.

Danes se klimatske naprave uporabljajo v vseh delih sveta. V nekaterih delih sveta, kot so Združene države Amerike, so klimatske naprave v gospodinjstvih skoraj nepogrešljive.

1.1 Vprašanja za raziskavo

Na podlagi zgoraj navedenih ugotovitev bomo v tem članku obravnavali naslednja vprašanja:

- Kakšna je svetovna poraba električne energije za klimatske naprave?
- Kako je povezana poraba električne energije za klimatske naprave z BDP v posamezni državi?
- Kako je povezana poraba električne energije za klimatske naprave s povprečno poletni temperaturo v posamezni državi?

1.2 Cilj raziskave

Cilj te raziskave je ugotoviti, kako so poraba električne energije za klimatske naprave, BDP in povprečna poletna temperatura povezani med seboj. Rezultati raziskave bodo lahko koristni za oblikovanje politik, ki bodo pomagale zmanjšati porabo električne energije in emisije toplogrednih plinov, ki jih povzročajo klimatske naprave.

2 Poraba električne energije in proizvodnja toplogrednih plinov

Zaenkrat so vsi porabniki električne energije odgovorni za proizvodnjo toplogrednih plinov, konkretno CO₂ (MacKay, 2013). Količina proizvedenega CO₂ je odvisna od načina proizvodnje električne energije. Povprečna emisija CO₂ na 1 kWh za posamezno državo je odvisna od strukture proizvodnje električne energije v tej državi. Države, ki proizvajajo večino električne energije iz obnovljivih virov, imajo nižje emisije CO₂ kot države, ki proizvajajo večino električne energije iz fosilnih goriv. Povprečna emisija CO₂ na 1 kWh v svetovnem merilu je 0,55 kg/kWh. Ta emisija se razlikuje glede na vir energije, ki se uporablja za proizvodnjo električne energije.

Najnižje emisije imajo obnovljivi viri energije, kot so sončna, vetrna in hidroenergija (Lave & Hendricks, 2013). Ti viri energije ne proizvajajo nobenih emisij CO₂, upoštevati pa je potrebno, da je veliko energije potrebno za izdelavo tehnologij za zajemanje obnovljivih virov in da so ti viri zelo nestalni.

Visoke emisije proizvajajo fosilna goriva, kot so premog, nafta in zemeljski plin (IPCC, 2013). Pri proizvodnji električne energije iz teh virov se sproščajo velike količine CO₂.

Klimatske naprave so v letu 2020 prispevale k približno 1,6 % svetovnih emisij toplogrednih plinov (IEA, 2022), kar je približno 4,8 milijard ton CO₂. Emisije iz klimatskih naprav so naraščale v zadnjih letih, saj se je povpraševanje po njih povečevalo. Povpraševanje je posledica globalnega segrevanja, ki povzroča vse višje temperature v poletnih mesecih. Za primerjavo, je razsvetljava prispevala približno 2,4 % svetovnih emisij toplogrednih plinov. To je približno 7,2 milijard ton CO₂. Emisije iz razsvetljave se zmanjšujejo, saj se vse več uporabljajo učinkovitejše razsvetljave, kot so LED-žarnice.

V gospodinjstvu zaenkrat več toplogrednih plinov prispevajo samo še hladilni aparati. Ti so prispevali k približno 2,2 % svetovnih emisij toplogrednih plinov v letu 2020. To je približno 6,6 milijard ton CO₂. Emisije iz hladilnikov in zamrzovalnikov se zmanjšujejo, saj se vse več uporablja učinkovitejših hladilnikov in zamrzovalnikov. Skladno s pričakovanim toplotnim segrevanje in posledično vedno večjo uporabo klimatskih naprav, lahko pričakujemo, da bodo v nekaj letih klimatske naprave postale največji porabnik električne energije v gospodinjstvih in posledično glavni povzročitelj toplogrednih plinov.

V kolikor se bo trend porabe električne energije nadaljeval, lahko to povzroči znatne težave za svetovno energetiko. Klimatske naprave so namreč pomembni porabniki električne energije in njihova poraba prispeva k povečanju emisij toplogrednih plinov.

2.1 Merjenje porabe električne energije za delovanje klimatskih naprav

Za izvedbo raziskave o uporabi klimatskih naprav, je bilo pridobljenih veliko podatkov. Za točne podatke bi bilo potrebno izvajati meritve na vsaki klimatski napravi. Ker se takšne meritve ne izvajajo, so določene vrednosti podane okvirno, ki so bile dobljene s pomočjo predhodno izvedenih raziskav.

Količino porabljene električne energije posamezne klimatske naprave določa:

- Zunanja temperatura
- Nastavljena temperatura v prostoru
- Izolacija klimatiziranega prostora
- Pravilna uporaba klimatske naprave
- Mesto namestitve zunanje naprave
- Vzdrževanje klimatske naprave
- Energijski razred
- Način uporabe klimatske naprave,...

Porabo električne energije na nivoju države določa število vgrajenih naprav. Tudi tukaj so vrednosti podane iz različnih raziskav, saj točno število delujočih naprav ni znano.

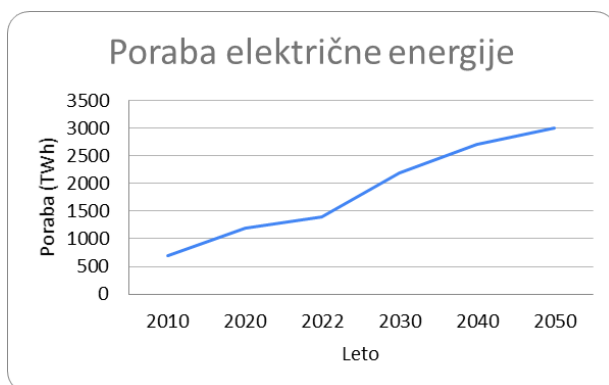
Klimatske naprave se uporabljajo predvsem za hlajenje bivalnih prostorov. Ključna za uporabo klimatskih naprav je zato zunanja temperatura. Za raziskavo so bili uporabljeni podatki o povprečni temperaturi v dveh najtoplejših mesecih v letu ob 12 uri v glavnem mestu države (WMO, 2023). Razlog za izbiro glavnega mesta in ne povprečne temperature v države je v zanesljivosti podatkov. Razlog za uporabo podatka o povprečni temperaturi ob 12 uri je, ker so lahko velike razlike med dnevno in nočno temperaturo, klimatske naprave naj bi se pa uporabljale samo za temperature višje od 26°C.

3 Uporaba klimatskih naprav v svetu

Število vgrajenih klimatskih naprav se hitro povečuje. Leta 2022 je bilo na svetu približno 3,6 milijarde klimatskih naprav, kar je 50 % več kot leta 2010 (IEA, 2022). Predvideva se, da se bo število klimatskih naprav do leta 2050 povečalo na 9,2 milijarde. Glede na število prebivalcev sveta – 8 milijard, je na vsakega prebivalca vgrajeno 0,45 klimatske naprave.

Slika 1 prikazuje porabo električne energije za klimatske naprave na svetovni ravni narašča. V letu 2022 je znašala 2.700 TWh, kar predstavlja 8 % svetovne porabe električne energije. V Evropi je ta delež 7 %, v Združenih državah Amerike znaša 15

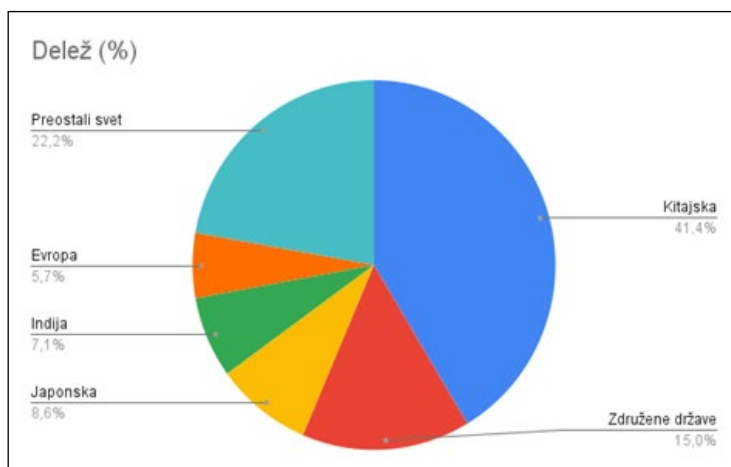
%. Poraba električne energije za klimatske naprave se povečuje, saj se povprečne temperature na Zemlji dvigujejo. Po napovedih (IEA, 2022) se bo ta delež do leta 2050 povečal na 18 % oziroma na 3.000 TWh.



Slika 1: Trend naraščajoče porabe električne energije zaradi klimatskih naprav

Vir: Lasten

Slika 2 prikazuje, da več kot 40% vseh klimatskih naprav uporabljajo na Kitajskem, kar je nekako pričakovano, saj je Kitajska največja po številu ljudi in tudi proizvodnje kapacitete ima največje.

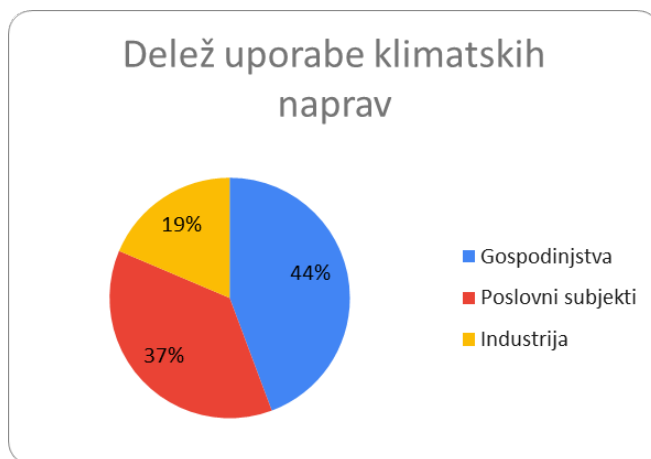


Slika 2: Porazdelitev porabe električne energije zaradi uporabe klimatskih naprav

Vir: Lasten

Slika 3 prikazuje, da je največ klimatskih naprav vgrajenih v gospodinjstvih.

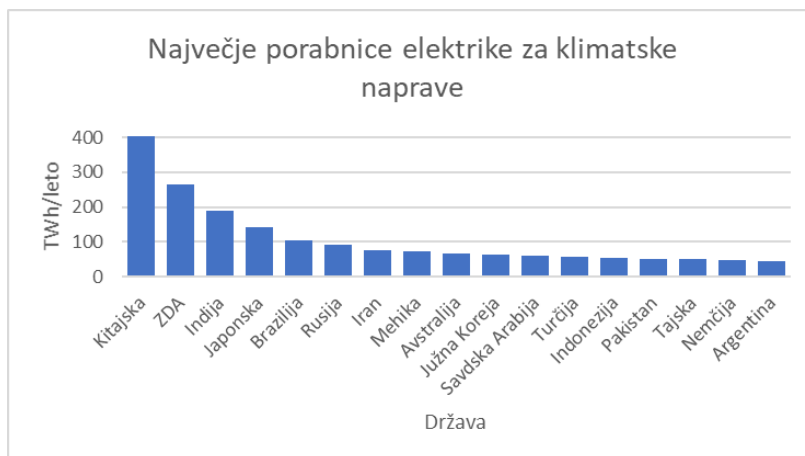
Pri trenutnem deležu vgrajenih klimatskih naprav lahko v prihodnosti pričakujemo, da se bo najbolj večalo število vgrajenih naprav ravno v gospodinjstvih, saj dobršen del nerazvitega sveta še ne uporablja množično klimatskih naprav tako, kot se uporabljajo v razvitem svetu in tudi vedno več ljudi dela doma.



Slika 3: Porazdelitev porabe po sektorjih

Vir: Lasten

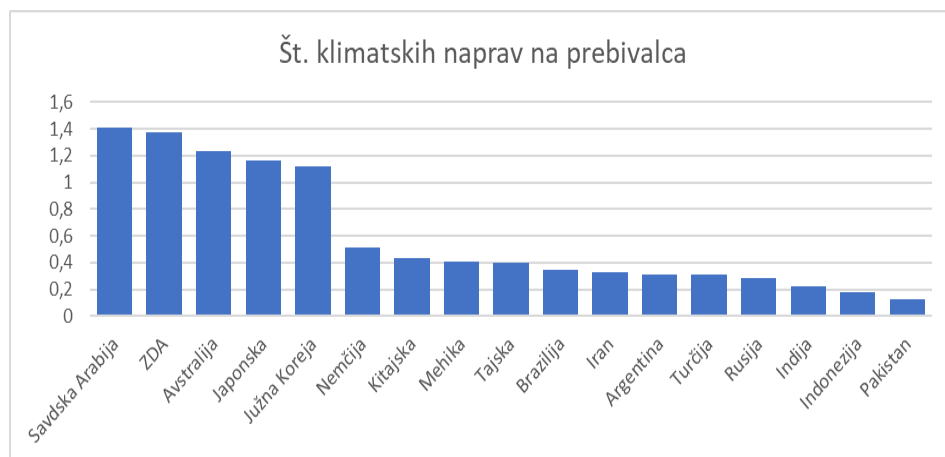
Za nadaljnjo podrobnejšo analizo je bilo izbranih 17 držav, ki porabijo največ električne energije za potrebe klimatskih naprav. Te države predstavljajo 70% vse porabljene energije. Na sliki 4 lahko vidimo, da je največja porabnica Kitajska. Kot bomo videli v kasnejših analizah je poraba posledica števila prebivalcev posamezne države in ne pretirane rabe klimatskih naprav.



Slika 4: Države z največjo porabo

Vir: Lasten

Boljši pokazatelj splošne uporabe klimatskih naprav v posamezni državi je upoštevanje, koliko naprav je vgrajenih na posameznega prebivalca. Na sliki 5 lahko vidimo, da največ naprav na prebivalca uporablja Savdska Arabija - 1,4 naprave na prebivalca, sledijo ZDA, Avstralija,... . Svetovno povprečje znaša 0,45 klime na prebivalca. Slovenija je z 0,3 vgrajene klime na prebivalca pod tem povprečjem.

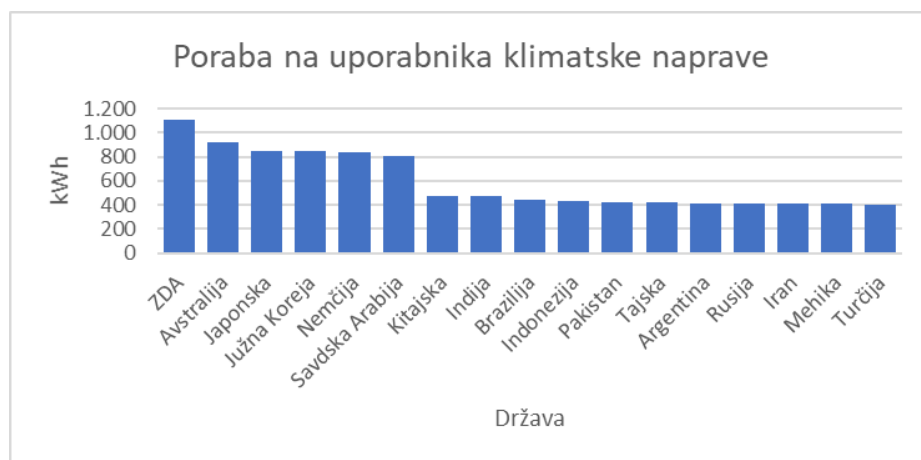


Slika 5: Število vgrajenih klim na prebivalca

Vir: Lasten

Poleg povprečnega števila klimatskih naprav na posameznika, je pomembno tudi, koliko se naprava uporablja. Naslednja slika 6 prikazuje koliko kWh električne energije odpade na povprečnega uporabnika klimatske naprave. Iz slike lahko vidimo, da največ klimatske naprave koristijo v ZDA, nato sledijo Avstralija, Japonska,... V Sloveniji znaša povprečna poraba 350 kWh na osebo.

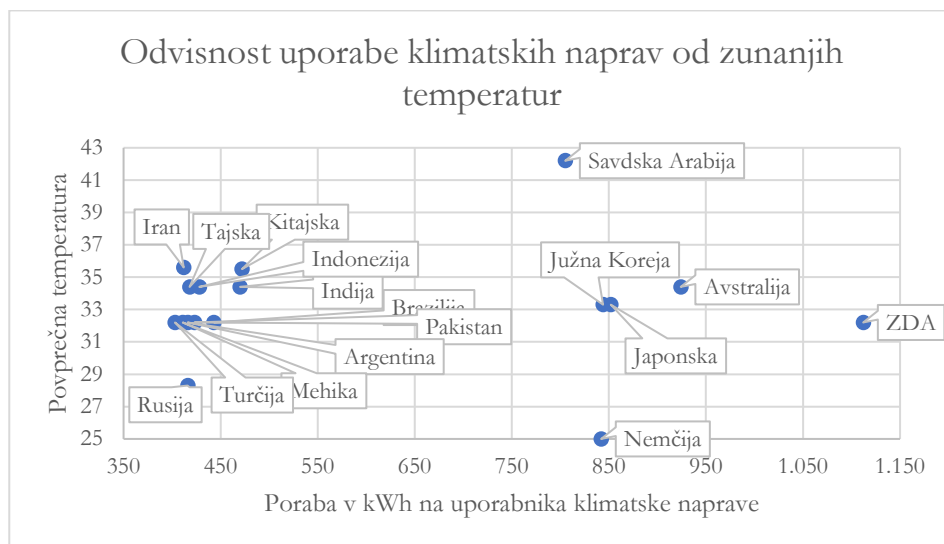
Logično lahko pričakujemo, da bo povprečna poraba odvisna od zunanjih temperatur. Torej v toplejšem pasu, ko se nahaja določena država, večja bo uporaba klimatskih naprav. Slika 7 prikazuje veliko razliko v porabi med državami, ki imajo primerljivo zunanjo temperaturo. Po porabi močno izstopajo ZDA, glede na nizko povprečno temperaturo pa izstopa Nemčija.



Slika 6: Povprečna poraba klimatske naprave na uporabnika klimatske naprave

Vir: Lasten

Pri ugotavljanju statistične povezanosti med zunanjo temperaturo in porabo električne energije na klimatsko napravo z uporabo Pearsonovega koeficienta korelacije (Blalock, 1972), ki znaša 0,019, lahko zaključimo, da uporaba klimatskih naprav ni povezana z zunanjo temperaturo.

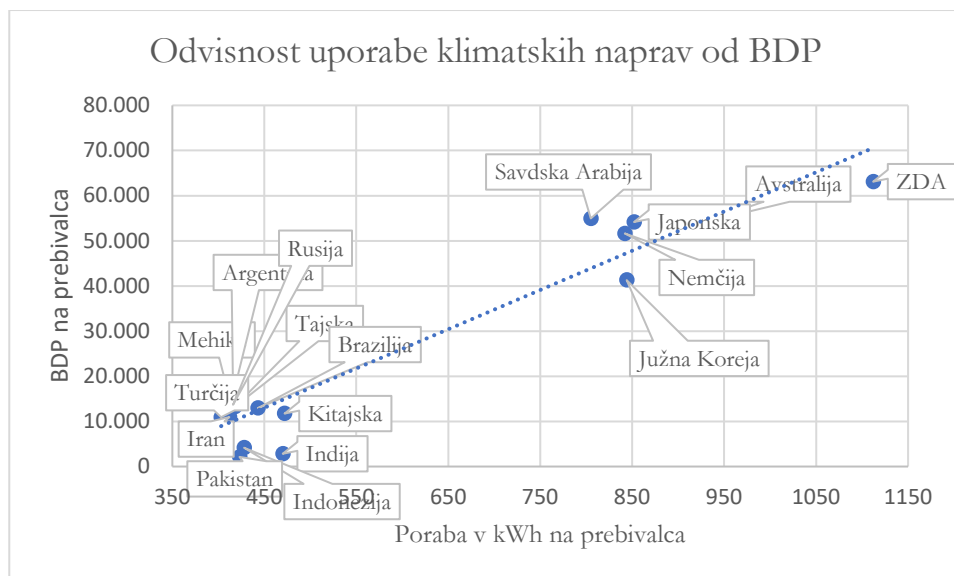


Slika 7: Poraba v odvisnosti od zunanje temperature

Vir: Lasten

Nazadnje je bilo v raziskavi preverjeno, ali je uporaba klimatskih naprav povezana z BDP posamezne države (World Bank, 2023). Na sliki 8 lahko vidimo, da so države razdeljene v dve skupini. Prvo skupino predstavljajo države, ki imajo majhen BDP in imajo tudi majhno porabo električne energije za klimatske naprave. Drugo skupino tvorijo bogate države – ZDA, Avstralija, Japonska, Savdska Arabija, Nemčija in Južna Koreja, ki tudi potrošijo največ energije.

Povezava med porabo in BDP je tudi statistično dokazljiva, saj znaša Pearsonov koeficient korelacije 0,956, kar pomeni zelo visoko povezanost. Enako dokazuje tudi prikazana trendna črta na grafu.



Slika 8: Poraba v odvisnosti od BDP države

Vir: Lasten

4 Zaključek

V članku je izvedena raziskava o uporabi klimatskih naprav v svetu. Število klimatskih naprav hitro narašča, glavna razloga sta globalno segrevanje in cenovna dostopnost naprav. V nekaj letih bodo klimatske naprave glavni potrošnik električne energije v povprečnem gospodinjstvu in s tem tudi glavni povzročitelj toplogrednih plinov zaradi porabe električne energije. V raziskavi je bilo ugotovljeno, da na uporabo ključno vpliva BDP posamezne države in ne same temperaturne razmere. Lahko zaključimo, da se naprave neupravičeno veliko uporabljajo in bi lahko s smotrno uporabo možno znižali porabo elektrike. Za zmanjšanje porabe električne energije in emisij toplogrednih plinov je pomembno, da uporabljamo energetske učinkovite klimatske naprave in da jih uporabljamo le, kadar je to potrebno. Najbolj se uporabi klimatskih naprav lahko izognemo z dobro izolacijo stavb. Samo zmanjšanje uporabe klimatskih naprav bi lahko dosegli predvsem z ustreznim trajnostnim osveščanjem ljudi.

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FORESIGHT ANALITIK: ANALIZA KLJUČNIH ZNANJ Z VIDIKA PONUDNIKOV VISOKOŠOLSКИH IZOBRAŽEVANJ V TUJINI IN MOŽNOSTI ZA IMPLEMENTACIJO V SLOVENSKEM VISOKOŠOLSКEM PROSTORU

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V prispevku obravnavamo koncept foresight analitike in njeno pomembnost v današnjem gospodarskem okolju. Izpostavljamo njeno ključno vlogo pri prilagajanju na tržne spremembe, napovedovanju trendov, upravljanju tveganj in oblikovanju trajnostnih strategij. Glavni del prispevka je osredotočen na identifikacijo znanj in veščin, ki so za foresight analitika ključna za uspešno vključitev na mednarodni trg dela. V ta namen smo izvedli analizo obstoječih študijskih programov, ki jih ponujajo visokošolske institucije v tujini. Nadalje smo proučili, kakšna je ponudba izobraževanj na temo foresight analitike v Sloveniji. Oblikovali smo smernice za prihodnji razvoj in implementacijo tega pomembnega področja v slovenski visokošolski prostor z namenom zadovoljevanja potreb gospodarstva.

Ključne besede:

foresight,
foresight
analitika,
strateško
predvidevanje,
znanja in
veščine
visokošolsko
izobraževanje

FORESIGHT ANALYST: ANALYSIS OF KEY SKILLS FROM THE PERSPECTIVE OF HIGHER EDUCATION PROVIDERS ABROAD AND POSSIBILITIES FOR IMPLEMENTATION IN THE SLOVENIAN HIGHER EDUCATION SECTOR

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This paper discusses the concept of foresight analytics and its relevance in today's economic environment. It highlights its key role in adapting to market changes, forecasting trends, managing risks and developing sustainable strategies. The main part of the paper focuses on identifying the skills and knowledge that are crucial for a foresight analyst to successfully enter the international labour market. To this end, an analysis of existing study programmes offered by higher education institutions abroad was carried out. Furthermore, we examined the range of foresight analytics training courses available in Slovenia. We have formulated guidelines for the future development and implementation of this important field in Slovenian higher education in order to meet the needs of the economy.

Keywords:

foresight,
foresight
analytics,
strategic
foresight,
skills and
knowledge
higher
education

1 Uvod

Vse večje zavedanje o pomenu dolgoročnega načrtovanja in pripravljenosti na prihodnje izzive je botrovalo razvoju bolj celovitih in sofisticiranih metod napovedovanja, ki so se uveljavile pod imenom »strateško predvidevanje« ali foresight analitika (ang. foresight analytics). Foresight analitika se nanaša na proces zbiranja, analize in interpretacije informacij ter trendov z namenom napovedovanja prihodnjih dogodkov, situacij ali sprememb na določenem področju (glej npr. OECD, 2019). Gre za proaktivno razmišljanje in načrtovanje, ki pomaga organizacijam, skupnostim in posameznikom pri pripravi na morebitne spremembe in doseganju dolgoročne uspešnosti. Foresight bi torej lahko označili kot kompleksen pristop k razumevanju možnih scenarijev in njihovih vplivov na organizacije, industrijo ali družbo.

Potreba po foresight analitiki v gospodarstvu je vedno bolj očitna, saj le-ta omogoča podjetjem, da se bolje pripravijo na prihodnost, sprejemajo bolj premišljene odločitve in ohranjajo konkurenčno prednost. Poleg tega foresight analitika pomaga podjetjem razumeti dinamiko trga in se prilagajati hitrim spremembam, kar je ključno za ohranjanje konkurenčnosti.

V pričujočem prispevku se posvečamo konceptu foresight analitike ter poudarjamo njeno pomembnost v sodobnem gospodarskem okolju. Izpostavljamo njeno ključno vlogo pri prilagajanju na tržne spremembe, napovedovanju trendov, upravljanju tveganj in oblikovanju trajnostnih strategij.

Osrednji del prispevka je namenjen identifikaciji ključnih znanj, ki jih mora imeti posameznik, specializiran za foresight analitiko. Na podlagi analize obstoječih študijskih programov, ki jih ponujajo visokošolske institucije v tujini, smo preučili, katera znanja in veščine so ključna za uspešno vključitev strokovnjaka za foresight analitiko na mednarodni trg dela.

Dodatno smo preučili trenutno ponudbo izobraževanj na temo foresight analitike v Sloveniji. Z namenom zadovoljevanja potreb gospodarstva smo oblikovali smernice za prihodnji razvoj ter implementacijo tega pomembnega področja v slovenski visokošolski prostor.

2 Kaj je foresight analitika

2.1 Razvoj foresight analitike

Foresight analitika se že desetletja obravnava kot koncept, povezan s področji znanosti, tehnologije in inovacij, ki se uporablja za oblikovanje srednje in dolgoročnih vizij tehnološkega, gospodarskega in družbenega razvoja. Foresight dejavnost se obravnava kot proces, ki privablja udeležence iz različnih skupin deležnikov (znanstvena skupnost, gospodarstvo, vlada, nevladne organizacije itd.), da razpravljajo o prihodnostno usmerjenih vprašanjih, izzivih ali temah. Proces predvidevanja prihodnosti je sistematičen in je oblikovan okoli metodologije, zasnovane za določeno področje in kontekst.

Izraz "foresight" se je v literaturi začel pojavljati v devetdesetih letih prejšnjega stoletja, pred tem pa je bil pogostejši izraz "napovedovanje" (Poteralska in Sacio-Szymańska, 2014). Od takrat je bilo predlaganih več različnih opredelitev foresight analitike. Ena najpogosteje citiranih je definicija iz leta 1995 (Martin, 1995), ki foresight opredeljuje kot proces, ki vključuje sistematičen poskus vpogleda v dolgoročno prihodnost znanosti, tehnologije, gospodarstva in družbe z namenom opredelitve področij strateških raziskav in nastajajočih splošnih tehnologij, ki bodo verjetno prinesle največje gospodarske in družbene koristi. Omenjena definicija je dokaj ozka in specifična. Najdemo pa lahko tudi zelo široke, ki foresight opredeljujejo kot umetnost in znanost predvidevanja prihodnosti (Loveridge, 2008). Čeprav obstajajo različne definicije, je vsem skupno to, da poudarjajo dolgoročno usmerjenost, participativno naravo, značilnosti določanja prioritet in usmerjenost k priporočilom za prihodnost družbe in gospodarstva (Saritas, 2006).

V nedavni študiji (Saritas, Burmaoglu in Ozdemir, 2022) je bila predstavljena evolucija razvoja področja foresight skozi desetletja, ki je bila pripravljena na osnovi preučevanja objav v znanstvenih revijah. Rezultati analize so potrdili pet generacij foresighta, ki jih je prepoznal že Georghiou (2008) in so predstavljene v tabeli 1 pod zaporednimi številkami od 1 do 5 (tehnološko napovedovanje, tehnološki, družbeni, inovacijski in industrijski foresight). Za vsako od generacij so podane ključne značilnosti, konceptualna podlaga, vrsta politike, struktura in zasnova ter njena oznaka oz. poimenovanje. V študiji (Saritas, Burmaoglu in Ozdemir, 2022) so se osredotočili predvsem na zadnjih 20 let ter za to obdobje identificirati tri nove

Tabela 1: Osem generacij foresight analitike

	značilnosti	konceptualna podlaga	vrsta politike	struktura/ zasnova	oznaka/ poimenovanje
1	napovedovanje tehnologij prihodnosti	znanost potiska inovacijo	znanstvena politika	ekspertne skupine	tehnološko napovedovanje (ang. Technological Forecasting)
2	uporaba tehnologije na trgu	povpraševanje vleče inovacijo	tehnološka politika	vklučuje podjetja in oblikovalce politik	foresight tehnologij (ang. Technology Foresight)
3	razširitev tržne perspektive za vključitev širše družbe	povpraševanje vleče inovacijo, povezovanje, integrirani model inovacije	tehnološka in inovacijska politika	družbeno-ekonomski akterji, interdisciplinarno	foresight tehnologij in družbeni foresight (ang. Technology Foresight and Social Foresight)
4	širši obseg, bolj razpršen	povpraševanje vleče inovacijo, povezovanje, integrirani model inovacije, sistemski model	inovacijska politika	različni akterji, ravni, cilji in zasnove	inovacijski foresight (ang. Innovation Foresight)
5	sektorsko ali področno usmerjene foresight dejavnosti	kombinacija razpršenih foresight programov	znanstvena, tehnološka in inovacijska politika povezana z industrijsko politiko in strateškim odločanjem	širok nabor akterjev iz sektorskih in industrijskih področij	industrijski foresight (ang. Industrial Foresight)

	značilnosti	konceptualna podlaga	vrsta politike	struktura/zasnova	oznaka/poimenovanje
6	sistemske perspektive, usmerjenost v velike izzive, globalizacija in lokalizacija	globalne in obsežne dejavnosti; kvantitativne in kvalitativne študije	sistemska, industrijska, sektorska in tematska politika	sistemi, omrežja akterjev	sistemski foresight (ang. Systemic Foresight)
7	od koncepta do komercializacije	znanstveno in industrijsko podjetništvo, podatki kot dopolnitev ekspertnemu znanju, računalniško podprte dejavnosti	tehnološka in inovacijska politika ter politika komercializacije	znanstveno, industrijsko in finančno partnerstvo	uporabni foresight (ang. Applied Foresight)
8	k družbi in človeku usmerjena prihodnost, digitalna transformacija, osredotočenost na tveganja in odpornost	kolektiv človek-tehnologija, inteligenca	integrirana tehnologija, gospodarska in družbena politika	neprekinjeno in dinamično medsebojno sodelovanje akterjev sistema z rutiniranim, v prihodnost usmerjenim delovanjem	priložnostni foresight (ang. Foresight-on-site)

Vir: lasten (povzeto po Georghiou (2008) ter Saritas, Burmaoglu in Ozdemir (2022))

generacije (sistemski, uporabni ter priložnostni foresight), ki so predstavljene v tabeli 1 pod zaporednimi številkami od 6 do 8. Ugotovili so, da so bile v začetku enaindvajsetega stoletja foresight dejavnosti usmerjene predvsem v inovacijsko politiko s povezavami med znanostjo in povpraševanjem. Kasneje so dejavnosti napovedovanja začele pokrivati teme in izzive družbene prihodnosti, kot so podnebne spremembe, energija, hrana in voda, trajnost in odpornost, upravljanje tveganj, obvladovanje nesreč ipd. To je zahtevalo razvoj politik na več ravneh upravljanja in sinergijsko delovanje deležnikov (sistemski foresight). Medtem je hiter razvoj tehnologij pripeljal do aplikativno usmerjenih foresight aktivnosti (uporabni foresight), katerega cilj je bil komercializacija nastajajočih in razvijajočih se tehnologij, zlasti na področju informacijskih in komunikacijskih tehnologij, kar je

pospešilo proces digitalizacije. Nedavna pandemija COVID-19 pa je pokazala, da taki izzivi zahtevajo še konkretnije pristope v realnem času in tesno sodelovanje znanstvenikov, gospodarstvenikov, oblikovalcev politik in drugih družbenih akterjev. Izkazalo se je, da je treba foresight približati krajem njegove uporabe in ga vključiti na dnevni red vseh zainteresiranih strani pri njihovih vsakodnevnih dejavnostih (priložnostni foresight oz. foresight na kraju samem).

2.2 Razlike med konvencionalnimi metodami napovedovanja in foresight analitiko

Ključne razlike med obema pristopoma v napovedovanju, konvencionalne metode in foresight analitika, so strnjeno povzete v tabeli 2.

Zaključimo lahko, da sta za učinkovito odločanje in načrtovanje v organizacijah pomembna oba pristopa. Izbira ustreznega pristopa naj temelji na naravi izzivov, ki jih želimo napovedovati, in izbranem časovnem horizontu. Medtem ko so konvencionalne metode napovedovanja dragocene za kratkoročno načrtovanje in obvladovanje tveganj na podlagi zgodovinskih podatkov, ponuja foresight analitika bolj celovit in usmerjen pogled v prihodnost pogled, ki poudarja strateško pripravljenost in prilagodljivost različnim možnim scenarijem v (razmeroma dolgoročni) prihodnosti.

Tabela 2: Ključne razlike med konvencionalnimi metodami napovedovanja in foresight analitiko

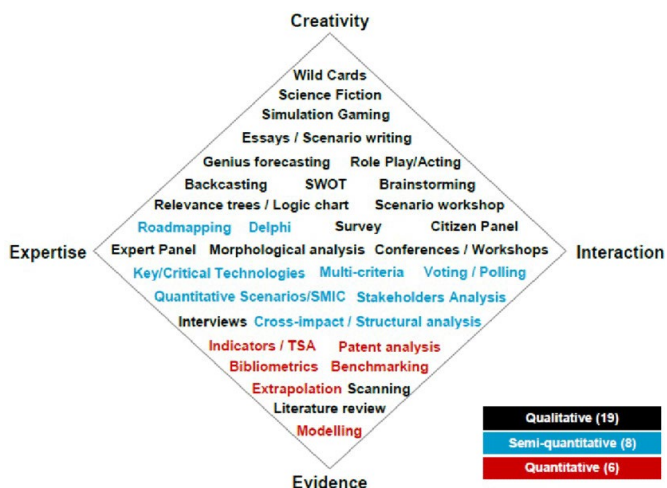
	konvencionalne metode napovedovanja	foresight analitika
časovni horizont	<ul style="list-style-type: none"> • kratkoročni (npr. nekaj mesecev) do srednjeročni (npr. nekaj let) 	<ul style="list-style-type: none"> • dolgoročni (npr. več desetletij)
metodologija	<ul style="list-style-type: none"> • napovedovanje bližnje prihodnosti na podlagi ekstrapolacije preteklih trendov • uporaba kvantitativnih metod in konkretnih podatkov iz preteklosti • temeljijo na predpostavki, da so trendi in vzorci, ki smo jim bili priča v preteklosti, relevantni tudi za prihodnost 	<ul style="list-style-type: none"> • fokus običajno ni usmerjen v izvajanje natančnih napovedi, pač pa v preučevanje širšega spektra možnih scenarijev v prihodnosti z upoštevanjem in razumevanjem (globalnih) dejavnikov, ki krojijo prihodnost • kombinacija kvantitativnih in kvalitativnih pristopov (kot npr. načrtovanje scenarijev, ekspertna mnenja metoda Delfi; glej sliko 2)
prilagodljivost	<ul style="list-style-type: none"> • so pogosto bolj toge in rigidne • težko sledijo nepričakovanim spremembam v okolju • učinkovite so stabilnih okoljih, ko se vzorci dogajanja iz preteklosti ohranjajo 	<ul style="list-style-type: none"> • metode poudarjajo prilagodljivost in sposobnost prilagajanja dinamičnemu okolju • organizacijam pomagajo proaktivno oblikovati svojo prihodnost na podlagi proučitve alternativnih scenarijev in jih tako bolje pripraviti na soočanje z negotovostmi v prihodnosti
namen	<ul style="list-style-type: none"> • uporabne predvsem za operativno načrtovanje in obvladovanje kratkoročnih tveganj 	<ul style="list-style-type: none"> • vključujejo strateško razmišljanje in inovacije, podpirajo razvoj inovativnih strategij • pomagajo organizacijam prepoznati nove priložnosti, potencialne izzive in globalne dogodke, ki lahko povzročijo prelomnice v poslovanju
razumevanje negotovosti	<ul style="list-style-type: none"> • negotovost tretirajo kot naključno odstopanje od pričakovanih trendov • težave pri upoštevanju povsem neznanih in nepričakovanih scenarijev 	<ul style="list-style-type: none"> • sprejemajo negotovost, saj se zavedajo, da je prihodnost že sama po sebi negotova • metode predvidevanja raziskujejo spekter možnih prihodnosti, vključno z t. i. »divjimi kartami« in na novo porajajočimi izzivi.

Vir: Lasten

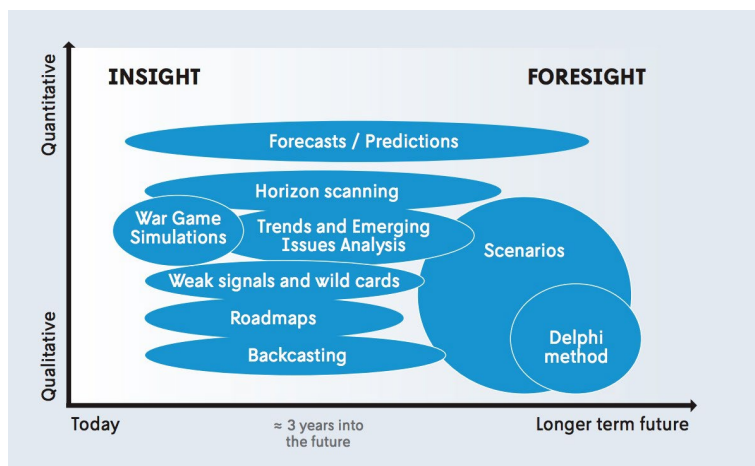
2.3 Metode foresight analitike

Proces foresight analitike se lahko izvaja v različnih oblikah, odvisno od narave, obsega in ambicioznosti problema, področja obravnave, razpoložljivih virov, časovnega horizonta in stopnje zrelosti konteksta. Izbira ustrezne metode foresight analitike je ključnega pomena za uspešnost procesa in uporabnost rezultatov (ETF, 2017).

Medtem ko konvencionalne metode napovedovanja temeljijo predvsem na kvantitativnih metodah in statističnih modelih (npr. časovne vrste, regresijska analiza, ...), se pri foresight analitiki le-te zelo pogosto dopolnjuje s t. i. hibridnimi metodami (poznane tudi pod imenom semi-kvantitativne metode) in kvalitativnimi metodami. Foresight analitik ima tako na izbiro celo množico metod, ki jih lahko uporabi v dani situaciji ob upoštevanju različnih dejavnikov, od katerih je napoved odvisna. Sistematičen pregled uporabnih metod predstavlja t. i. foresight diamant, ki ga je razvil Popper (2008), v sklopu katerega je, glede na štiri dejavnike (strokovnost, ustvarjalnost, povezljivost in dokazljivost), razvrstil 33 metod, uporabnih v sklopu foresight analitike. Iz slike 1 je razvidno, da je 6 metod (18 %) opredeljenih kot kvantitativne, 8 metod (24 %) kot hibridnih, medtem ko je večina (58 %) metod kvalitativnih. Slika 2 ponazarja uporabnost posameznih metod glede na časovni horizont napovedovanja.



Slika 1: Foresight diamant (Popper, 2008, citirano v Čifci, 2019)



Slika 2: Uporabnost posameznih metod foresight analitike glede na časovni horizont napovedovanja

Vir: <https://www.futuresplatform.com/blog/9-foresight-methodologies-successful-companies-use-stay-ahead>

Nekateri viri (glej npr. ETF, 2017) delijo metode foresight analitike na tri kategorije: normativne metode (ang. normative methods), raziskovalne metode (ang. exploratory methods) in dopolnilne metode (ang. supplementary methods). Normativne metode izhajajo iz stališča želene prihodnosti in nadaljujejo z iskanjem načinov za njeno uresničitev. Primeri takih metod so napoved za nazaj (ang. backcasting) ali načrtovanje poti (ang. roadmapping). Raziskovalne metode izhajajo iz stališča sedanjosti in na podlagi različnih predpostavk preučujejo različne možne scenarije v prihodnosti. Primeri takih metod so metoda delfi (ang. Delphi method), skupina strokovnjakov (ang. expert panel), pregledovanje obzorja (ang. horizon scanning), scenariji (ang. scenarios). Dopolnilne metode, kot so npr. pregled literature (ang. literature review), SWOT analiza, viharjenje možganov (ang. brainstorming) ali fokusne skupine (ang. focus groups), ki niso striktno metode foresight analitike, se pogosto uporabljajo v kombinaciji z normativnimi ali raziskovalnimi metodami z namenom učinkovitejšega doseganja ciljev foresight analitike.

Chulok (2021) navaja različne pristope oz. metode tudi glede na področje proučevanja, in sicer sociologijo, gospodarstvo, institucije in infrastrukturo, izobraževanje ter vlado.

Vidimo, da je paleta metod, uporabnih za potrebe foresight analitike, izjemno raznolika. V taki množici je težko trditi, da je katera od metod boljša od ostalih. Izbira ustrezne metode je odvisna prilagodljivosti na konkretno situacijo, lastnosti obravnavanega okolja in kulturnih navad v tem okolju ter drugih dejavnikov. Običajno do najboljših rezultatov pridemo, če kombiniramo več različnih metod.

3 Potrebe po foresight analitiki v poslovnem svetu

V sodobnem gospodarstvu se poudarek na foresight analitiki krepi, saj se podjetja in organizacije soočajo s hitrimi tehnološkimi, družbenimi in ekonomskimi spremembami. Foresight analitika tako postaja ključno orodje za prepoznavanje prihodnjih trendov, izzivov in priložnosti, ki omogoča podjetjem in organizacijam, da sprejemajo bolj informirane odločitve, se lažje prilagajajo spremembam, se izognejo potencialnim tveganjem in izkoristijo konkurenčne prednosti. Ključni prednosti, ki jih foresight analitika prinaša podjetjem in organizacijam, bi lahko strnili na naslednji način:

- *Sposobnost navigacije skozi negotovosti*: Poslovno okolje postaja vse bolj kompleksno in negotovo. Foresight analitika pomaga organizacijam predvideti in se pripraviti na različne možne prihodnosti, s čimer zmanjšuje ranljivost za nepričakovane (tudi neželene) dogodke (Rohrbeck in Gemünden, 2011).
- *Usmerjenost v inovacije in sledenje razvoju trga*: S prepoznavanjem nastajajočih priložnosti in potencialnih področij za rast foresight analitika spodbuja naklonjenost do inovacij, ki podjetjem in organizacijam omogočajo prilagajanje tehnološkemu napredku, spreminjajočim se potrošniškimi vzorcem ter dinamiki trga (Sarpong in Meissner, 2018).
- *Obvladovanje tveganj*: Razumevanje prihodnjih tveganj je ključno za učinkovito obvladovanje tveganj. Foresight analitika omogoča podjetjem in organizacijam prepoznavanje potencialnih groženj in izzivov ter izvajanje proaktivnih strategij za omejevanje s tem povezanih tveganj (Taheri Demneh, Zackery, in Nouraei, 2023).
- *Konkurenčna prednost*: Podjetja, ki uporabljajo foresight analitiko, pridobijo konkurenčno prednost, saj so bolj pripravljena izkoristiti nastajajoče trende. Ta proaktivni pristop izboljšuje agilnost in odpornost organizacije (Purwanto, Ashari Nasution in Anggoro, 2023).

- *Sposobnost načrtovanja dolgoročne strategije*: Foresight analitika podpira dolgoročno strateško načrtovanje. Namreč, z razmislekom o prihodnjih scenarijih organizacije razvijejo trdne strategije, ki so v skladu z njihovo vizijo in cilji, s čimer prispevajo k trajnostnemu uspehu (OECD, 2019; Semke in Tiberius, 2020).

Področje uporabe foresight analitike se je v strokovni in znanstveni literaturi uveljavilo pod imenom korporativni foresight (ang. Corporate foresight). Sistematični pregled literature na tem področju so pripravili Marinković et al. (2022). Posebno vejo foresight analitike, ki se v zadnjem času skokovito razvija, najdemo tudi v tehnološki industriji (ang. Technology foresight, glej npr. Minghui, et al., 2022). V literaturi najdemo kar nekaj študij primera, ki opisujejo uporabo foresight analitike v konkretnih poslovnih okoljih. Na primer, Çifci (2019) se osredotoča na uporabo foresight analitike na področju kibernetike varnosti v Turčiji, Rohrbeck, Arnold in Heuer (2007) delijo izkušnje z implementacijo foresight analitike v mednarodnem podjetju Deutsche Telekom Laboratories, Ejdyš et al. (2018) pa uporabijo foresight za pripravo alternativnih scenarijev za razvoj fakultete.

4 Analiza ključnih znanj z vidika ponudnikov visokošolskih izobraževanj v tujini

V tujini lahko zasledimo kar pestro ponudbo izobraževanj na temo foresight analitike na vseh stopnjah študija od dodiplomske, magistrske in doktorske, pa tudi krajša nekajdnevna strokovna izobraževanja. Več visokošolskih ustanov pa vključuje vsebine foresighta v svoje študijske programe s posameznimi predmeti, opravljene so tudi poskusne izvedbe krajših tečajev z namenom evalvacije pripravljenih vsebin in vpeljavajo le-teh v učni proces (npr. Ead, 2021). Na spletu smo zasledili nekaj celovitih pregledov obstoječih študijskih programov s področja foresighta, in sicer:

- WFSF - World Futures Studies Federation (2021). Academia. Accreditaion. Future Courses Globally.
- University Futures and Foresight Degrees and Programs (Dawson, 2024).

V nadaljevanju navajamo nekaj prestižnih univerz, ki že imajo programe na temo foresighta, in sicer:

- University of Houston - Master of Science in Foresight (<https://dot.egr.uh.edu/programs/graduate/foresight>) ali krajši programi (Professional Certificate in Foresight (<https://dot.egr.uh.edu/programs/professional/fore>))
- University of Turku, Turku School of Economics - Finland Futures Research Centre, <https://www.utu.fi/en/university/turku-school-of-economics/finland-futures-research-centre> (<https://www.utu.fi/en/university/turku-school-of-economics/finland-futures-research-centre>)
- SOIF - School of International Futures (<https://soif.org.uk/>)
- Regent's University London - Master of Arts in Foresight (<https://www.regent.edu/program/dsl-strategic-foresight/>)
- University of Hawai'i at Manoa - Alternative Futures Graduate Program (<https://politicalscience.manoa.hawaii.edu/alternative-futures/>)
- Centre for Future Studies - University of Stellenbosch Business School (<https://www.stellenboschbusiness.ac.za/institute-futures-research>)
- Tamkang University - Graduate Institute of Futures Studies (<http://future.tku.edu.tw/main.php>)

Na podlagi proučitve obstoječih študijskih programov in predmetov ugotavljamo, da je za uspešno opravljanje vloge foresight analitika potreben zelo širok spekter znanj in veščin. Namreč, uspešen foresight analitik mora združevati tehnična znanja s sposobnostjo kreativnega in inovativnega razmišljanja, vizionarskega pogleda, interdisciplinarnega pristopa ter imeti široko razumevanje družbenih, ekonomskih, tehnoloških in geopolitičnih dinamik, ki oblikujejo prihodnost. Kot ključna znanja in veščine bi izpostavili naslednje:

- Razumevanje metodologij predvidevanja, torej poznavanje različnih metodologij za analizo prihodnosti, kot so scenarijsko načrtovanje, Delphi metoda, BCG matrika...
- Analitične sposobnosti, ki vključujejo zbiranje, pregled in analize podatkov o trenutnih trendih ter interpretiranje rezultatov napovednih modelov, trendov ter dogodkov s potencialnim z vplivom na prihodnost.

- Strateško razmišljanje vključuje razumevanje strateškega okvirja in kako foresight oz. analiza prihodnosti prispeva k oblikovanju in prilagajanju organizacijskih strategij.
- Tehnološka pismenost se nanaša na poznavanje in uporabo sodobnih tehnologij ter ocene njihovega vpliv na posameznika, družbo ter gospodarstvo.
- Obvladovanje kompleksnih sistemov se nanaša na sposobnost razumevanja kompleksnosti in sistemskih povezav med različnimi dejavniki, dogodki ter trendi.
- Sposobnost vodenja intervjujev, fokusnih skupin, skupinskih razprav in delavnic za pridobivanje mnenj, stališč in idej iz različnih virov.
- Kritično razmišljanje omogoča prepoznavanje predpostavk, omejitev in morebitnih napak v analizi prihodnosti.
- Kreativnost oz. sposobnost kreativnega razmišljanja in generiranja inovativnih in vizionarskih rešitev ter alternativnih scenarijev omogoča dobro napovedovanje nepredstavljljive in negotove prihodnosti.
- Učinkovite komunikacijske spretnosti so ključne za predstavitev kompleksnih konceptov in rezultatov foresight analize tako strokovni kot širši javnosti.
- Psihološko razumevanje človeškega vedenja, ki deluje kot posameznik znotraj skupine in je hkrati soustvarjalec odločitev vpliva na oblikovanje prihodnosti.
- Ključna znanja na področju specifične dejavnosti, za katero se pripravljata foresight analiza, omogočajo poglobljen vpogled in posledično boljšo analizo in predvidevanje prihodnosti.
- Etika in družbena odgovornost sta ključni, če želimo, da z orodji, metodami in rezultati foresight analitike kot družba pridobimo oz. zgradimo in sooblikujemo planetu in družbi naklonjeno in prijazno prihodnosti.

5 Stanje v Sloveniji

V našem izobraževalnem prostoru izobraževalni program na temo foresighta oz. predvidevanja prihodnosti še ne obstaja.

V sklopu Erasmus projekta (Faganel, 2013) je Fakulteta za management Univerze na Primorskem s partnerji razvijala Študijski modul Creative Strategic Foresight, katerega cilji so vključevali promocijo sistematičnega vključevanja ustvarjalnosti in strateškega predvidevanja v evropske izobraževalne sisteme. Cilj projekta je bil prikazati in ponudi pot, kako postati kot družba bolj izobraženi na omenjenem področju in zato "inovativnejši, prodornejši, ustvarjalnejši in uspešnejši pri strateškem predvidevanju". Rezultat projekta je bila torej konceptualna ideja študijskega programa, ki pa v slovenskem prostoru (še) ni zaživel.

Kljub temu pa se vključujejo posamezni koncepti foresighta v različne predmete na slovenskih fakultetah. Koncept intuitivnega foresighta (ang. Intuitive foresight) je tako predstavljen v učbeniku za Podjetništvo: Glavni dejavniki razvoja (Antončič in drugi, 2022), ki je nastal kot plod sodelovanja med Ekonomsko fakulteto Univerze v Ljubljani, Ekonomsko-poslovno fakulteto Univerze v Mariboru in Fakultete za management Univerze na Primorskem.

6 Zaključek in smernice nadaljnjega dela

Na podlagi vsega napisanega lahko povzamemo, da v slovenskem visokošolskem prostoru nedvomno obstaja velika potreba bo zagotavljanju znanj in veščin, ki jih foresight analitik pri svojem delu potrebuje. Žal vzpostavitev novega študijskega programa v Republiki Sloveniji ni ravno enostavna naloga. Postopek priprave in prijave novega študijskega programa sestoji iz več razmeroma kompleksnih korakov, ki bi jih lahko strnili na naslednji način:

1. *Identifikacija potreb in pobuda za vzpostavitev programa:* Na podlagi analize razvojnih trendov, potreb na trgu dela ali drugih relevantnih dejavnikov se ugotovi potreba po novem študijskem programu, na podlagi katere se pripravi pobuda za njegovo vzpostavitev. Pobuda lahko pride iz gospodarstva ali akademske sfere.
2. *Priprava programske dokumentacije:* Na podlagi izražene pobude nato univerza ali visokošolska institucija oblikuje delovno skupino, sestavljeno iz strokovnjakov iz relevantnih področij, ki bo odgovorna za pripravo novega študijskega programa. Delovna skupina nato pripravi elaborat študijskega programa, ki vključuje strukturo programa, opis predmetov, učnih ciljev, metodologijo ocenjevanja in druge podrobnosti. Pri oblikovanju elaborata

je potrebno upoštevati smernice, ki jih določa Nacionalna agencija za kakovost v visokem šolstvu (NAKVIS, <https://www.nakvis.si/>) in druge relevantne zakonodajne smernice.

3. *Interni postopki in odobritev na institucionalni ravni:* Elaborat študijskega programa se predstavi na ustreznih strokovnih organih univerze ali visokošolske institucije, ki je pobudnica vzpostavitve novega študijskega programa (npr. katedre, ki delujejo na področju, za katerega se študijski program pripravlja), kjer poteka notranja revizija vsebinske ustreznosti predlaganega programa. Ko je študijski program iz vsebinskega vidika usklajen, se predloži v presojo in odobritev akademskemu organu (senat, poslovodni odbor, akademski zbor).
4. *Akreditacija novega študijskega programa:* Po odobritvi na interni ravni se sproži postopek akreditacije, ki poteka pod okriljem NAKVIS-a. Postopek akreditacije poteka skladno z merili NAKVIS (2019). Postopek akreditacije vključuje oceno vseh predloženih dokumentov in morebitni obisk strokovne komisije.
5. *Vpis v Evidenco eVŠ visokošolskih zavodov in študijskih programov:* Po uspešni akreditaciji pri NAKVIS se nov študijski program vpiše v evidenco eVŠ (<https://www.gov.si/teme/evs-evidenca-visokosolskih-zavodov-in-studijskih-programov/>), ki se vodi pri Ministrstvu za visoko šolstvo, znanost in inovacije (MVZI).
6. *Izvedba programa:* Po pridobitvi akreditacije NAKVIS in vpisu v eVŠ lahko univerza/ visokošolska institucija prične z izvajanjem novega študijskega programa, ki seveda mora potekati v skladu s sprejetimi smernicami in standardi kakovosti.

V grobem ocenjujemo, da v danih okoliščinah za izpeljavo celotnega postopka potrebujemo približno dve leti. Ob zavedanju, da potrebe gospodarstva obstajajo in bodo v prihodnosti le še narasle menimo, da bi veljalo k izzivu pristopiti čim prej. Da bi z novim študijskim programom čim bolje pokrili vrzeli v analitskih znanjih in veščinah, bi kot prvi naslednji korak predlagali izvedbo sistematične raziskave konkretnih specifičnih potreb po foresight analitiki v slovenskem gospodarstvu.

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STRUCTURAL LCA AS A TOOL TO ENVIRONMENTAL NEUTRALIZABILITY OF PRODUCTS AND SERVICES

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Environmental neutralizability is a recently introduced concept to study the reduction of the environmental impact of products and services on their production costs. In this paper, we combine the ISO 14040 and ISO 14044 based LCA and cost price models, highlighting the similarities between both models and the processes of their development. The combination of these models provides information on the environmental neutralizability of products and services. Crucial to understanding environmental neutralizability of a given product is structural LCA, which distinguishes between fixed and recurrent emissions. We demonstrate the applicability of the introduced models and concepts on data obtained for the German transportation sector.

Keywords:

environmental neutralizability, structural LCA analysis, mobility sector, GHG target emissions

1 Introduction

The 2030 climate and energy framework outlines EU-wide targets and policy objectives spanning from 2021 to 2030. Emphasising the reduction of net greenhouse gas emissions by a minimum of 55% compared to 1990 levels, the European Commission's proposals in July 2021 aim to align climate, energy, transport, and taxation policies towards this ambitious goal. These measures pave the way for the EU to achieve climate neutrality by 2050, positioning it as a trailblazer on this front (European Commission (a), n.d.). Key targets within the 2030 climate and energy framework include a notable increase in ambition:

- Greenhouse gas emissions: A shift from a 40% to at least a 55% reduction (relative to 1990 levels).
- Renewable energy: An elevation from a 32% to a 42.5% share.
- Energy efficiency: Targets set for final energy consumption rising from 32.5% to 36%, and for primary energy consumption reaching 39%.

The EU's target to achieve climate neutrality by 2050, creating an economy with net-zero greenhouse gas emissions, forms the core objective of the European Green Deal (European Commission (b), n.d.). This commitment aligns with the EU's pledge to global climate action under the Paris Agreement (European Council, 2024). The transition toward a climate-neutral society represents both a pressing challenge and an opportunity to forge a more promising future for everyone. This transformation involves every facet of society and economic sectors, spanning from the power sector to industry, mobility, buildings, agriculture, and forestry.

The European Union's commitment to achieving a 55% reduction in EU emissions by 2030 is legally enforced under the European climate law. In line with this obligation, EU nations are actively drafting new legislation to meet this target and ultimately achieve climate neutrality within the EU by 2050 (European Council, 2024). The Fit for 55 package encompasses a series of proposals designed to amend existing EU laws and introduce fresh initiatives. Its primary objective is to align EU policies with the established climate objectives as agreed upon by both the Council and the European Parliament. The term 'Fit for 55' is coined in reference to the EU's ambitious goal of reducing net greenhouse gas emissions by a minimum of 55% by 2030.

In pursuit of its 2050 target, the EU is actively addressing the reduction of emissions from cars, given that road transport contributes to one-fifth of the EU's CO₂ emissions. By 2030, the EU is targeting a 55% reduction in car emissions and a 50% reduction in van emissions compared to 2021 levels. This effort is aimed at achieving the objective of zero emissions from new cars and vans by 2035.

The Council has approved a new regulation, part of the 'Fit for 55' package, imposing stricter CO₂ emission standards for new cars and vans in the EU. Key aspects of the regulation include reduction targets of 55% for new cars and 50% for new vans by 2030-2034 compared to 2021 levels, achieving 100% emissions reductions for both by 2035, introduction of a regulatory incentive mechanism for zero- and low-emission vehicles (ZLEV) from 2025-2029, rewarding manufacturers meeting specific sales benchmarks and lastly consideration for e-fuels and a review in 2026 to assess progress towards emission reduction targets, examining technological advancements and the transition to zero emissions. Other provisions involve gradual reduction in emission credits for eco-innovations, the development of a common EU methodology for assessing CO₂ emissions, and derogation for small volume manufacturers until 2035. This regulation revises previous rules, holding manufacturers accountable for their fleet's average CO₂ emissions, with penalties for exceeding targets. This initiative aligns with the broader 'Fit for 55' package, aiming to reduce net greenhouse gas emissions by 55% by 2030 and achieve climate neutrality by 2050.

Best available techniques (BAT) refer to the most advanced and effective stage in the development of activities and operational methods. BAT signifies practical methods suitable for establishing emission limit values and permit conditions, aimed at preventing or, when not feasible, minimizing emissions and their impact on the overall environment. Under this definition 'Techniques' encompass not just the technology used but also the installation's design, construction, maintenance, operation, and decommissioning. 'Available techniques' refer to those developed at a scale feasible for implementation in the relevant industrial sector, considering economic and technical viability. 'Best' signifies the most effective methods for achieving a high level of environmental protection overall (WeCOOP, n.d.).

The aforementioned policies build upon the concept of environmental neutrality. In ESRS (European Union Law, 2023 (b)), it is introduced through the concept of net zero target. To quote, *setting a net-zero target at the level of an undertaking aligned with meeting societal climate goals means: i. achieving a scale of value chain emissions reductions consistent with the abatement required to reach global net-zero in 1.5°C pathways; and ii. neutralizing the impact of any residual emissions (after approximately 90-95% of GHG emission reduction with the possibility for justified sectoral variations in line with a recognized sectoral pathway) by permanently removing an equivalent volume of CO₂.*

In our analysis, we concentrate on the transportation sector. Thus, we need to look at how these global targets are translated to sector goals. These details are left to the countries themselves. As the first case, we look at Germany. The German government defined their goals to achieve the target of the 1.5 °C pathway in their climate protection plan 2050 (BMUB, 2016). This plan defines the overall targets in line with the EU targets and then goes into separate targets by sector for 2030 and 2050. The transportation sector has so far been considered a challenging sector that could not achieve great reductions compared to 1990 so far. Currently the tariff sectors just about manage to keep the CO₂e values at an even level.

Projections for traffic in Germany see an increase in traffic volume. The only solution available is to reduce the specific emissions of any given vehicle sufficiently that it overcompensates the increase in traffic volume. With current state-of-the-art, BEV are the best available technology to achieve this (fuel cell vehicles are a proposed alternative but are insufficiently produced). In the climate action plan 2030, the German government emphasises this by introducing plans for incentives to buy BEV for individual cars and trucks (BMU, 2019).

The current aims of the climate plan of Germany for the transportation sector aim for a reduction from 163 million tons in 1990 to 98 million tons in 2030 which is a reduction target of about 40%. This will not achieve the overall 55% reduction target and thus other sectors need to compensate for 2030 though there is hope that additional activities to increase railway traffic as well as individual mobility by alternative means will help to achieve a higher reduction in transportation. Still by 2050 the transportation sector needs to achieve the same target as all others of 90-95%. This means that after 2030, the rate of reduction has to accelerate in comparison to other sectors (BMUB, 2016).

In our contribution, we use the Life Cycle Assessment approach to provide new insights into the structural challenges of Environmental neutrality or more formally the above stated net-zero target. As stated, we concentrate on transportation and the obvious product to look at here are the vehicles for individual transportation. Here, the net-zero target clearly separates into what we call fixed emissions and recurrent emissions. In the example, fixed emissions result at the beginning and at the end of the lifecycle and can be attributed to producing the vehicle that will be used in transportation and recycling its salvageable components at the end of lifetime. Recurrent emissions can be attributed to using the vehicle for actual transportation. We then show that net-zero target of transportation then translates into either significantly reducing both fixed and recurrent emissions, or reducing the recurrent emissions significantly, allowing the fixed emissions to be reduced less. On the other hand, for products of significant recurrent emissions, it is impossible to sufficiently neutralise their lifetime emissions by just focusing on the fixed emissions.

The above distinction is relevant for any product or sector. A generalisation of the approach shows that if recurrent emissions of a sector, industry or product could not meet the target, the residual emissions will be neutralised by permanently removing enough greenhouse gases from the atmosphere. For recurrent emissions, this induces an extra (recurrent) cost to each unit of the product, affecting its competitiveness and inducing a push towards best available technologies. Additionally, this observation motivates development of CO₂ capture technologies.

2 Models and methods

In this section, we describe the models used in our study.

2.1 The base model

The base model we apply is a linear cost and linear production model, which we outline in this chapter but will be detailed in a different contribution. In it, the decision vector of desired outputs of the technology is a m -dimensional vector $x \in R^m$, and it specifies all the desiderata of the production process that are in control by its managers. The vector of the change of the state of the world achieved of the production (including products, byproducts, pollutants, as well as change in resources such as (raw) materials, partial products, energy, labor, time, money) is a

m-dimensional vector $\mathbf{y} \in R^m$. For the sake of completeness, we may assume that the state of the world contains all the products and all the resources required for their production. Similarly, we assume all these coordinates can participate in decision making, thus justifying the same dimension of the vectors \mathbf{x} and \mathbf{y} . The (linear) technology producing change of the state of the world \mathbf{y} given decision \mathbf{x} is described by technology matrix A (which is a square matrix by assumptions) and initial state of the world \mathbf{y}_0 . The technology matrix has, for each relevant output dimension i , a single row of coefficients A_i that describes the amount of output \mathbf{y}_i produced following a single decision x_i resulting in the total production of $A_i \mathbf{x}$ of output \mathbf{y}_i from the complete vector of inputs \mathbf{x} . Accounting for the investment production of output (usually pollutant) $\mathbf{y}_{\{0,i\}}$, we get the final equation $\mathbf{y}_i = A_i \mathbf{x} + \mathbf{y}_{\{0,i\}}$ for the production of output i , or $\mathbf{y} = A \mathbf{x} + \mathbf{y}_0$ as the vector equation for the production of all the outputs. Similarly, the cost of production of \mathbf{y} is $c_y = c^T \mathbf{x} + c_0$ (1) where c_y is the production cost (scalar) of the vector of outputs \mathbf{y} , c is the (column) vector of costs of decisions, \mathbf{x} is the decision vector, and c_0 is the total of fixed costs of production.

From the above model, we focus on two components of the output vector, the production of a product i , $\mathbf{y}_i = A_i \mathbf{x} + \mathbf{y}_{\{0,i\}}$ (2) and the production of a pollutant $\mathbf{y}_p = A_p \mathbf{x} + \mathbf{y}_{\{0,p\}}$ (3). Then, $\mathbf{y}_p(n) = nA_p \mathbf{x} + \mathbf{y}_{\{f,p\}}$ (4) is the amount of pollutant p produced in the lifetime of the production plant, where A is the previous technology matrix, A_p is its p -th row, and $\mathbf{y}_f = \mathbf{y}_0 + \mathbf{y}_1$ is the vector of fixed outputs including fixed set-up production vector \mathbf{y}_0 and the fixed decomposition production vector \mathbf{y}_1 . Then, $\mathbf{y}_{\{f,p\}}$ is the p -th component of this vector. The p -pollutant footprint of a unit of product i as f_p and \mathbf{y}_i as the number of units of product \mathbf{y} produced in a single batch/year of production. We obtain

$$f_p = \frac{nA_p \mathbf{x} + \mathbf{y}_{\{f,p\}}}{nA_i \mathbf{x} + \mathbf{y}_{\{f,i\}}} \quad (5)$$

2.3 Understanding net-zero footprint production.

Net-zero footprint is earlier defined as reaching the societal targets of sufficiently low production of pollutants. There are two possible interpretations of this definition. First, we say that a product has a strong net-zero footprint if both fixed

and recurrent footprint are reduced by its appropriate fraction. To allow for generality we find relevant in current practice, we assume different fractions $r_r, r_f, 0 < r_r, r_f \leq 1$ in recurrent and fixed footprint reduction. Introducing $y_{\{r,0\}} = (A_p x)$ as initial recurring footprint results in $t_r = r_r y_{\{r,0\}}$ as recurring threshold, and $y_{\{f,p,0\}}$ as initial fixed footprint results in $t_f = r_f y_{\{f,p,0\}}$ as a fixed threshold. Thus we obtain $(A_p x) \leq t_r$ (6) for recurring footprint and $y_{\{f,p\}} \leq t_f$ (7) for fixed footprint. A product respecting (6) and (7) has reached a strong net-zero target both in its fixed and recurrent component of the footprint.

Given the above, a product may not reach both constraints (6) and (7), yet it may still reduce the footprint sufficiently. For this case, we say that a product reaches a weak net-zero target, if the combined footprint is reduced by the required amount. After some algebra we omit due to page restrictions, and introducing d_r as the discrepancy in the recurrent footprint and d_f as the discrepancy in the fixed footprint, we obtain $n d_r + d_f \leq 0$ (8)

As n is the lifetime of the production facility in the number of batches produced, which is a positive number, equation (8) is always satisfied for strong net-zero products, which have both d_f and d_r smaller or equal zero. At least one needs to be negative for the equation (8) to hold. If only the d_f is negative and d_r is positive, we obtain $-\frac{d_f}{d_r} \geq n$ (9), an infeasible constraint as it converts the fixed footprint into recurrent footprint, due to the coupling of the lifetime of the facility with the (small) number of the units of product produced. Assuming d_f is positive and d_r is negative, the inequality reverses and we obtain: $-\frac{d_f}{d_r} \leq n$ (10).

In this case, the significant reduction of recurrent footprint allows for lesser reduction in the fixed footprint, provided the lifetime of the facility is long enough. Moreover, the greater the reduction of the recurrent footprint, the larger the d_r and hence the smaller the required reduction of the fixed footprint. It is even possible to estimate the reduction of the recurrent footprint that would, given a lifetime, allow for no reduction in the fixed footprint. In this case, $d_f = y_{\{f,p,0\}} - t_f$ and we obtain

$$d_r = \frac{d_f}{n} = \frac{y_{\{f,p,0\}} - t_f}{n} \quad (11)$$

Another interesting scenario is completely decarbonizing recurrent emissions (for instance, by providing emissions-free electricity), and observing the lifetime that allows for reaching net-zero target without reducing the current fixed emissions. In (8), we have $d_r = -t_r$ and $d_f = y_{\{f,p,0\}} - t_f$, implying $\frac{y_{\{f,p,0\}} - t_f}{t_r} \leq n$ (12)

We continue by integrating the proposed mathematical model into the process of LCA analysis through structural LCA analysis.

3 Structural LCA

The structural environmental footprint model proposed in this paper is based on the Life Cycle Assessment (LCA) methodology standardised in the ISO standards 14040 and 14044. The LCA methodology provides a framework for comprehensive environmental footprint assessments. It includes four main phases:

- i. goal and scope definition,
- ii. life cycle inventory (LCI) analysis,
- iii. life cycle impact assessment (LCIA), and
- iv. interpretation of the results.

In our model, we are using phases (i), (ii) and (iii) to assess the environmental footprint of the technology, while in the phase (iv) - interpretation of the results, we propose a new classification of technology's environmental footprint. We argue that the total footprint can always be divided into two segments, the fixed footprint and recurrent footprint. In relation to LCA, the recurrent footprint aligns with the technology's operational phase while the fixed footprint aligns with the material extraction, manufacturing, and end of life phases, as they are usually defined in the goal and scope definition phase of LCA analysis.

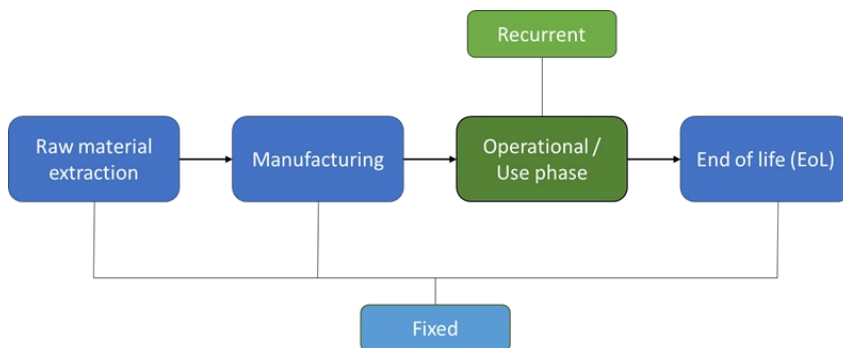


Figure 1: LCA product's stages and connection to Fixed and Recurrent environmental footprint

Source: own source

For a given technology, we can define its environmental footprint as a sum of its fixed footprint and recurrent footprint. Each technology can be described with a set of material and energy inputs, and each material or energy input can be considered a technology and therefore described with a set of material and energy inputs. By knowing a fixed and recurrent footprint of each technology, we can link all inputs as shown in Figure 2.

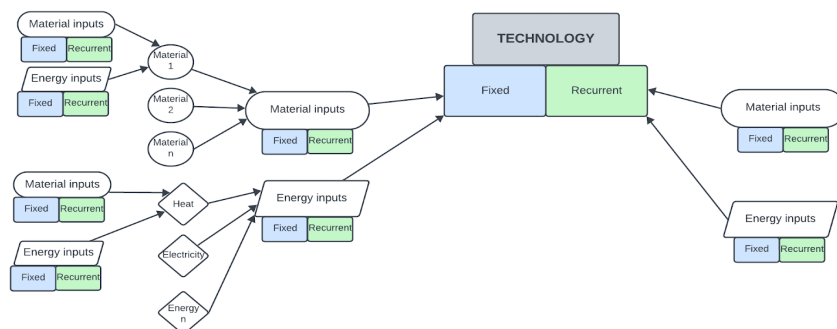


Figure 2: Structural breakdown of a technology

Source: own source

The main difference between conventional and structural LCA is how we combine the data on fixed and recurrent footprint. In structural LCA, we split material and energy inputs into fixed and recurrent footprint. In conventional LCA, we would

assign both (fixed and recurrent footprint) to the operational/use phase, while in structural LCA, we assign recurrent to recurrent and fixed to fixed (Figure 3).

We can show the difference with an example of a battery electric vehicle (BEV) that uses electricity from solar panels (Table 1). In conventional LCA, we would assign all emissions from manufacturing of solar panels and emissions from producing electricity to the use phase. In Structural LCA, we treat this differently. We assign the emissions from manufacturing of solar panels to the fixed footprint and the emissions from producing the electricity (i.e. produced by maintenance) to the recurrent footprint. The reasoning is that once the solar panels are built, the emissions are already fixed in the environment, irrespective of our use of electricity.

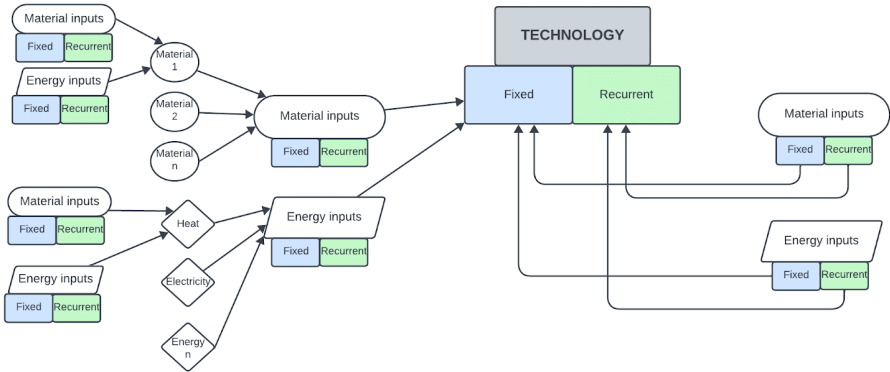


Figure 3: Assigning fixed and recurrent footprint in structural LCA

Source: own source

Table 1: Applying conventional and structural LCA to the case of BEV

Example	Conventional LCA	Structural LCA
Manufacturing of BEV	Manufacturing phase	Fixed
Manufacturing of solar panels	Use phase	Fixed
Electricity from solar panels for driving	Use phase	Recurrent

We can further define different levels of technology’s environmental neutrality. Technology can either be:

- i. environmentally not neutral,
- ii. neutral by offsetting,
- iii. neutral by permanent pollutant removal (e.g. carbon capture & storage) or
- iv. neutral by design.

We can argue that technology that is environmentally not neutral is unsustainable, and it will eventually have to become neutral. To achieve neutrality, a technology can rely on external assistance in terms of offsets or permanent pollutant removals. In this case, the technology is not neutral but it can be “net-neutral” when we expand system boundaries.

Offsetting can offer a short-term solution to sustainability but in a finite world, we will eventually run out of offsetting possibilities. Furthermore, there is a growing concern about the effectiveness of carbon offsets and their use in greenwashing which increases the importance of high-quality carbon offsets and a well-regulated carbon market (Greenfield and Harvey, 2023).

Therefore, a better long-term solution is net-neutrality by permanent pollutant removal. In theory, we should be able to capture and store pollutants that a technology is emitting. The problem is that this approach uses significant resources which incur additional costs. If the cost of permanent pollutant removal is higher than the cost of making a technology neutral by design, then the technology will not be competitive. In this case, only difficult to neutralize (by design) and high value-added technologies might stay on the market in the long term.

When analyzing a given technology and its neutralizability, we first need to examine the neutrality of its inputs. The inputs are split into fixed and recurrent. We consider fixed inputs as a one time event and recurrent inputs as all inputs that will be needed during technology’s lifetime. Recurrent inputs are often resources used for the operation and maintenance (fuels, materials, electricity...) but they may also include inputs needed to extend technology’s lifetime (i.e. repairs, upgrades...).

Both fixed and recurrent inputs can either meet the net-zero target or not. We analyse four different scenarios of a technology reaching the net zero target and what can be done to neutralize the technology in the short or long term (Figure 2).

Table 2: Technology’s neutrality based on inputs and options for the neutralizability of the technology

Technology’s inputs		Technology status	Neutralizability options	
Fixed footprint net-zero target	Recurrent footprint net-zero target	Technology net-zero target	Short term Neutralizability	Long term Neutralizability $n \rightarrow \infty$
no	no	no	By offsetting or permanent removals	Permanent removals
yes	no	no	By offsetting or permanent removals	Permanent removals
no	yes	no	By offsetting or permanent removals	By offsetting or permanent removals
yes	yes	yes	no need	no need

We see in Table 2 that only the technologies with fixed and recurrent inputs reaching net-zero target can be considered net-zero technologies. In all other cases, we can neutralize the technologies in the short term by offsetting or permanently removing pollutants. Offsetting may also be a viable option for long-term neutralizability in case that recurrent footprint is reaching a net-zero target, as we only need to neutralize a set amount of fixed initial footprint. However, when the recurrent footprint does not meet the net zero target, the neutralizability can be achieved only by permanent removals. This is due to the assumption that extending the lifetime to infinity, the amount of inputs reaches infinity and requires offsetting an infinite amount of pollutants which is not viable. By permanent removals, we can form a closed-loop where the emitted and removed amounts are always equal. This however implies recurrent costs to the technology.

4 Applying structural LCA to the mobility sector – use case

As stated above, Germany will be the demonstration case. In Table 1, we show the number of privately owned cars in column 1, the traffic volume in column 2 and the GHG emissions in column 3. For 1990 and 2019, we use historical data from the environment agency of the German government (Umwelt Bundesamt (2023(a,b,c))). For the years 2030 and 2050 we use projections the same agency published for the

number of cars and traffic volume (Umwelt Bundesamt, 2018) and the climate protection plan of the German government for the GHG targets in 2030 and 2050 (BMUB, 2016).

The two remaining columns follow from the first two. The average km a car drives in a given year is the traffic volume divided by the number of cars and the GHG in CO₂e gramm per km follows from that and the GHG emissions.

Table 3: Indicators in transportation

Year	Number of cars in million	Traffic volume in billion km	CO₂e in million t (only for fuel consumption)	Av. km per car per year	CO₂e in g per km (for the av car)
1990	36.8	496.4	164.4	13489	331.19
2019	47.1	644.8	164.9	13690	255.74
2030	48.5	641	98	13216	152.9
2050	47.5	655	8.5	13789	12.98

With Table 4, we have the recurrent emissions historically and the target recurrent emissions for the average car in the transportation sector in Germany. For the presented model, we also need the fixed emissions per car produced for both current values and the target values.

In Table 4, we use a summary published by the scientific service of the German parliament of reported data on the GHG balances in transportation to get the current values for different types of cars (Deutscher Bundestag, 2022).

Table 4: Production and lifetime GHG profile of cars

Car Type	CO2e in t from production	Total CO2 in t over lifetime
ICE gasoline	6.35	31.05
ICE Diesel	6.5	28.6
BEV (current electricity mix)	9.6	22.95
BEV (100% renewable electricity)	9.8	10.5

The last variable missing for the model is the target value for fixed emissions from car production. For this, we look at the target in the industry sector in table 5. Historical data on the GHG numbers is provided by the environmental agency of the German government (Umwelt Bundesamt, 2023(d)) and the targets are published in the climate protection plan of the German government (BMUB, 2016).

Table 5: GHG targets in the industry and manufacture sector in Germany

Year	CO2e from industrial processes in million	Reduction in % compared to 1995
1995	238.9	0
2019	181.99	23.8
2030	141	40.9
2050	10	95.8

For the calculations according to equation (11) and (12) of the model, these reductions are applied to car production in 2030 ($t_{\{f,2030\}}$) and 2050 ($t_{\{f,2050\}}$). From Tables 3 to 5, we can thus create Table 6 with the values of the variables needed to compute the model.

Table 6: Variables needed to compute the model

	BEV emissions	fixed / recurrent
Current fixed GHG emission per car produced ($y_{\{f,p,0\}}$)	9.8t CO ₂ e	fixed
Target fixed GHG emissions per car produced in 2030 ($t_{\{f,2030\}}$)	7.6t CO ₂ e	fixed
Target fixed GHG emissions per car produced in 2050 ($t_{\{f,2050\}}$)	0.5t CO ₂ e	fixed
Target recurrent emissions per car in 2030 ($t_{\{r,2030\}}$)	152.9g CO ₂ e/km	recurrent
Target recurrent emissions per car in 2050 ($t_{\{r,2030\}}$)	12.98g CO ₂ e/km	recurrent

In terms of vehicles, privately owned cars are responsible for the major share of both traffic volume and emissions. Since we concentrate on cars as a product, we will also concentrate on them in regard to the data. The EU targets are all compared to the year 1990.

A usual car has a life expectancy of 12 years. For BEV additional importance has to be put on the lifetime of the battery. In Germany for BEV, the total of 160,000 km (or a 8 year lifetime of normal use) is the accepted norm (Rudschies, 2022).

For equation (12), this results in an $n \geq 14,388$ for 2030 and $n \geq 716,487$ for 2050. The model thus shows that, to reach the 2030 goals if all cars would be electric with carbon neutral electricity, their lifetime would have to be at least 14,388 km to compensate for their complete fixed carbon footprint. While the lifetime is achievable, the condition that all cars go electric by 2030 is not. Similarly, assuming all cars go electric with carbon neutral electricity, to reach the 2050 goals, lifetime of 716,487 km would compensate for the current fixed footprint of BEV production.

5 Conclusions and further research

In our contribution, we analysed an abstract mathematical model behind generic pollutant-footprint neutrality. The model yields a set of constraints that together define a feasible set of strategies towards reaching neutrality of a specific pollutant. In the model, the distinction between fixed and recurrent emissions plays a crucial role. We apply the findings of the model to propose structural LCA, based on bookkeeping the distinction between recurring and fixed pollutant emissions. We illustrate the model using the data of the German transportation sector and demonstrate the trade-off between increasing lifetime of the vehicles vs. reducing the footprint of the car production.

Several similar trade-off constraints can be produced using the stated mathematical model. Altogether, these constraints define a feasible set of general policies and individual approaches to carbon neutralizability of various products and services. Our prototype investigation has piloted some of the constraints on the German transportation sector. In the future research, we plan to extend the model with additional constraints that can be investigated given the available data, thus allowing to formalise the concept of feasible policy set. Furthermore, we plan to investigate the availability of the data for sectors beyond transportation and countries beyond Germany.

Structural LCA that we introduced has applications both in political and corporate decision making (through the above-described feasible set of policies) as well as in corporate planning and decision making. Furthermore, it allows management to identify opportunities and clearly communicate corporate policies to investors, clients, employees, local communities, and other stakeholders. In our future research, we will investigate these aspects of the newly introduced concepts.

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FOSTERING SUSTAINABLE RURAL DEVELOPMENT THROUGH PARTICIPATORY APPROACHES

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In the last twenty years, local self-governments in rural areas have initiated a transformative process to create appealing living environments capable of satisfying modern human needs while ensuring a high quality of life. With this aim, they are constantly trying to create optimal conditions that would keep the current population, and also attract new people and capital. In order to succeed in this, it is crucial to enable the entire local community to participate in the process of sustainable development, and a community is made of all stakeholders operating in one area, including local self-government. Therefore, when designing a local community development strategy, it is very important to take into account the needs of all local stakeholders in the area.

Keywords:

rural
areas,
local
community,
participation,
revitalization,
forestry

1 Introduction

A long-term sustainable development of rural areas is a challenge faced by numerous local self-governments in rural areas across the European Union. These are areas that traditionally rely on the development of agriculture, with a gradual strengthening of other activities, especially sustainable rural tourism. A prerequisite for any concept of sustainable rural development is the involvement of relevant stakeholders, and one of the fundamental challenges lies in establishing effective connections and networks among all these stakeholders. A local government can encourage this through a variety of mechanisms, for example, through organizing public discussions or conducting opinion surveys where stakeholders can put forth their viewpoints. In such a complex approach, it is very important to inform the relevant stakeholders about the possibilities and ways of participation. According to Koprić (2014), self-governments must assume a long-term responsibility for local and regional development, in all its aspects. In order for this to be possible, it is necessary to formulate a long-term strategy towards developing a self-government system that relies on professional input, with participation of local and regional subjects.

2 Sustainable development of rural areas of the European Union

The term “sustainable development” originated in forestry. It referred to the afforestation of areas and the logging of forests with an aim of balancing these two activities so as not to compromise the biological restoration of forests. The term itself was introduced in the 1970s, but elements of sustainable development policies could be found in the earlier works of Richard, Malthus and Mill. The concept of sustainable development entered the international politics in 1987 with the publication of the report “Our Common Future” by the UN World Commission on Environment and Development. The conclusion at the time was that the unreasonable use of numerous essential natural resources, along with release of pollutants from various sources, exceeds the threshold that is physically sustainable in nature, and that without significant reductions in exploitation of materials and energy, in the following decades may see an uncontrolled decline in the amount of food, energy consumption and industrial production per person. The term “sustainable development” has been increasingly present in scientific and professional terminology since the 1980s.

The management of sustainable development requires multidisciplinary collaboration among stakeholders in various scientific fields. Sustainability is a key component of the development process, as it creates balances the development of society, economy the environment. The ultimate goal is a clearly defined development trajectory that will lead to economic, social and political changes, thereby enhancing the overall quality of life for the entire rural population. Sustainable development, to put it simply, represents a pursuit of responsible business, which meets the needs of the present and future generations, and preserves and wisely uses natural resources. By applying the concept of sustainable development, rural areas can tackle developmental challenges, to the benefit of current and future generations.

An inadequate development of rural areas affects the entire country. The consequences are manifested in the form of underutilization of resource bases and poor valorization of existing strategic advantages, which is primarily attributed to unfavorable structural indicators in problematic areas. In addition, there is a weakening of both spatial and functional integration of the territory, arising from the depopulation of a substantial portion of the area.

2.1 The role of local self-governments in the development of rural areas

Public affairs are activities that are carried out in the public interest, and are established by the legitimate political bodies of a country. In centralized countries, public affairs are exclusive responsibility of the central government. In decentralized countries, part of public affairs is the responsibility of self-governing units operating at lower levels of the territorial system. While local self-government systems in modern, interconnected Europe have undergone harmonization, there are still some variations in the definitions of local affairs, accompanied by legal and other distinctions among categories of local matters.

Local self-government entails the right and the capacity of local entities to regulate and manage a significant segment of public affairs, responsibly and in the best interests of the local population, within the framework specified by law. The responsibility of a local self-government involves the formulation of strategic planning documents. In their publication "Strategic local development programs - Croatian experiences" (2010), Đokić, Rašić Bakarić, Šišinački presented the

experiences of applying a participatory approach in the creation of strategic development documents at the local level.

The 2008 European Charter of Local Self-Government contains the basic principles of local self-government. Citizens can directly participate in the management of local affairs through various forms of direct decision-making, and the Charter outlines the procedures for obtaining opinions in all matters directly related to local units.

A rural area encompasses different regions with various activities and landscapes, and it also includes the natural environment, agricultural areas and arable land, villages, small towns, regional centers and industrialized rural areas. In this regard, its role as a “buffer zone” is also important, as it provides a regenerative environment which is crucial for ecological balance. Finally, the significance of rural regions as places for rest and leisure is also steadily increasing.

2.2. Development of rural areas in the Republic of Croatia

An analysis of Croatia's economic development pointed to significant inequalities among its counties in terms of basic indicators of social and economic development (educational status of the population, unemployment rate, employment rate, wages, development index, competitiveness, development of entrepreneurship, foreign currency savings of households). As for social and economic development, the best results are recorded by the City of Zagreb and the counties of Primorje-Gorski Kotar and Istria, while the counties of Vukovar-Srijem, Virovitica-Podravina and Brod-Posavina typically show unfavorable results.

Speaking of the basic indicators of demographic, social and economic development (population density, educational structure of the population, unemployment and employment rates), Croatia falls significantly behind the EU average.

The ranking of counties by competitiveness aligns with the ranking based on the GDP per capita and development index; seven least competitive Croatian counties are also the counties with the lowest development index (below 75% of the Croatian average). The business environment in the most competitive counties (the City of Zagreb, Varaždin, Istria, Međimurje and Primorje-Gorski Kotar) is marked by a positive migration balance, a more prominent role of entrepreneurial zones (except

the City of Zagreb) and a more favorable educational structure of the population. Additionally, a negative correlation was found between the counties' competitiveness, the emigration of the population and small numbers of entrepreneurial zones (Požega-Slavonija, Vukovar-Srijem, Sisak-Moslavina, Virovitica-Podravina and Lika-Senj). Entrepreneurial activity is somewhat more pronounced in the counties of the Adriatic Croatia, which has been recording an above-average number of companies per 1,000 inhabitants (35 in comparison with the state average of 31 companies per 1,000 inhabitants). Entrepreneurial infrastructure is more developed in the counties of the Continental Croatia, where there are more business zones as compared to the Adriatic Croatia.

Taking a look from a regional perspective, we may ascertain that the development of Croatian counties is uneven. The negative effects of insufficient development of certain regions are emigration and a decline in entrepreneurial activity. This has been more pronounced over the past few years, especially since the accession of the Republic of Croatia to the European Union. A good regional development policy would effectively stop this phenomenon and pave the way for a better future in these regions. After Croatia joined the EU, greater opportunities for independent development management at the regional and local levels have emerged. This is evident in the changes in the legislative framework, better opportunities for the local governments to stimulate their own development, and a stronger encouragement participatory processes, for example, in the creation of strategic documents.

3 The possibility of sustainable development and revitalization through participatory involvement of stakeholders

The research was conducted in the area of Vodnjan. Considering that the topic of this paper focuses on public participation and involvement in the processes of proposing and making decisions, it was essential to predefine the target group as accurately as possible. In other words, it was necessary to identify the significant stakeholders who could influence the direction of future development. The research was conducted among stakeholders engaged in agriculture, gathered in the Vodnjan-based Association "Agroturist" and the Agricultural Cooperative Vodnjan – Cooperativa agricola Dignano. The purpose of the empirical research, carried out in Vodnjan, was to show that the process of revitalization and sustainable development

in rural areas can significantly benefit from the synergy between local self-governments and stakeholders. A questionnaire was used as the research instrument.

Table 1 shows the structure of the sample by gender and age.

Table 1: Sample structure

Group		Age groups					Total:
		18-30	30-40	40-50	50-60	60 +	
Agriculture	Women	2	0	0	0	0	2
	Men	4	4	2	4	2	16
	Total:	6	4	2	4	2	18

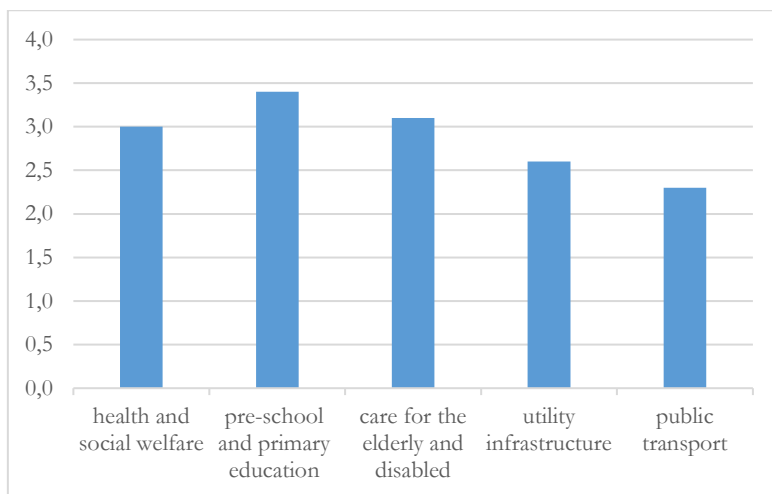
Source: author's work

3.1 Analysis of research results

After the characteristics of the sample were determined, the next question focused on measuring the level of satisfaction with the quality of the town's public services. The respondents were offered a Likert response scale ranging from 1 (unsatisfactory) to 5 (excellent). They rated the following public services: health and social welfare, pre-school and primary education, care for the elderly and disabled, utility infrastructure and public transport.

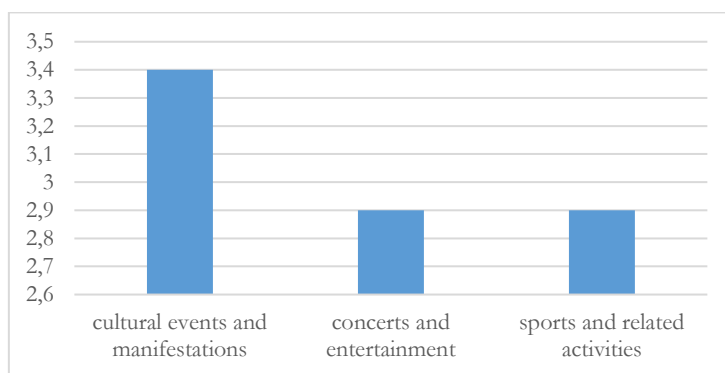
As shown in Chart 1, the public service of pre-primary and primary education was rated highest, with 3.4 points, followed by health and social care with 3.0 points, communal infrastructure with 3.1, care for the elderly and disabled with 2.6; and, finally, the public transport with 2.3 points.

The second question was related to the town's offer of activities. The respondents rated the following activities: cultural events and manifestations, concerts and entertainment, sports and related activities.

Chart 1: Level of satisfaction with the quality of public services in the town of Vodnjan

Source: Author's work

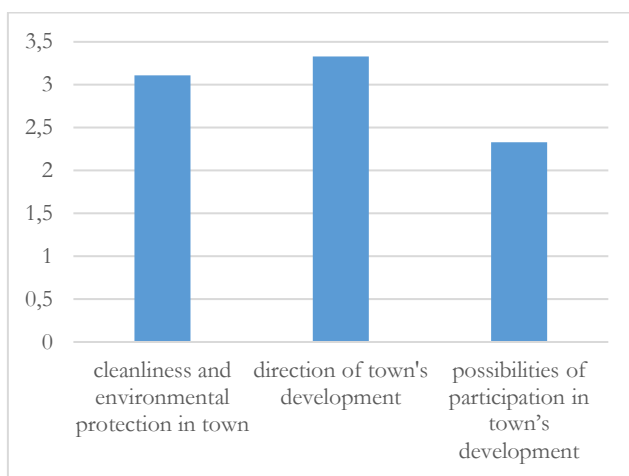
Chart 2 indicates that cultural events and manifestations hold the highest ranking with 3.4 points, followed by the offerings of concerts and entertainment with 2.9 points, and sports and related activities, also with 2.9 points.

Chart 2: Offered activities

Source: Author's work

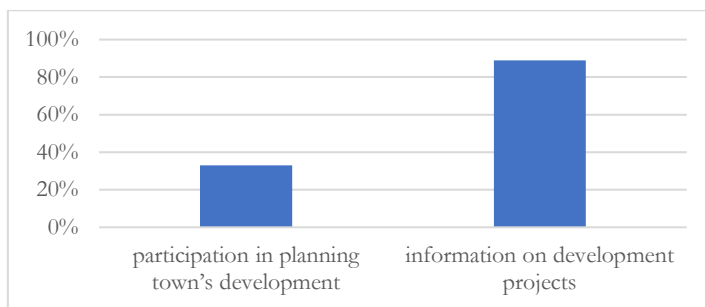
The next question was related to the satisfaction with the level of cleanliness, maintenance and environmental protection in the town, where the average level of satisfaction was 3.11. As for the level of satisfaction with the development of Vodnjan in the past ten years, the average level of satisfaction was 3.33. When asked to assess the possibilities of stakeholder participation in the town's development, the respondents rated it as 2.33.

Chart 3: Satisfaction with the city's development



Source: Author's work

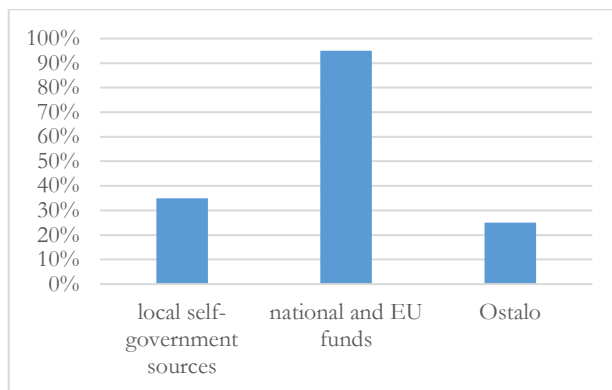
The following question addressed the opportunities and ways of participating in the planning of the town's development. Out of the total sample, 33% of the respondents participated in the planning of the town's development. The majority of respondents participated in planning the town's development through parent organizations, which enabled them to voice their proposals. When asked about stakeholder awareness regarding the activities, projects and opportunities for the development of agriculture, 88.89% of the respondents reported they were informed about it.

Chart 4: Participation and information level in projects

Source: Author's work

The next question concerned the respondents' knowledge about the options for funding the further development of their businesses. The respondents were offered three types of funding sources, and they had to say how much they were informed about each source.

It was established that more than 90% of the respondents were informed about the funding options available from the national and EU funds, while a smaller number of them also knew about the funding options offered by local self-government and some other sources.

Chart 5: Understanding the options for funding further development of activities

Source: Author's work

The objective of this research was to collect information and analyze the role that the observed self-government has in the development of its rural area, with an emphasis on the implementation of participatory decision-making models and information obtained through examination of public opinion. Using the collected data, it is possible to identify the development limitations, but also the development possibilities in the observed area.

Questions referring to the level of information and public participation in local development have shown that respondents from agricultural sector are very well informed about the funding opportunities. Moreover, they also constitute the largest group of users of the funds offered by the local self-government or other national or international institutions. This fact points to the great role of the local self-government in the development of agriculture, which aligns with the objectives stated in the Vodnjan Development Strategy.

4 Conclusion

Based on the conducted empirical research and drawing on the experiences of other local self-governments, it is possible to propose some guidelines for creating a model for the future sustainable development of the Vodnjan area. Experiences of local self-governments in rural areas of Italy and Slovenia show that a participatory process of involving stakeholders in the design and implementation of the development strategy, coupled with available sources of financing, can enhance the sustainable development of rural areas.

The model of sustainable revitalization that needs to be applied in the area of Vodnjan should include a combination of several successful models that are already applied in other regions such as Italy and Slovenia, with certain modifications tailored to address the unique needs of the town of Vodnjan.

In the last twenty years, local self-governments in rural areas have initiated a transformative process to create appealing living environments capable of satisfying contemporary human needs while ensuring a high quality of life. With this aim, they are constantly trying to create finest conditions that would retain the current population, and also attract new people and capital. In order to succeed in this, it is crucial to enable the entire local community to participate in the process of

sustainable development, bearing in mind that a community is made of all stakeholders operating in one area, including local self-government. Therefore, when designing a local community development strategy, it is very important to take into account the needs of all local stakeholders in the area. The findings from the conducted research provide the local self-government with valuable insights regarding the perspectives of local stakeholders on the current situation as well as their aspirations for the future. Additionally, these results can serve businesses and potential investors in planning their future investments. The obtained results can also serve as the foundation for further research within the framework of municipal, city, county and state institutions. Furthermore, a large number of statistical data gathered in this research may be used as sources for certain analyses. Educational institutions, universities and institutes may use the data to expand on their research, especially in the context of the community-led local development. Finally, in the context of contributing to the profession, this research points to the benefits of involving the local community in the participatory process of planning a sustainable rural development.

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OPTIMIZACIJA PROCESA UPRAVLJANJA S STRANKAMI

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Relativno novo podjetje na trgu se sooča s težavami v poslovanju, katerih posledica je obstoječi proces upravljanja s strankami. Zaradi preobremenjenosti zaposlenih, izgube dokumentacije in upada povpraševanja smo se odločili za temeljito prenovo obstoječega procesa upravljanja s strankami. Pregledali smo ugotovitve številnih strokovnjakov s področja CRM sistemov in informacijske tehnologije. Pridobljene ugotovitve smo povezali z analizo stanja v delovnem okolju. Skozi analizo stanja obstoječega procesa upravljanja s strankami smo odkrili, da se podjetje X poslužuje tradicionalnih metod hranjenja podatkov o strankah, katere so jih privedle do povečanega nezadovoljstva vseh deležnikov v prodajnem procesu. Na osnovi pregleda literature in izvedene analize stanja v delovnem okolju, smo razvili prototip CRM sistema v programu Access, ki vključuje vse bistvene informacije za nemoteno poslovanje. V predlaganih smernicah za prihodnost smo zajeli različne programske rešitve, vendar je njihova implementacija v obstoječe delovno okolje, omejena zaradi zapletov in finančnih omejitev podjetja X.

Gljučne besede:

podjetje X,
stranke,
Access,
CRM,
optimizacija

OPTIMIZATION OF THE CUSTOMER MANAGEMENT PROCESS

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A relatively new company to the market, faces problems in business, resulting in an existing customer management process. Due to employee overload, loss of documentation and drop in demand, we decided to thoroughly overhaul the existing customer management process. We reviewed the findings of numerous experts in the field of CRM systems and information technology. The obtained findings were linked to an analysis of the situation in the working environment. By analysing the status of the existing customer management process, we discovered that company X employs traditional methods of storing customer data, which led them to increased dissatisfaction of all stakeholders in the sales process. Based on a review of literature and an analysis of the situation in the working environment, we developed a prototype CRM system in Access, which includes all the essential information for smooth operations. In the proposed guidelines for the future, we have covered various software solutions, but their implementation in the existing working environment is limited due to complications and financial constraints of X.

Keywords:
Company X,
Customers,
Access,
CRM,
optimization

1 Uvod

V obdobju tehnoloških sprememb in globalne konkurence na trgu je ključno, da podjetja uporabljajo optimizirane procese upravljanja s strankami. Uporaba sistema upravljanje s strankami (v nadaljevanju CRM) omogoča, da funkcionalno zajamemo in spremljamo vse potrebne podatke o strankah, ki jih potrebujemo pri svojem poslovanju (Alghamdi, 2023).

Sodobno poslovanje temelji na spodbujanju tesne povezave med prodajalci in potrošniki izdelkov ter storitev. Razvoj CRM sistema v podjetjih omogoča sinhronizacijo podatkov, učinkovito komunikacijo in uspešno prodajo (Stefanov et al., 2023). Rîpa in drugi (2023) so ugotovili, da deset najboljših podjetij uporablja CRM vendar, da je ta bolj primeren za podjetja, ki se nahajajo v Ameriki. Poslovna uspešnost je izid, ki je nenehno povezan z integracijo virov in tehnologije (Wang, 2023).

Gorandal in Simanjuntak (2021) pojasnjujeta, da uporaba CRM sistema vpliva na zadovoljstvo in zvestobo potrošnikov. Yasiukovich in Haddara (2021) poudarjata, da so mala in srednje velika podjetja gonilna sila gospodarstva in, da morajo imeti razvit učinkovit model upravljanja s strankami. S hranjenjem koristnih informacij o strankah lahko vplivamo na povečanje kakovosti storitev, katere pozitivno vplivajo na izid poslovanja (Aljawarneh et al., 2020).

Nwankwo in Kanyangale (2023) ugotavljata, da so mala in srednja podjetja izgubila veliko strank zaradi neučinkovitega upravljanja s strankami. Anšari in drugi (2019) navajajo, da podjetja potrebujejo velike količine podatkov o strankah, da bi lahko s pomočjo CRM izboljšali izkušnje strank in prilagodili produkte ali storitve. Li in drugi (2023) pojasnjujejo, da umetna inteligenca (v nadaljevanju UI) pospešuje učinkovitost delovanja CRM sistema.

Uporaba informacijske tehnologije se je posplošila na vse funkcije v organizacijah. Spoznanja o trženju podatkovnih baz izhajajo iz leta 1960 (Sakunthala, 2023). Čeprav številna podjetja nimajo vzpostavljenega CRM, je sistem UI napredoval do te mere, da lahko izboljša uspešnost organizacije (Ledro et al., 2023). Metode tradicionalnega hranjenja podatkov temeljijo na fizičnih dokumentih. Tovrstna metoda zbiranja in hranjenja podatkov o strankah je nadvse zamudna in dokaj nedostopna.

Podjetje X je novo podjetje na trgu, katero je specializirano za storitve nege telesa. Zaradi neučinkovitega CRM sistema se podjetje X trenutno sooča z zmanjšanim povpraševanjem po storitvah. Glavnina podatkov v podjetju X je beležena po tradicionalnih metodah, vendar je del podatkov shranjen tudi v Excelovih razpredelnih.

Motivacija za izvedbo raziskave, izvira iz prepoznane potrebe po izboljšavah v procesu upravljanja podatkov o strankah v podjetja X. Potrošniki iščejo hitre rešitve in si želijo učinkovite obravnave, katera ni izvedljiva ob neučinkovitem CRM sistemu. Nihče izmed nas ne želi zapravljati časa v čakalnih vrstah, zato se lahko zgodi, da se hitro odpravimo k konkurenčnem podjetju.

Majhna podjetja največkrat poslušajo po tradicionalnem modelu, kateri ne daje produktivnih rešitev v danem času. Zbiranje velikega števila podatkov, na podlagi tradicionalnih metod ima veliko slabosti, kot so na primer: pomanjkanje natančnosti in zanesljivosti podatkov, večja tveganja za krajo podatkov in obsežno delo zaposlenih.

Različni modeli ali sistemi za vodenje podatkov o strankah so velikokrat plačljivi, zato se manjša podjetja odločajo za hranjenje podatkov, ki se vpisujejo ročno ali s pomočjo enostavnih zakupljenih orodij. Inovativne metode hranjenja podatkov so podprte s tehnologijo, ki nam omogoča dostopanje do informacij kjerkoli in kadarkoli. Ker problematika neučinkovitega upravljanja s strankami narašča, nismo imeli težav s pridobivanjem ustrezne literature.

Področje CRM sistemov je raziskano, vendar se v zadnjih letih pojavlja tudi UI poslovanje. Namen naloge je preučiti relevantno literaturo s področja CRM in informacijskih sistemov (v nadaljevanju IS) in jo povezati z ugotovitvami, ki jih bomo pridobili pri pregledu obstoječega stanja v podjetju X. Cilj naloge je razviti učinkovit CRM sistem, ki bo zajel vse podatke o strankah, ki jih zaposleni potrebujejo pri poslovanju v podjetju X. Dodali bomo tudi sugestije, ki bodo omogočale nemoteno izvajanje delovnih procesov tudi v času hitrega razvoja podjetja X.

2 Metodologija

Podjetje X se sooča s problemom upravljanja s strankami, kar zaposlenim ne nazadnje povzroča stres in prekomerne obremenitve na delovnem mestu. Večinski del dokumentacije se hrani v pisni obliki, le nekaj pa je shranjeno v Excelovih razpredelnih. Pogoste izgube pisne dokumentacije so do sedaj povzročile nelagodje pri zaposlenih, in posledično težave pri poslovanju s strankami.

V času opravljanja študentskega dela v podjetju X, smo se študentje srečevali s problemi v procesu upravljanja s strankami. Ideja izvira iz dejanskih izkušenj, ki smo jih pridobili med opravljanjem delovnih nalog in kritik, ki so jih izpostavile stranke glede upravljanja s podatki. Cilj, ki ga želimo doseči je, da s pomočjo pregleda literature in analize stanja v podjetju X optimiziramo obstoječi proces upravljanja s strankami.

Za naš pristop k proučevanju problema, smo uporabili raziskovalno strategijo načrtovanja in razvoja. V začetni fazi smo pregledali relevantno literaturo, ki nam je pripomogla pri načrtovanju in razvoju končne rešitve ter podajanju predlogov za prihodnost. Na podlagi obravnavanega problema smo identificirali dve ključni besedi za iskanje literature po spletnih bazah, ki sta »Access in CRM«.

Relevantno literaturo smo pridobili iz spletnih baz ScienceDirect, ProQuest, Google Scholar in Web of Science. Iz obsežnega nabora člankov smo izluščili tiste, ki so po naši presoji ključni za reševanje obravnavane problematike in jih analizirali ter povzeli njihove strnjene ugotovitve. Zaradi hitrega razvoja tehnologije in posledično nadgrajevanja obstoječih sistemov CRM smo uporabili literaturo, ki ni bila starejša od petih let.

Na podlagi pridobljene relevantne literature smo lahko večplastno obravnavali problematiko, saj smo pridobili vpogled v dobre prakse s področij upravljanja podatkov o strankah in informacijskih rešitev. V naslednjem koraku smo predstavili podjetje X in izvedli analizo stanja v delovnem okolju. V podjetju X smo opazovali zaposlene pri njihovem delu, pri čemer smo pridobili informacije o načinu ravnanja s podatki. Opravili smo tudi pogovor z zaposlenimi v podjetju X, v katerem smo odkrili vzroke za nastanek obravnavane problematike. V nadaljevanju smo pregledali

dostopno interno gradivo o prodaji, evidentiranju, hranjenju ter upravljanju podatkov o strankah.

V zaključni fazi sta nam analiza stanja v delovnem okolju in pregled literature, pomagala pri razvoju prototipa. S pomočjo analize stanje smo pridobili glavnino podatkov, katere smo uporabili v prvem koraku načrtovanja CRM sistema za izbrano podjetje. Rešitev smo razvili s pomočjo orodja Access, ki ga ima podjetje X zakupljenega.

Med tvorjenimi tabelami v programu Access smo vzpostavili relacijske povezave. V nadaljevanju smo s pomočjo tabel kreirali obrazce, ki bodo podjetju X omogočali vpis podatkov o ponudbi, strankah, prodanih in izvedenih storitvah. Zasnovovali smo tudi primere poizvedb in poročil, ki bodo zaposlenim v podjetju X omogočali preprost dostop do zahtevanih podatkov.

Ker je podjetje X novo na trgu, smo se izogibali visokim stroškom pri investicijah v specializirano programsko opremo za upravljanje podatkov o strankah. Primere tovrstne programske opreme smo predlagali za prihodnje poslovanje za čas, ko se bo podjetje X razširilo in bo upravljalo z večjo količino podatkov, ki jih bo po pričakovanjih težko obvladovati samo s programom Access.

Proučevanje obravnavane tematike predstavlja temelj za rast in uspeh malih ter srednje velikih podjetij. Implementacija CRM orodja v prakso omogoča grajenje odnosov s strankami, ki je ključ do uspeha vsakega podjetja. Predlog za uvedbo učinkovitega in celostnega sistema upravljanja s strankami v programu Access, bo podjetju X omogočal nemoteno izvedbo delovnega procesa in zmanjšal obremenjenost zaposlenih.

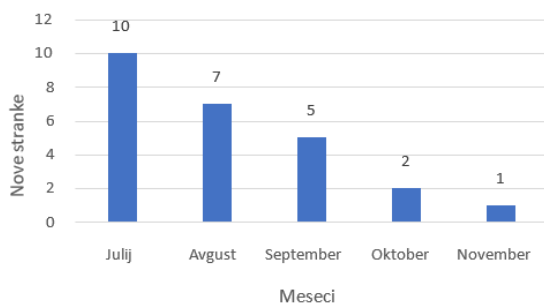
Pri raziskovanju so nam strogo določeni roki predstavljali precejšen logističen izziv. Izvedbo celovitega pregleda literature, so nam omejevali omejeni finančni viri tako, da smo se posluževali samo tistih, do katerih nam je omogočila dostop Univerza v Mariboru. Iz priloge 1 je razviden proces raziskovanja.

3 Rezultati

3.1 Splošni podatki podjetja X

Podjetje X je bilo ustanovljeno pred nekaj leti in njegova prvotna dejavnost je nega telesa. V svojem asortimentu storitev ponuja številne vadbe in masaže, ki pripomorejo k izgubi telesne teže, zategovanju in izboljšanju tonusa kože, odpravljanju celulita in vode iz telesa ter zmanjšanju obsega telesa (Podjetje X, 2023a).

Njihova ponudba obsega tako enkratne obiske, kot tudi mesečne in trimesečne pakete (Podjetje X, 2023a). Kljub temu, da je podjetje X v zagonu, in ne zaznava drastičnega porasta povpraševanja, mora zagotavljati učinkovito in kakovostno hranjenje podatkov. Iz slike 3.1.1 je razvidno, da je število novih strank upadlo, zaradi nesporazumov povezanih z izgubo dokumentacije, neučinkovitega sistema upravljanja s strankami ter konfliktov s preobremenjenimi delavci.



Slika 1: Število novih strank v podjetju X (Podjetje X, 2023b)

Podjetje X ponuja storitve višjega cenovnega ranga, kar je razvidno iz cen, ki se gibljejo med 250 in 1200 evri. Visoke cene prodajnih storitev, so med drugim posledica zagotavljanja visokokakovostne obravnave strank. S hitrim dostopom do podatkov lahko v podjetju izdelajo celovito sliko potrošnika, kar jim pripomore pri prepoznavanju bodočih potreb in vedenja strank, (Ploder et al., 2021).

Zbirka podatkov v podjetju X je podlaga za izvajanje analize prodaje in posledično, uspešnosti na trgu. V primeru povečanja povpraševanja in v izogib težavam, mora podjetje razpolagati z učinkovitim modelom zajemanja informacij o strankah, njihovih nakupih in osebnih podatkih. Visokokakovostne storitve, vključno z nemotenim delovnim procesom, lahko podjetje X zagotovi samo v primeru enotnega pregleda nad podatki o strankah.

3.2 Upravljanje podatkov o strankah

Podjetje X arhivira osnovne informacije o strankah kot so ime, priimek, datum rojstva, kontaktna številka ali elektronski naslov. Zgoraj navedeni podatki se hranijo v tradicionalni pisni obliki, kjer so organizirani v razvrščevalnih mapah glede na priimek. Poleg osnovnih podatkov se v pisni obliki hranijo vsi vprašalniki, ki so povezani z varovanjem zasebnih podatkov strank in njihovem zdravstvenemu stanju ter kopije pogodbe o nakupu paketov, vključno z računom.

V procesu opazovanja zaposlenih smo zaznali dosledno evidentiranje prihodov strank. Vsakodnevno se v orodju Excel beležijo vsi prihodi in uporabljene storitve znotraj paketa. Iz sistema »PricePilot« zaposleni pridobijo podatke o naročenih strankah, ki jih morajo ustrezno evidentirati ob njihovem prihodu. Iz slike 3.2.2 lahko razberemo, da zaposleni ob prihodu stranke v Excelovo razpredelnico zabeleži slednje podatke: ime, priimek, ura in datum prihoda ter naziv izvedenih storitev.

168		
169	PRIHOD (št.)	
170	IME	PRIIMEK
171	URA	
172	DATUM	
173		

Slika 2: Evidenca prihodov strank
(Podjetje X, 2023c)

Večinoma stranke ne vodijo lastne evidence o koriščenju storitev, zato v primeru potrebe po teh podatkih, zaprosijo zaposlene za izpis zgodovine tretmajev. Ugotovili smo, da so podatki razpršeni v Excelovi razpredelnici po mesecih in jih je potrebno ročno pregledovati. Za rešitev tega problema lahko uporabimo tehniko hitrega

iskanja ob pogoju, da bodo zaposleni usposobljeni obvladovanja osnovnih funkcij programa.

Zaposleni v pogovoru poudarjajo, da se je problematika pojavila, ko se je fizična dokumentacija med pregledovanjem založila, v najslabšem primeru celo izgubila. Tovrstne težave so bile posledice omejitve pri dostopu do osebnih podatkov stranke, podatkov o nakupu paketov in številu obiskov. Težave so se pojavljale tudi pri pridobivanju razpršenih podatkov iz Excelove razpredelnice.

Trenutno problematiko lahko odpravimo s prenosom dokumentacije v digitalno obliko, kjer bi vzpostavili CRM sistem. Z implementacijo ustrezne programske opreme v delovno okolje, bi zaposlenim v podjetju X omogočali enostavnejši in učinkovitejši dostop do podatkov ter preprečili možnost njihove izgube. Uvedba CRM sistema v podjetje X, bi poenostavila postopek arhiviranja dokumentacije in pripomogla k boljši preglednosti in ažurnosti pri upravljanju podatkov.

3.3 Predlog rešitve

Na podlagi analize obstoječega stanja v podjetju X smo ugotovili, da podjetje nima ustreznega programskega orodja, ki bi omogočal učinkovito hranjenje podatkov o strankah. Zaradi shranjevanja dokumentacije samo v pisni obliki, v delovnem okolju prihaja do izgube pomembnih podatkov.

Evidentiranje prihodov v razpredelnici Excel ni učinkovito zastavljeno in zaposlenim zaradi njihovega slabega znanja o programu, povzroča časovne zaplete. Z napredno tehnologijo imamo možnost, da z enim klikom pridobimo vse potrebne podatke iz različnih dokumentov. Iz prakse ugotavljamo, da se v veliko podjetij zaradi pomanjkanja znanja zaposlenih o zmožnostih, ki jih ponuja programska oprema, implementira samo standardni osnovni model CRM sistema.

Tržne dejavnosti lahko usmerjamo v primeru celostne pridobitve podatkov o potencialnih kupcih (Ploder et al., 2021). Dubey in drugi (2020) ugotavljajo, da je napredna tehnologija ponudila celovite rešitve za soustvarjanje boljšega in učinkovitejšega delovnega okolja v bančništvu in tudi v drugih sferah. Zegullaj in drugi (2023) prav tako pojasnjujejo, da je obvladovanje CRM sistemov pomembno zaradi povečanja zvestobe strank.

Uspešno obvladovanje težav v podjetju X, je odvisno od učinkovitega procesa upravljanja s strankami. Program Access je enostaven za uporabo, vendar to ne spremeni dejstva, da bi morali vodilni v podjetju X omogočiti zaposlenim usposabljanje za uporabo programa. Informacijski sistem bi zajemal vse podatke vezane na stranko s poudarkom na njene prihode v podjetje, ki so povezani z nakupom in koriščenjem storitev.

Za rešitev v programu Access smo se odločili izključno z namenom učinkovitega hranjenja podatkov ter hitrega iskanja po njihovih bazah. V podjetju X imajo zakupljene paket Microsoft Office-a, ki vključuje tudi orodje Access, zato ta izbira ne bi povzročila dodatnih odhodkov, ki bi lahko ovirali podjetje pri doseganju zastavljenih poslovnih ciljev.

Na podlagi podatkov, ki jih podjetje X arhivira, smo kreirali pet tabel, ki so ključnega pomena za ustvarjanje obrazcev (stranka, pošta, ponudba, prodaja in koriščenje). V tabeli stranka, bodo zajeti vsi osebni podatki vključno z dostopno pdf obliko dokumenta o zdravstvenem stanju in varovanju osebnih podatkov. Preostale tri tabele so povezane s podatki o ponudbi raznolikih storitev, njihovi prodaji in koriščenju. V naslednjem koraku smo vzpostavili relacije med tabelami.

Vzpostavljanje referenčne integritete med tabelami bo v prihodnje varovalo podatke pred morebitnimi spremembami. Vrsta relacije, ki smo jo opredelili kot ena proti mnogo nam pove, da je iz enega kraja lahko več potrošnikov. V nadaljevanju smo ustvarili obrazce, v katere bo podjetje X lahko vpisovalo potrebne podatke, ki se bodo avtomatično shranjevali.

Pri shranjevanju bodo podatki vidni tudi v tabelah. Poročila smo oblikovali z namenom hitrega povzemanja ključnih podatkov v kratkem času (Seznam kupljenih ali porabljenih storitev). V petem koraku smo izdelali tudi poizvedbe, ki jih podjetje X lahko uporabi pri pregledovanju in spreminjanju arhiviranih podatkov.

Poleg tega smo ustvarili tudi glavni meni, ki omogoča hiter dostop do obrazcev, poizvedb in poročil. Razvoj prototipa CRM sistema v Accessu smo zaključili z izdelavo makrota, ki omogoča avtomatizacijo obrazca glavnega menija. Iz slike 3.3.1 je razviden glavni meni vključno z vsemi Accessovimi predmeti.

V zadnjih letih se podjetja ne osredotočajo več toliko na prodajo, temveč predvsem na potrebe potrošnikov. Smatramo, da je uporaba CRM sistema konkurenčna prednost, tako v globalnih podjetjih, kot tudi v malih in srednje velikih podjetjih. CRM sistem je lahko povezan tudi z načrtovanjem virov podjetja (ERP), kar nam omogoča upravljanje z dobičkom in marketinškimi strategijami v podjetju (Pohludka in Štverková, 2019).



Slika 3: Glavni meni in Accessovi predmeti

V primeru razvoja podjetja X predlagamo, da podjetje podatke prenese v drugi CRM sistem, ki lahko zajame več elementov pri poslovanju s strankami. Nekateri izmed učinkovitih modelov CRM so: Intrix, Monday sales CRM in Pipedrive. Pohludka in Štverková (2019) pojasnjuje, da je Salesforce CRM sistem postal temelj poslovanja upravljanja s strankami, izdelki in marketinškimi dogodki.

4 Zaključki

Zmanjšanje prihodkov na dolgi rok lahko za podjetja pomeni izgubo posla. Nezadovoljni zaposleni in neučinkovit sistem CRM onemogočata uspešno povezavo med potrošnikom in ponudnikom, kar negativno vpliva na finančni izid poslovanja. Čeprav se nekatera podjetja še vedno poslužujejo tradicionalnih metod beleženja podatkov, je tehnologija toliko napredovala, da se v CRM sisteme brez težav vključuje tudi umetna inteligenca.

Iz spletnih baz smo pridobili relevantno literaturo, katere izsledke smo v nadaljevanju, primerjali z analizo obstoječega stanja v delovnem okolju. Literatura je zajemala članke s področij procesa upravljanja s strankami in uporabe informacijske tehnologije za shranjevanje, vodenje in analiziranje podatkov.

Podjetje X arhivira osebne podatke o strankah, njihovih nakupih in izvedenih storitvah. Pri pregledu internega gradiva in opazovanju zaposlenih smo ugotovili, da podjetje X večino podatkov potrebnih za poslovanje beleži samo v pisni obliki. Edina izjema so podatki o prihodu strank in koriščenju njihovih zakupljenih storitvah, ki se hranijo v Excelovi razpredelnici.

Hranjenje podatkov o strankah v fizični obliki in neučinkovita uporaba informacijske tehnologije je bila posledica izgube številne dokumentacije in prekomernih obremenitev na delovnem mestu. Omenjeno se je odražalo skozi nezadovoljstvo zaposlenih in neučinkovito ter prepočasno obravnavo strank.

Ugotovili smo, da problematika izvira iz neučinkovitega procesa upravljanja s strankami. Ob učinkovitem hranjenju podatkov lahko podjetje X predvidi vedenje strank. Natančnejše predvidevanje vedenja strank, bo podjetju omogočilo čas za ustvarjanje novih ali prenovo obstoječih storitev, s katerimi bodo lažje zadržali obstoječe stranke in privabili nove.

Na podlagi ugotovitev številnih avtorjev in analize stanja v podjetju X smo predlagali rešitev, ki se lahko s pomočjo programa Access implementira v delovno okolje in zmanjša rizik za nastajanje nadaljnjih poslovnih nevšečnosti. Za program Access smo se odločili z namenom, da podjetje obvarujemo pred večjimi odhodki in, da podjetju takoj zagotovimo učinkovit model za vodenje podatkov o strankah.

V predloge za prihodnost, smo vključili nekaj idej za programske rešitve, kot so Intrix, Salesforce, Monday sales CRM in Pipedrive. S tem prispevkom želimo opozoriti podjetja, da ima uvedba CRM številne prednosti pri poslovanju in je nujna ne glede na njihovo velikost in število podatkov.

Zahvala

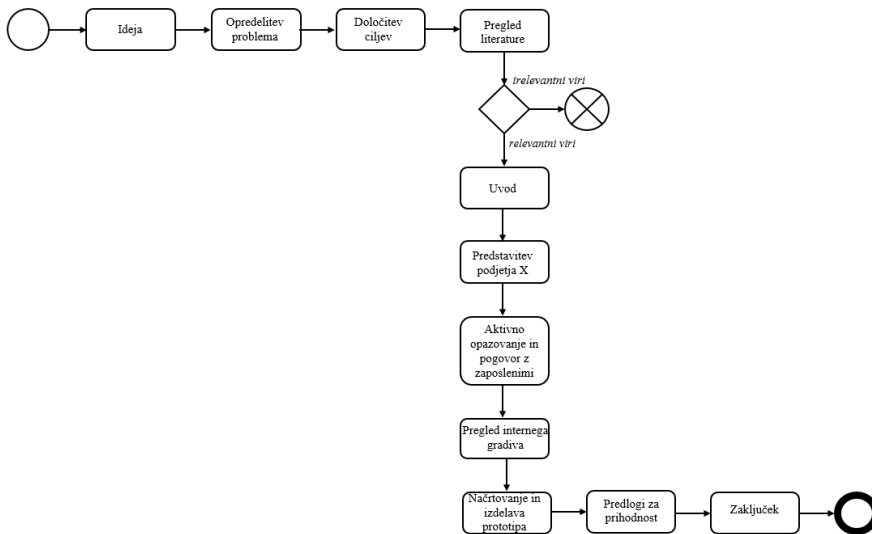
Zahvaljujemo se direktorju podjetja X, kateri nam je omogočil analizo stanja v delovnem okolju in s tem pripomogel k reševanju obravnavane problematike.

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Priloge



Priloga 1: Proces raziskovanja

Vir: Lasten

DIGITALNA PREOBRAZBA SISTEMA OSNOVNOŠOLSKE VZGOJE IN IZOBRAŽEVANJA

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V članku bomo govorili o digitizaciji, digitalizaciji in digitalni preobrazbi osnovnošolskega sistema vzgoje in izobraževanja, ki povečuje zahteve po novem znanju in odgovorni uporabi IKT ter večji digitalni bralni pismenosti učencev v osnovnih šolah. Prikazan bo tudi pogled na odgovorno rabo IKT s strani učencev, ki se zaradi povečane uporabe tehnologije v osnovnih šolah soočajo z izzivi neuravnotežene uporabe digitalnih naprav. To raziskovalno področje postavlja pomembna vprašanja o prihodnosti prenove osnovnošolskega izobraževanja in vplivu digitalnih tehnologij na naš osnovnošolski izobraževalni sistem, odgovorni rabi tehnologije ter uveljavljanju Akcijskega načrta Evropske komisije za digitalizacijo izobraževanja.

Ključne besede:

digitalizacija,
preobrazba,
izobraževanje,
pismenost,
odgovornost

DIGITAL TRANSFORMATION OF THE PRIMARY SCHOOL EDUCATION SYSTEM

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In the article, we will talk about digitization, digitalization, and digital transformation of the primary school education system, which fulfilled the requirements for new knowledge, responsible usage of IT, and greater digital reading literacy of students in primary schools. It will also present a view of the responsible use of IT by students who face the challenges of the unbalanced use of digital devices due to the increased use of technology in primary schools. This research area raises important questions about the future of the renewal of primary school education and the impact of digital technologies on our primary school education system, the responsible use of technology, and the implementation of the European Commission's Digital Education Action Plan.

Keywords:
digitalization,
transformation,
education,
literacy,
responsibility

1 Introduction

The primary school education system is undergoing significant transformations dictated by rapid technological changes. In 2008, the European Parliament and the Council of the European Union defined eight key lifelong competencies, including digital literacy, which must be developed at the class level of primary school education. Integrating digital literacy into lessons plays a key role here, with teachers being the critical bearers of this process. Teachers must cultivate a positive attitude towards digital technology and be properly digitally literate to integrate it into their teaching successfully. The use of digital technologies in primary schools brings a lot of new challenges, such as lack of appropriate equipment, lack of teacher training, and difficulty ensuring standardized data security. Integrating digitalization into the learning process requires a proper plan, teacher training, and the provision of appropriate equipment to take advantage of its benefits. More detailed inspections of the accreditation of learning content are also being introduced, thus creating a more transparent syllabus and curriculum.

2 Traditional and digital reading literacy

Addressing the challenges brought about by the digital transformation of Slovenia's primary school education system provides an opportunity for a continuous transition from a traditional to a modern education system and, thus, the improvement of digital reading literacy. The traditional primary school education system that we currently know faces changes and reforms. The modern education system's demand for new knowledge and greater digital reading literacy is increasing. In recent years, with the introduction of digital technologies in Slovenian primary schools, the number of digital learning materials available to teachers and students has increased significantly. At the same time, specific challenges have arisen in their use, such as differences between teachers, the lack of training of teachers to work with digital learning materials, and the lack of appropriate devices and equipment in schools.

The development of digital technology has influenced the transformation of the way society acquires, stores, and transmits knowledge. As the central information carrier, the book faces changes due to informational progress. In the modern era, computerization is at the fore through various media, emphasizing the difference

between reading digital and printed texts. Digital texts, enriched with visual elements, enable different connections between text segments and other components (Grosman 2009, pg. 21).

This allows the reader to shape and adjust the sequence of the text according to their interests. In contrast, printed text that is read linearly remains unchanged. The reading of printed texts is thus predetermined and linear. Digitization thus brought about a considerable difference between the two ways of reading (Grosman 2009, pg. 22-24).

2.1 Digital media and reading literacy in the primary school classroom

A turning point in the history of text carriers is the shift from printed texts and books to digital texts and media. Changes in text carriers are related to the new meaning and meaning of knowledge in society. This process increases the number of texts while the texts have become shorter. This led to changes in the way of reading. Shorter texts are read quickly or skimmed over, while books and more demanding texts require in-depth reading. Such reading is cognitively more demanding, presenting a more significant challenge to the reader. Still, it also increases the understanding of the text, especially if it is read in printed form (Kovač and Van der Weel 2018, pg. 3-4).

Digital media in learning is not necessarily a better source of knowledge and learning than paper media. Using digital media requires an individual to do more than just read, as it also involves focusing and following the primary line of the text. It is a broader and more demanding process that goes beyond just reading. Therefore, dealing with digital text often seems more difficult than dealing with printed text. As a result of skimming, inexperienced readers can fall into the trap of superficial and unverified information and sources. Although deep reading of digital texts is possible, it requires more effort and experience (Barzillai and Thompson 2018, pg. 1 - 2).

Reading Research PISA (Programme for International Student Achievement) shows that students who read printed texts have better-developed reading skills (PISA 2022). The International Reading Literacy Survey PIRLS shows that such students also achieve better results in tests of reading digital texts (IEA PIRLS 2021). The

PIAAC (International Survey of Competence) research also deals with reading research but additionally focuses on the reading literacy of others. The findings show that Slovenia's reading skills are worse than reading literacy in other participating countries. There are also statistically significant differences in reading achievement in Slovenia, which are related to the level of education achieved (PIAAC).

It is essential to encourage the reading of printed texts in primary school educational institutions, but at the same time, meaningfully include digital texts. Digital content offers many texts but cannot be equated with an ideal means of learning to read. We must emphasize the importance of reading even before the child enters the educational system. Children's early childhood development has a significant impact on their ability to read. Exposure to letters, signs, text direction, and other literacy basics during this period can positively affect reading development. Reading together with parents brings into the child's consciousness the image of reading as an activity that attracts their parents' attention (Barzillai and Thompson 2018, pg. 3–4).

Parents play a crucial role in establishing a positive bond between them and the child, which gives reading a positive connotation. This positive attitude encourages the child's interest in reading literacy. Children deprived of such experiences may enter school with deficits in reading literacy. There is a possibility that this deficit will persist even in later periods of life (Barzillai and Thompson 2018, pg. 1–4).

3 Digitization, digitalization, and digital transformation

3.1 Digitization and digitalization

Although they seem similar at first glance, the concepts of digitization and digitalization have different meanings. They are often confused in everyday speech, which leads to incorrect use of these terms.

Digitization involves converting analog information into digital form. It converts physical objects or information (such as text, images, and sounds) into digital data that electronic devices can easily store, process, and transmit. For example, scanning paper documents to create digital copies, converting physical photos to digital images, or converting analog audio recordings to digital files.

On the other hand, digitalization is a broader concept beyond simply converting analog information into digital information. It involves using digital technologies to change business processes, models, and systems. Digitalization aims to leverage the capabilities of digital technology to improve efficiency, productivity, and overall performance. For example, it is implementing digital tools and technologies into business operations, such as using cloud computing, data analytics, and mobile applications to streamline processes that improve decision-making.

Therefore, it makes sense to distinguish the conversion to a digital format (digitization) from the introduction of digital technologies in the broader process and changing the way of operation (digitalization) (Gobble, 2018, pg. 56-59).

Gartner's Dictionary for Information Technology's definition of digitization describes digital technologies as the transformation of analog to digital process, also known as digital enablement. Digitization involves converting analog information into a digital format without altering the fundamental nature of the process. It essentially enables the representation of data, media, or processes in a digital, computer-readable form, preserving the content while facilitating more efficient storage, transmission, and manipulation. (Gartner Glossary). In other words, it is to change the process into digital form without changing the subject.

This digitalization perspective emphasizes the transition process to digital business and introducing digital technologies into business practices. In contrast, some scientific authors see digitalization as a broader concept that affects various areas of society, including social, economic, and organizational aspects. According to this interpretation, digitalization involves transforming multiple aspects of social life based on digital communication and media infrastructures. This concept covers the macro level of social structures and practices. There are different views on digitalization - one that focuses on business models and another that covers broader social and organizational aspects. (Brennen et.al. 2014, pg. 1-11).

Digitalization of learning processes, content, and the use of ICT in primary schools

Digital technologies are increasingly present in primary schools, but their use still varies among individual teachers. Digitalization of learning processes and content is being implemented gradually in Slovenian primary schools, emphasizing teacher

training. (Radovan, 2022, pg. 1). The Slovenian Ministry of Education and its Digital Education Unit offer and have conducted various trainings and education that help develop teachers' digital skills.

Digitalization in primary school education thus primarily refers to the use of innovative ICT in the learning process. The implementation of digitalization provides new possibilities and opportunities for improving the quality of education and the development of new teaching methodologies, which can contribute to tremendous learning success. Integrating digital technologies into education with the help of the gamification aspect can increase performance and improve the students' motivation, strengthens their critical thinking, and enable better and easier adaptation of the learning process for different students (Radovan, 2022, pg. 1).

3.2 Digital transformation

Digital transformation marks a fundamental change in an organization that affects strategies and organizational structure. This term was coined in the business world, so its definitions focus on economic aspects. Digital transformation encompasses systematic socio-technical changes made possible by resources and work processes that are becoming increasingly digitized. It is a continuous process of adapting the organization to the fundamentally changing digital environment to meet the digital expectations of customers, employees, and partners. Introducing digital technologies into business processes is a small part of the organization's digital transformation. Successful digital transformation requires a focus on two complementary areas of activity: transforming the customer proposition and transforming the business using digital technologies to increase customer interaction and engagement (Kovač, 2001, pg. 14-15).

Digital transformation of the primary school education system

Introducing information and communication technology (ICT) into the educational process is a dynamic field constantly developing in theory and practice. The concept of "digital transformation" refers to various processes and recommendations for integrating technology in schools, especially at the political level. The action plan for digital education prepared by the European Commission directs these processes which is crucial to digitalizing the educational process (Radovan, 2022, pg. 3).

The European Commission adopted the Digital Education Action Plan (ANDI) in 2020 to promote high-quality, inclusive, and accessible digital education in Europe. ANDI focuses on two key strategic priorities: fostering the development of a highly capable digital education ecosystem and enhancing digital competencies for digital transformation. The plan was collaboratively developed with various stakeholders, including students, teachers, school principals, professors, researchers, union representatives, and policymakers (Radovan, 2022, pg. 3-4).

During the formulation of ANDI, several critical shortcomings were identified, such as the lack of digital competencies among learners and teachers, unequal access to digital resources, insufficient solutions for the didactic use of digital technologies in teaching, scattered projects without proper collaboration, and national coordination, and the need for the establishment and enhancement of projects addressing the pedagogical digital competencies of teachers. ANDI emphasizes the importance of an interdisciplinary approach and close collaboration with stakeholders at the local, regional, national, and European levels for the successful digital transformation of education (Radovan, 2022, pg. 4-5).

The term "digital transformation of the primary school education system" refers to systematic socio-technical changes made possible by digitized resources and workflows. In the context of primary school education, digital transformation is defined as a term used primarily at the political and decision-making level to describe various processes and recommendations to governments regarding integrating technology into schools (Radovan, 2022, pg. 4).

The distinction between the processes of "digitization," digitalization, and "digital transformation" is crucial in understanding the strategies. Digitization describes the transformation of physical aspects of education into digital forms, including the computerization of education. Digitalization involves the transition to digital processes of data transmission and processing. In contrast, digital transformation permanently impacts social and business processes and represents a profound transformation of existing educational processes with the help of digital technologies. The purpose of digital transformation is not only to go digital but also to improve teaching and learning processes and create a more inclusive education. This concept has broader goals than computerization and substantially impacts

different levels of education, from macro to micro level. (Radovan, 2022, pg. 4-5 after Schmidt and Tang, 2020, pg. 1).

All three definitions conclude that digitization or computerization refers to transforming the physical aspects of primary school education into digital forms. Digitization means the system's transition to digital data transfer and processes (Gobble, 2018, pg. 56-59). Digital transformation has a more profound impact on social and business processes and includes transforming primary school education processes with the help of digital technologies. It represents a continuous process of adapting the system to digital changes, which leads to a complete transformation of education and training by the new opportunities and requirements of digital technology.

4 Responsible use of ICT in primary schools

The increased use of digital technologies in primary schools also refers to the responsible use of ICT in learning. Internet use in schools opens new opportunities, but it also presents a series of challenges, including students' deviant behavior. This can manifest itself in various ways, such as cyber-harassment, inappropriate online communication, extortion, identity theft, spreading false information, and more. Deviant behavior of students in the digitalization of primary school education can also manifest in addiction to digital devices and games, which can affect students' academic success and social and emotional aspects.

In addition, it is essential to provide adequate infrastructure and equipment in schools to ensure equal opportunities for all students. However, there are concerns that over-reliance on digital technologies could have a negative impact on children's social skills. These can also help improve the learning process, but it is essential to use them wisely. This means they should be used to improve the learning process, not just because they are available. Nevertheless, specific challenges remain in using digital technologies in the learning process, such as time management problems and questions about the suitability of some digital tools for children.

The challenges include adapting teachers' teaching to modern technologies, including knowledge transfer and moving away from traditional teaching methods. Parents face less time for a personal approach due to the increased use of technology.

In contrast, children face the challenges of excessive use of digital devices and the impact on their psychophysical state. The problematic issue also relates to physical and cyber violence, which can occur because of excessive use of technology, and to society's attitude towards parents who reject the increased use of IT by their children.

5 Conclusion

In the digital transformation of the primary school education system, cooperation between teachers, parents, and experts in digital literacy is crucial. Joint efforts can contribute to creating guidelines and recommendations for the safe and high-quality use of digital technologies in educational processes. All the above contents show a need for more responsible use of ICT by elementary school students in digitalizing the educational system and introducing appropriate measures for monitoring students' responsible use of ICT in the elementary school education system. When introducing digital technologies into the education system, students, teachers, and parents must be aware of the potential risks and dangers that the use of the Internet and digital devices can bring. To this end, promoting awareness of the safe and responsible use of technology and teaching students the importance of ethical values and correct behavior online is necessary.

To achieve a balanced relationship between digitalization and traditionality in the learning process, it makes sense to consider creating new subjects that would enable a gradual change in mindset and perception of the new or modern concept of digital transformation of education. This area of research raises important questions about the future of education and the impact of digital technology on our primary education system and society.

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REŠEVANJE PROBLEMATIKE PLASTIČNIH ODPADKOV IZ KMETIJSKE DEJAVNOSTI

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Plastični materiali so se v zadnjih desetletjih zaradi mnogih dobrih lastnosti uveljavili praktično na vseh področjih. Tako tudi v kmetijstvu njihova uporaba narašča, v zadnjem obdobju še posebno zaradi čedalje bolj razširjenosti uporabe folije za baliranje in silažo. Ta se je pokazala kot izredno uporabna in omogoča kakovostno shranjevanje travinja. Vendar pa plastični odpadki iz kmetijstva ne sodijo med komunalne odpadke in je za njih odgovoren povzročitelj sam. Zato je bila situacija na tem področju precej neurejena tako v Sloveniji kot tudi drugod po svetu. Pogosto je prihajalo do divjega odlaganja teh odpadkov ali pa do njihovega sežiganja v naravi, kar seveda povzroča vrsto škodljivih posledic za okolje. Za njihovo preprečitev je potrebno tudi v primeru plastičnih odpadkov iz kmetijstva slediti načelom trajnostnega ravnanja z odpadki in hierarhije ukrepov ter v čim večji meri spodbujati uvajanje krožnega gospodarstva. V skladu s temi smernicami se tudi v Sloveniji vzpostavlja model zbiranja kmetijske folije, ki se je izkazal učinkovit tako iz ekonomskega kot okoljskega vidika.

Ključne besede:

folije za siliranje, plastični odpadki, plastika v kmetijstvu, krožno gospodarstvo, recikliranje

SOLVING THE PROBLEM OF PLASTIC WASTE FROM AGRICULTURE

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In recent decades, plastic materials have become established in almost every field thanks to their good properties. The use of plastic materials in agriculture is also increasing, especially in recent years due to the widespread use of plastic film for grass silage (agro-stretch foil). This foil has proven to be very effective and provides good quality storage of grass. However, plastic waste from agriculture is not classified as municipal waste and the producer is responsible for this waste. Because of this the situation in Slovenia and also in the other countries was rather messy. There were many examples of wild landfilling and uncontrolled burning of plastic, both of which have harmful influences on the environment. For the prevention of this harmful impact, it is necessary also in the case of plastic waste from agriculture to follow the principles of sustainable waste management, hierarchy of measures and promote the introduction of circular economy as far as possible. In accordance with these guidelines, also in Slovenia is establishing a model of waste agricultural foil collection which has proven to be efficient both from an economical and an environmental point of view.

Keywords:

agro-stretch
foil,
plastic
waste,
plastic in
agriculture,
circular
economy,
recycling

1 Uvod

Plastični odpadki povzročajo velike obremenitve okolja. Plastični materiali so odlikujejo po celi vrsti lastnosti, kot so majhna gostota, relativno velika trdnost in nizka cena, ki močno povečajo uporabnost izdelkov iz teh snovi. Iz plastike je mogoče narediti izdelke praktično vseh oblik in barv. Plastični materiali so tudi odporni proti vlagi in biološki razgradnji. Vendar pa mnoge izmed navedenih lastnosti, ki so zelo zaželene, dokler je izdelek v uporabi, postanejo vir problemov po koncu življenjske dobe proizvoda, ko le-ta odsluži in postane odpadek. Med sektorje, v katerih se je v zadnjih desetletjih zelo razširila uporaba plastičnih materialov, sodi tudi kmetijstvo. V kmetijstvu je uporaba plastičnih materialov prinesla številne koristi, saj olajšuje delo in prispeva k zmanjšanju izgub in povečanju pridelka (FAO, 2021).

Neustrezno ravnanje s plastičnimi odpadki ima vrsto škodljivih posledic za okolje, tako za tla, vo+de in ozračje. Problem predstavlja posebno divje deponiranje in sežiganje plastičnih odpadkov. Plastični odpadki se tako kopičijo v naravnem okolju. Zaradi odmetavanja na bregove rek in morske obale izjemno velike količine plastičnih odpadkov končajo v vodah. Največ plastičnih odpadkov nastane zaradi uporabe plastične embalaže. Plastični odpadki v vodnem okolju se glede na dimenzije delijo na makroplastiko, mezoplastiko in mikroplastiko.

Makroplastika predstavlja večje predmete, ki v vodnem okolju ogrožajo vodne živali, saj povzročajo mehanske poškodbe kot so ureznine, zadavljenja ali zadušitve. Poleg plastične embalaže pri tem veliko prispevajo tudi ostanki plastičnih vrvi in mrež iz ribolova. Plastični odpadki pa zaradi termičnih in mehanskih vplivov (sončna svetloba in abrazija) pogosto razpadejo tudi na delce manjših dimenzij, ki jih kategoriziramo kot mezoplastiko in mikroplastiko. Predvsem slednja je nevarna, ker vstopa v prehransko verigo vodnih živali in na koncu tudi v človeško prehrano.

2 Plastični odpadki iz kmetijske dejavnosti

Kmetijski sektor vključuje živinorejo in poljedelstvo (kjer lahko vključimo tudi vinogradništvo, sadjarstvo in vrtnarstvo), ribogojstvo in ribištvo ter gozdarstvo. V svetovnem merilu se največ plastičnih snovi letno porabi v živinoreji in poljedelstvu (10 milijonov ton), v ribištvu in ribogojstvu se porabi 2,1 milijona ton in v gozdarstvu

0,2 milijona ton (FAO, 2021). V pričujočem prispevku bi se omejili na plastične odpadke, ki nastajajo v sklopu živinoreje in poljedelstva, predvsem pa na problematiko odpadnih folij in mrežic za baliranje silirane trave.

V tabeli 1 so navedeni plastični izdelki, ki se uporabljajo na področju poljedelstva in živinoreje (Fačeti, 2023).

Tabela 1: Plastični izdelki, ki se uporabljajo v kmetijstvu

Tip plastičnega izdelka	Namen uporabe
Zastirne folije	Preprečevanje rasti plevelov, zmanjšanje izgube vode iz tal, manjša poraba pesticidov, vode za namakanje, spodbujanje rasti rastlin
Folije in mreže za rastlinjake in tunele	Zaščita rastlin, pospeševanje rasti, podaljšanje sezone posevkov, povečanje pridelka
Namakalne cevi in kapalniki	Manjša porabe vode za namakanje
Vreče	Embalaža semen, gnojil in drugih materialov
Plastenke	Embalaža gnojil, tekočih pesticidov ipd.
Zaščitni tekstil in flis	Zaščita pridelkov pred nizkimi temperaturami ali premočnim sončnim sevanjem
Zaščita za sadje, vrečke, ovoji, mreže	Zaščita sadja pred škodljivimi insekti in škodljivimi vremenskimi vplivi
Zaščita rastlin	Zaščitijo sadike pred poškodbami zaradi živali in obenem ustvarijo ugodno mikroklimo za rast rastlin
Pakirna embalaža za pridelke	Zagotavljanje kakovosti in varnosti živil pri maloprodaji, zmanjšanje odpadkov hrane
Silažne-balirne folije	Pomoč pri fermentaciji biomase, namenjene za krmo živali

Vir: Fačeti, 2023

V Evropi se le 2 % plastike uporabi v kmetijskem sektorju, kljub temu pa to bistveno prispeva k povečanju pridelka tako v poljedelstvu kot v živinoreji. Z uporabo plastičnih izdelkov je lažje uravnavati pomembne parametre pri pridelavi, kot so temperatura, zračna vlaga, svetloba, namakanje, zaščita pred plevelom ipd., ki vplivajo na rastline, pridelke ali krmo. Po eni strani uporaba plastike v kmetijstvu predstavlja problem, saj letno v Evropi nastane več kot 1,175 milijona ton odpadne kmetijske plastike (od tega več kot milijon ton odpadne folije), a po drugi strani uporaba plastičnih materialov v kmetijstvu tudi prispeva k precejšnjemu zmanjšanju

obremenitev okolja, saj omogoča manjšo uporabo sintetičnih gnojil, pesticidov, vode za namakanje in pripomore k zaščiti strukture zemlje (APE Europe, 2022).

3 Siliranje trave v bale

V zadnjem obdobju se je predvsem močno povečala uporaba silažno-balirnih folij. Siliranje krme se je uveljavilo, ker se je silaža izkazala kot zelo primerna krma za živino. Zaradi anaerobnih pogojev v bali se razgradijo mlečnokislinske bakterije. Zato je silaža lažje prebavljiva (Western Packaging, 2019).

Pri siliranju je potrebno sušeno travo stisniti v balo in jo oviti z mrežico. Balo nato ovijejo s folijo, ki preprečuje dostop zraka do trave in tako zagotavlja anaerobne pogoje (Zaplotnik, 2019). Silaža je v zimskem obdobju najpomembnejši vir beljakovin za živali. V največji meri se siliranje uporablja pri travi pokošeni v maju. Siliranje se lahko uporablja tudi pri drugi ali tretji košnji, vendar je pridelek manjši. Ne sme pa biti trava, uporabljena za siliranje, prestara (Sirše, 2012).

Folije za baliranje silirane trave so običajno predvsem iz polietilena (PE) ali polipropilena (PP), mrežice pred baliranjem iz polistirena (PS) in vrvice za vezavo bal iz poliamida (PA).

Odpadne folije in mrežice za baliranje skupaj plastičnimi vrečkami ter folijami in prekrivkami iz vrtnarstva sodijo med odpadke iz kmetijstva in ne med komunalne odpadke. Po Klasifikacijskem seznamu odpadkov jih uvrščamo v kategorijo 02 01 04 – Odpadna plastika (razen embalaže). Za tovrstne odpadke je dolžan poskrbeti uporabnik oziroma povzročitelj sam in ne sodijo pod obvezo občinske gospodarske službe, kot velja za odpadno embalažo. Tako teh odpadkov ni dovoljeno odlagati v ali poleg zabojnikov za odpadno embalažo, npr. v zbiralnicah ločenih frakcij (Gabrenja in Šajn, 2020).

Zato je stanje na področju ravnanja z odpadnimi folijami in mrežicami za baliranje precej neurejeno in se pogosto dogaja, da jih povzročitelji ali odlagajo v naravi ali pa jih sežigajo na prostem. V obeh primerih gre za nesprejemljiv način ravnanja, ki seveda povzroča precej škode v okolju. Pri nenadzorovanem gorenju prihaja do emisij polutantov in toplogrednih plinov v ozračje in do izgube uporabnih materialov.

4 **Sodobni koncepti ravnanja na področju plastičnih odpadkov**

V preteklosti je bilo urejeno deponiranje prevladujoč način ravnanja z odpadki. Večina odpadkov je končala na odlagališčih in je bilo pomembno predvsem to, da ni prišlo do tako imenovanega divjega deponiranja, to pomeni odlaganja odpadkov v naravi. Za sodobno razumevanje problematike odpadkov pa tak način ni več ustrezen. Tudi sodobni koncepti ravnanja z odpadki dopuščajo odlaganje odpadkov na urejenih odlagališčih, vendar kot najmanj zelen način ravnanja z odpadki, ki se uporablja le takrat, ko so druge možnosti izčrpane.

Sodobni koncepti ravnanja z odpadki postavljajo naslednjo hierarhijo načinov ravnanja (GOV.SI, 2023):

1. Preprečevanje nastajanja odpadkov
2. Priprava za ponovno uporabo
3. Snovna izraba (recikliranje)
4. Drugi postopki predelave (energetska izraba)
5. Odstranjevanje odpadkov (urejeno deponiranje ali sežig brez energetske izrabe)

Sodobni koncepti na prvo mesto postavljajo preprečevanje nastajanja odpadkov. Izdelke naj bi uporabljali čim dlje je možno. Temu sledi priprava izdelkov za ponovno uporabo (čiščenje, popravilo ipd.). Kadar to več ni možno pa temu sledi snovna izraba odpadkov – recikliranje, pri katerem iz odsluženih izdelkov izločijo posamezne materiale, ki se nato uporabijo kot sekundarne surovine. Kadar tudi to ni več izvedljivo ali smiselno, se odpadki uporabijo kot vir energije. Odpadke uporabijo kot gorivo. V tem primeru se lahko prihranijo primarni viri energije (npr. fosilna goriva), prednost pa je tudi v tem, da imajo preostanki po gorenju bistveno manjšo prostornino kot odpadki pred termično obdelavo in so tudi inertni. Zato termično obdelavo odpadkov (incineracijo ali sežig) uporabljajo včasih tudi v primerih, ko količina energije, ki se sprosti pri gorenju, ni dovolj velika, da bi bila smiselna energetska izraba. Velik omejevalni dejavnik za termično obdelavo odpadkov pa so emisije, ki nastanejo pri gorenju. Te so pogosto razlog, da sežig odpadkov ne pride v poštev. Vsekakor pa je jasno izpostavljeno, da ima snovna izraba (recikliranje) prednost pred energetske predelavo.

V primeru odpadnih folij in mrežic za baliranje ponovna uporaba ni možna. Ker folije in mrežice ne vsebujejo nevarnih snovi, je tudi v tem primeru poudarjena prioriteta recikliranja pred energetska izrabo (Evropsko računsko sodišče, 2020). Problem pa predstavlja čiščenje folij.

5 Praksa ravnanja s kmetijsko odpadno plastiko v Evropi in po svetu

Večinoma imajo države članice Evropske unije lastne predpise glede ravnanja z odpadno plastiko iz kmetijstva. Z izjemo embalaže pa ni skupne evropske politike, ki bi urejala to področje.

Vsekakor je na področju ravnanja z odpadno plastiko v Evropi potrebno omeniti združenje APE Europe. (APE Europe, b.d.). APE Europe združuje podjetja in organizacije iz Evrope, ki se ukvarjajo s kmetijsko plastiko. Vključene so družbe iz raznih evropskih držav, tudi takšnih, ki niso članice Evropske unije.

Združenje APE je bilo ustanovljeno v Franciji leta 2009. Namen ustanovitve je bila ureditev ravnanja z odpadno kmetijsko folijo, a so se v naslednjih letih vključili tudi proizvajalci raznih drugih plastičnih izdelkov, ki se uporabljajo v kmetijskem sektorju: proizvajalci mrež in vrvi za baliranje trave (2013), proizvajalci protitočnih mrež (2014) in nato še proizvajalci fleksibilnih namakalnih sistemov (2018). Namen združenja je zagotovitev financiranja zbiranja odsluženih plastičnih izdelkov. Kmetovalcem in kmetijskim podjetjem je ta način omogočen enostaven in stroškovno učinkovit način oddaje plastičnih odpadkov. Sistem temelji na načelu razširjene odgovornosti proizvajalca (EPR – extended producer responsibility). Glavna cilja vključenih partnerjev (proizvajalcev in prodajalcev plastičnih izdelkov za kmetijsko dejavnost) pa sta razvoj nacionalnih shem zbiranja ter inoviranje in razvoj čim bolj okolju prijaznih izdelkov (Fačeti, 2023).

Države, ki so uvedle nacionalne sheme zbiranja (NCS – national collecting schemes) dosegajo stopnjo zbiranja odpadne kmetijske plastike med 75 in 95 %, delež recikliranja zbrane plastike pa je kar 98 %. Države, ki so uvedle nacionalne sheme so: Francija, Irska, Islandija, Nemčija, Norveška, Španija (Andaluzijska regija), Švedska in Združeno kraljestvo (APE Europe, b.d., Fačeti, 2022).

Krogotok plastičnih materialov, ki so uporabljeni v kmetijskem sektorju, je mogoče razdeliti v devet korakov (APE Europe b.d.):

1. Plastični granulati
2. Proizvodnja izdelkov za uporabo v kmetijstvu (folije, mreže, cevi itd.)
3. Uporaba izdelkov (baliranje travinja, zaščita, namakanje ...)
4. Odstranitev plastičnih izdelkov po uporabi
5. Zbiranje in ločevanje
6. Čiščenje in transport
7. Dodatno čiščenje in priprava za recikliranje
8. Recikliranje
9. Izdelava granulata

V Tabeli 2 je prikazan pregled nekaterih dobrih praks ravnanja z odpadno plastiko iz kmetijskega sektorja iz različnih držav Evrope, Severne Amerike in Oceanije (Fačeti, 2023).

Tabela 2: Pregled programov ravnanja z odpadno kmetijsko plastiko v raznih državah

Program	Država	Cilji in značilnosti programa
PoliEco	Italija	Recikliranje odpadnega blaga in polietilena, z izjemo PE embalaže (CIPA plasticulture, 2023)
Sastak Machinery Ring Trial	Združeno kraljestvo	Optimizacija zbiranja, zagotoviti stroškovno učinkovito zbiranje odpadne kmetijske plastike (Fačeti, 2023)
IFFPG Bring centri	Irski	Zbiranje odpadnih folij in tudi nesilažne odpadne plastike. Možna oddaja plastike v zbirni center ali pa tudi na domačem dvorišču. Ob nakupu folije kmetje prejmejo nalepko, s katero ob oddaji lahko uveljavljajo popust (IFFPG, 2023).
MAPLA	Španija	Vključuje 90 % distributerjev folije v državi, načrtovana širitev tudi na druge plastične izdelke (vrvi, mreže, cevi ipd.) (APE Europe, b.d.)
A.D.I. VALOR	Francija	V obdobju 2009-2018 zbrano čez 460.000 ton rabljene plastike. Vključuje 310.000 kmetov, 1300 distributerjev in 350 proizvajalcev. Zbiranje poteka na 8000 lokacijah po vsej

Program	Država	Cilji in značilnosti programa
		državi. Zbiranje vseh vrst kmetijske plastike (Adivalor, 2022)
Gront Punkt Norge	Norveška	Ustanovljeno s strani 6 podjetij, ki se ukvarjajo s predelavo plastike in tudi nekaterih drugih materialov. Leta 2018 zbrano 17.800 ton, kar je 84 % odpadne plastike iz kmetijskega sektorja. Sodelovanje v shemi z nakupom plastike z oznako Green Dot (zelena pika). (Gront Punkt Norge, 2023).
ERDE	Nemčija	Ločena reciklaža kmetijskih folij iz PE-LD in PE-LLD. Kmetje lahko na zbirna mesta brezplačno oddajo očiščeno plastiko: silažne prekrivke, folije, cevi, mreže in preje (Fačeti, 2023).
DrumMUSTER	Avstralija	Zbiranje veterinarskih in agrokemičnih posod in embalaže za fitofarmaceutska sredstva. Zaenkrat pa še ni vključeno zbiranje plastične folije. Organizirana so redna izobraževanja za kmete in osebje zbiralnic (DrumMUSTER, 2023).
Plasback in Agrorecovery	Nova Zelandija	Zbiranje vse kmetijske in vrtnarske plastike. Kmetje odpadno plastiko oddajajo v zabojnike iz reciklirane plastike. Stroške odvoza in zabojnika poravnajo kmetje. Na ta način reciklirajo 85 % uvožene silažne folije (Fačeti, 2023)
Revolution Plastics	ZDA	Kmetje, ki kupijo plastične izdelke od podjetja, lahko v zameno brezplačno oddajo odpadno plastiko. Program oskrbuje več kot 4000 kmetij na srednjem zahodu ZDA in zberejo 675 ton plastike letno (Redefine recycling, 2023).
Cleanfarms	Kanada	V programu sodeluje več kot 20 organizacij (občine, proizvajalci, predelovalci, trgovci, neprofitne organizacije. Med posameznimi zveznimi državami so razlike. V Alberti poteka od 2020 triletni pilotni projekt, kjer zbirajo vreče za žito in vrvice. Ocenjeno je, da letno nastane 2500 ton odpadnih polietilenskih vreč za zrnje in 3000 ton polipropilenskih vrvic (Cleanfarms, 2023).

Vir: Fačeti, 2023

6 Program EIP Recikel agro-stretch folije

V Sloveniji je bilo pri ravnanju z odpadnimi kmetijskimi folijami v preteklih letih kar precej problemov. Že pred letom 2018 so kmetijske zadruge prenehale sprejemati odpadno folijo. Od leta 2019 kmetje odpadno folijo lahko oddajo komunalnim podjetjem, a je oddaja folije večinoma plačljiva. Zato so precej pogosti primeri divjega deponiranja folije ali sežiganja na prostem. Razlogi za to so tako v neurejenem sistemu zbiranja odpadnih folij kot tudi v pomanjkljivi ozaveščenosti in informiranosti uporabnikov (Fačeti, 2023).

Primer dobre prakse zbiranja odpadne kmetijske folije v Sloveniji je projekt »Vzpostavitev modela reciklaže agro-stretch folije za bale in silažne folije s ciljem olajšati organizacijo za kmete in zmanjšati negativne posledice na okolje« (skrajšano EIP Recikel agro-stretch folije) Kratica EIP pomeni European Inovation Partnership (Evropsko partnerstvo za inovacije). Projekt je trajal od 1.12. 2020 do 30.11.2023 (Grm Novo mesto, 2020; Fačeti, 2023).

Namen projekta je organizacija modela za zbiranje odpadne folije za bale in silose. Model temelji na zbiralnih mestih pri organizatorjih zbiranja, v katere lahko kmetje oddajo odpadne folije. V zameno za oddano folijo prejmejo dobropis, ki ga lahko izkoristijo pri nakupu nove folije. Za projekt je pomembno vključiti čim večje število organizatorjev zbiranja, kar lahko postane posamezna kmetija. Ta lahko potem prevzema odpadno folijo tudi od drugih kmetij, ki za dostavljeno folijo prejmejo ustrezen dobropis, ki je sorazmeren količini odpadne folije, določeni s tehtanjem. Sistem je podprt s spletno aplikacijo, kar olajša tudi evidentiranje oddanih količin ter pridobljenih dobropisov. Odvoz folije od zbirnega mesta pri organizatorju zbiranja do zbirnega centra lahko uredi organizator zbiranja ali pa podjetje Virc d.o.o., ki je tudi ustanovitelj projekta. Trenutno je v Sloveniji 11 zbirnih centrov, ki relativno dobro pokrivajo območje Slovenije, največ pa jih je v jugovzhodni Sloveniji (Dolenjska z Belo krajino). Zbrana folija se nato preda podjetju Omoplast d.o.o., ki deluje na dveh lokacijah in je vodilni predelovalec odpadne plastike v Sloveniji (Grm Novo mesto, 2020; Fačeti, 2013).

Projekt temelji na tako imenovani win-win shemi, kjer imajo koristi vsi udeleženci. Ob tem, da se zmanjša obremenjevanje okolja, kmetje lahko enostavno oddajo odpadno plastiko ter zaradi dobropisa tudi po nižji ceni nabavijo novo folijo.

Ponudniki nove folije so zaradi oglaševanja na spletni strani bolj prepoznavni, predelovalci odpadne folije pa imajo zagotovljen bolj organiziran in konstanten dotok materiala. Zbiralci odpadne folije pa imajo zaslužek pri zbiranju in odvozu folije (Grm Novo mesto, 2020; Fačeti, 2023).

Projekt ima sicer poleg vzpostavitve modela zbiranja še nekaj drugih ciljev, saj so vključene tudi raziskave o čistosti zbranih odpadnih folij, o vplivu materiala folije na okolje, o vedenju materialov med uporabo, vplivu vremenskih razmer na folijo in na krmo ter vplivu načina skladiščenja na kvaliteto krme (Grm Novo mesto, 2020; Fačeti, 2023).

Potrebno je poudariti, da tehnološki vidiki pri recikliranju odpadne folije ne predstavljajo bistvenega problema, ampak večji izziv predstavljajo organizacijski in komunikacijski vidiki. Posebno pomembna za uspešno delovanje modela zbiranja je učinkovita komunikacija. Kmetovalce je potrebno obveščati o obstoju modela, načinu njegovega delovanja, lokacijah zbirnih mest ter jim razložiti pomen ustreznega ravnanja z odpadno plastiko za zaščito okolja. Predvsem so na tem področju pomembni kmetijsko gospodarski zavodi (KGZ) pa tudi kmetijske zadruge.

Komunikacijske kanale bi po učinkovitosti lahko razvrstili po naslednjem vrstnem redu (Fačeti, 2023):

1. Neposredna komunikacija med prodajalcem in stranko
2. Spletna stran Agrofolija.si
3. Kmetijsko gospodarski zavodi
4. Komunikacija med kmeti (organizatorji zbiranja)
5. Kmetijske zadruge

7 Zaključki in predlogi

Model EIP Recikel se je izkazal učinkovit pri zaščiti okolja in tudi ekonomsko zanimiv tako za kmetovalce kot tudi za prodajalce in predelovalce folije. Predstavlja zelo lep primer implementacije krožnega gospodarstva v kmetijskem sektorju. Vsekakor bi bilo potrebno vključiti še čim več dodatnih lokacij za zbiranje odpadne folije. Tudi število zbirnih mest bi bilo smiselno povečati, da bi tudi v drugih delih

države dosegli podobno pokritost kot je v jugovzhodni Sloveniji. Pomebno je ozaveščanje kmetovalcev kot uporabnikov o pravilnem ravnanju z odpadno folijo in tudi z drugo kmetijsko plastiko ter promocija modela zbiranja. Zelo enostavno in učinkovito je promocijo mogoče izvajati ob nakupu folije. Pri izobraževanju in ozaveščanju pa imajo seveda ključno vlogo strokovnjaki, ki dobro poznajo stanje na terenu, predvsem so na tem področju kompetentni kmetijsko gozdarski zavodi.

Učinkovito delovanje modela zbiranja predstavlja tako iz logističnega kot ekonomskega vidika ugodno rešitev za kmetovalce. V koliko bo model zaživel še v večji meri, je za to pričakovano, da se bo obseg nesprejemljivih načinov ravnanja kot so odlaganje folije v naravi ali sežiganje na divjih odlagališčih še zmanjšalo. Kljub temu bi bilo smiselno okrečiti inšpekcijski nadzor kot tudi organizirati občasne čistilne akcije.

Model EIP Recikel je posvečen problemu odpadne agro-stretch folije, ki v zadnjem obdobju predstavlja največji vir odpadne plastike v kmetijstvu. Model skuša slediti sodobnim konceptom ravnanja z odpadki, kjer sta na prvem mestu preprečevanje nastanka odpadka in ponovna uporaba. Ker se je folija izkazala kot zelo učinkovita možnost za povečanje pridelka, zmanjšanja količine porabljene folije ni pričakovati, ponovna uporaba pa tudi pri foliji praktično ni možna. Zato pa je vsekakor potrebno v čim večji meri zagotoviti recikliranje folije. Model vsekakor postavlja absolutno prednost recikliranju (snovni izrabi) folije pred energetske izrabo. V prihodnosti bi bilo smiselno model razširiti še na druge plastične odpadke iz kmetijskega sektorja.

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EXPLORING STAKEHOLDER ESG INTERESTS FOR LISTED COMPANIES IN THE EU HEALTHCARE SECTOR

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This study empirically examines the complex correlation between Environmental, Social, and Governance (ESG) performance and financial dynamics in the European Healthcare industry. Utilizing comprehensive datasets from Refinitiv and EMIS, the study includes 209 publicly traded firms, carefully classified based on the NUTS for easier comparison of ESG ratings across different regions. The research aims to achieve three objectives: firstly, to demonstrate the distribution of ESG metrics using heat-map analysis; secondly, to evaluate the concentration of ESG scores within the healthcare sector; and thirdly, to determine stakeholders' interests by analyzing sector-specific ESG characteristics. The study intends to offer significant insights into the impact of ESG practices on financial performance, with a specific focus on the healthcare sector's unique features. This investigation adds to the expanding pool of knowledge on the subject and thoroughly examines the ESG situation of healthcare companies in Europe. This study provides a contemporary and comprehensive analysis of the interactions between ESG factors and financial performance as firms strive to incorporate sustainable practices.

Keywords:
ESG,
healthcare
sector,
stakeholder,
finance,
companies

1 Introduction

Over the past three decades, scholars and practitioners alike have been grappling with the intricate nature of contemporary business challenges. In this pursuit, "stakeholder theory" or "stakeholder thinking" has emerged as a transformative narrative aimed at unraveling and addressing three interrelated business predicaments. This study examines companies listed in the EU healthcare sector based on their ESG (Environmental, Social, Governance) indicators, financial indicators, geographical location and stakeholder metrics, with linkage analyses between indicators. Additionally, it examines the potential for stakeholder theory to provide valuable insights into sustainable and ethical value creation while proposing future directions for research in this domain.

Stakeholder theory, at its core, seeks to decipher the complexities surrounding the creation and exchange of value in contemporary business environments. Over the last three decades, this concept has become a critical tool for unraveling the intricate web of relationships between businesses and the various entities affected by their operations. The first challenge it addresses is the fundamental question of how value is created and traded within the business ecosystem. (Bidhan et al., 2010)

Stakeholder theory also serves as a guiding framework for managerial thinking. By recognizing the interdependence between value creation and the ethical dimensions of business, managers can adopt a more holistic approach to decision-making. Through stakeholder theory, managers gain a comprehensive understanding of their role in creating value that extends beyond mere financial gains. (Tullberg, 2013)

As stakeholder theory continues to evolve, future research should explore its potential to provide even more nuanced insights into sustainable and ethical value creation. Further investigations can delve into the dynamics of stakeholder engagement, assessing the effectiveness of different strategies in different contexts. Additionally, research could focus on developing practical tools and frameworks that empower businesses to implement stakeholder-oriented approaches successfully.

2 Literature Review and Methodology

2.1 Literature Review

2.1.1 ESG

The term ESG was first used in 2004. ESG is based on three pillars. The symbol E is the environmental criterion, which includes the energy used by the company, the waste produced, the resources required and the consequences of using them as an outcome. Last but not least, it encompasses carbon emissions and climate change. S is the social criterion, which refers to the company's relationships and the reputation it has in the communities and institutions where it operates. S includes employment relations, diversity and inclusion. G stands for corporate governance, the adaptation of practices, controls and procedures to manage and effectively make decisions in accordance with the law and to meet the needs of external stakeholders. ESG (Environmental, Social, Governance) is the codified expression of all this to investors and shareholders in a transparent and measurable way that allows comparison between companies. It is a useful tool that helps to articulate the company's commitments to environmental and social objectives in an accountable and tangible way. Establishing ESG values and metrics is a company-specific planning process. Some companies may choose to implement qualitative ESG incentive targets even if they have rigorous ESG factor data and reporting. It is critical that ESG stakeholder goals and values are chosen to ensure that ESG targets are met, to increase stakeholder value and not simply to serve as window dressing or greenwashing. (Kay et al., 2020)

2.1.2 Healthcare sector in EU

The notable rise in the participation of large business companies in these projects suggests a shifting landscape of collaboration, potentially driven by the increasing complexity and scale of technological ecosystems. The broadening geographic scope of proposed ecosystems indicates a growing global perspective and impact. Additionally, the shift towards a healthcare application domain, coupled with the transformation of monolithic services into aggregated services, reflects a dynamic response to evolving societal needs. The heightened interest from European initiatives in the development of technological ecosystems related to the health

sector indicates a strategic focus on advancing healthcare technologies. While these findings contribute valuable insights into the current state of technological ecosystems in the health sector. Its adaptability can serve as a valuable template for future mapping studies in diverse research domains. As the technological landscape continues to evolve, ongoing mapping studies will be crucial for staying abreast of emerging trends and guiding future initiatives in the dynamic field of health technology. (García-Holgado et al., 2019)

2.1.3 Shareholders and stakeholders in listed healthcare companies

In the realm of investment decisions, investors engage in rigorous modeling and calculations before determining whether to buy, hold, or sell specific shares. The cornerstone of estimating the intrinsic value of an investment lies in the widely adopted Discounted Cash Flow (DCF) approach, a time-tested method for valuing companies and their shares. Despite the dominance of DCF, the past few decades have witnessed the emergence of innovative techniques, such as the real options theory, in financial literature. The central question addressed is whether these modern alternative methods have the potential to supplant DCF in shaping investor decisions. Through a meticulous analysis of the strengths and weaknesses of each approach, the ultimate conclusion is reached. While acknowledging that modern techniques may present viable alternatives in specific scenarios, the undisputed and empirically supported finding is that the Discounted Cash Flow approach remains the most authentic and reliable method for company valuation. (Ulbert et al., 2017)

Entrepreneurship education, fostering knowledge, skills, competencies, and attitudes, seeks to enhance entrepreneurial capacity. The pandemic catalyzed the digital evolution of higher education, giving rise to the NETMIB online incubation platform. This paper introduces NETMIB, a novel solution leveraging online opportunities for skill and attitude assessment. Employing an online survey-based research method, an Entrepreneurial Orientation (EO) Index was devised as a valid scale for gauging entrepreneurial attitudes in online incubation. The study reveals that student idea owners in the online incubation process exhibit significantly higher inclination towards business activities, coupled with a stronger desire for independence and achievement. These insights aid in targeted educational interventions within incubation programs, with the online EO Index serving as a valuable performance measure across diverse incubation initiatives. (Tóth-Pajor et al., 2023)

2.2 Methodology

Based on the study of the literature on entrepreneurial orientation, it can be seen that it is one of the most important influencing factors in the operation of s. Many foreign and European research have been conducted for different countries on how the companies operating there relate to Executive Officer, including innovation, risk-taking, and proactivity. Since no such survey has yet been prepared for healthcare sector businesses, I formulated the following hypotheses for databased on the literature.

My first hypothesis regarding healthcare sector enterprises is related to how likely they are to use ESG criteria system.

H1: Stakeholder value results in a high esg score

My next hypothesis is related to the different orientations within strategic management.

H2: Stakeholder value results in a high e score

H3: Stakeholder value results in a high s score

H4: stakeholder value results in a high g score

From the point of view of risk-taking, I set up two hypotheses, on the one hand, in relation to how risk-taking or risk-avoiding the healthcare sector businesses are, and on the other hand, how risk-taking affects the company's performance.

H5: In the case of healthcare sector, technological innovation is easier to implement than R&D

H6: The majority of healthcare sector s avoid risk

Initially, there were 209 listed European companies, and only those that aligned their financial and calendar year. However, due to Brexit on 1 February 2020, UK companies were excluded, leaving 188 companies after the exclusion, as well as

companies from Switzerland and Norway, bringing the total number of companies to 134. After applying the selection criteria, the reduction was 36% in terms of average number of employees and 34.9% in terms of total number of companies.

3 Results

This dataset serves as a comprehensive baseline overview of health sector-related companies in various European countries, providing key metrics on the number of companies and their respective employee counts. The data represents a foundational snapshot of the healthcare industry landscape as of the specified period.

Table 1: Start Country and Employee data

Country	companies (pcs)	Employeeesscal Yr EndPeriod To PeriodAvg
Belgium	8	21 563
Denmark	13	98 405
Finland	4	20 436
France	18	206 851
Germany	20	743 008
Hungary	1	12 981
Ireland; Republic of	1	-
Italy	4	19 041
Netherlands	3	82 526
Norway	2	88
Poland	1	3 771
Slovenia	1	11 687
Spain	6	28 950
Sweden	64	101 366
Switzerland	31	293 596
United Kingdom	32	294 331
SUM	209	1 938 598

Source: Refinitiv and EMIS

The sample encompasses a total of 209 health sector-related companies distributed across multiple European countries. Notable variations are observed in both the number of companies and the size of their workforce. Germany stands out with the highest number of companies (20) and a substantial employee count of 743,008,

underscoring its significant presence in the health sector. Sweden follows closely with 64 companies and 101,366 employees.

While some countries, like Hungary and Poland, have a smaller representation with one company each, others like the United Kingdom and Switzerland feature a more extensive presence, with 32 and 31 companies, respectively.

This baseline dataset not only outlines the distribution of health-related companies but also provides a benchmark for future assessments and comparisons within the dynamic European healthcare industry. The aggregated employee count of 1,938,598 signifies the substantial workforce associated with these health sector companies, setting the stage for ongoing monitoring and analysis to track industry trends and developments.

The European Union (EU) allocates grants to economically disadvantaged regions within member states, aiming to facilitate their convergence with the EU average. Operating under the Objective 1 scheme, NUTS2 regions with a GDP per capita below 75% of the EU average qualify for structural funds from the central EU budget. This structure creates a regression-discontinuity design, leveraging the discrete shift in the likelihood of receiving EU transfers at the 75% threshold. Further intricacies arise when considering smaller regional aggregates, known as NUTS3 regions, nested within NUTS2 mother regions. While some relatively prosperous NUTS3 regions may receive EU funds due to their qualifying NUTS2 mother region, some economically challenged NUTS3 regions may not receive funds if their NUTS2 mother region fails to qualify. Empirical findings reveal positive growth effects resulting from Objective 1 funds, though no discernible impact on employment. A straightforward cost-benefit analysis suggests that not only are Objective 1 transfers effective in fostering growth, but they also demonstrate cost-efficiency. This underscores the significance of the EU's targeted support in aiding the development and convergence of economically disadvantaged regions, contributing to the overall cohesion and success of the European Union. (Becker et al., 2018)

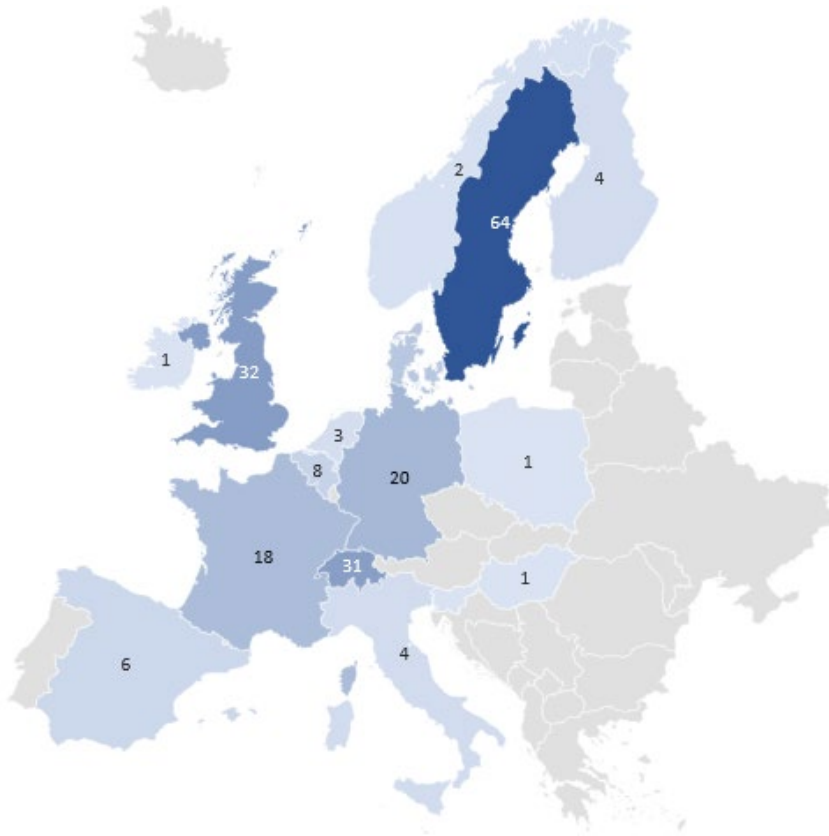


Figure 1: Europe heatmap

Source: self-made figure based on the data in Table 1

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Table 2: After Select criteria Country and Employee data

	companies (pcs)	Employeeesccal Yr EndPeriod To PeriodAvg
Belgium	8	21 563
Denmark	10	82 413
Finland	4	20 436
France	18	206 851
Germany	16	653 747
Hungary	1	12 981
Ireland; Republic of	1	-
Italy	4	19 041
Netherlands	3	82 526
Poland	1	3 771
Slovenia	1	11 687
Spain	6	28 950
Sweden	61	96 625
SUM	134	1 240 589

Source: self-made figure

Specification 1: Employing Pooled Ordinary Least Squares (OLS) with a dataset comprising 1904 observations. The model incorporates 134 cross-sectional units, with a time-series length of 14 years 2009-2022. The dependent variable under consideration is TRTRESGScore. Robust (HAC) standard errors are utilized to enhance the model's resilience and accuracy. Specification 2: Employing Fixed-effects with a dataset encompassing 1904 observations. The model incorporates 134 cross-sectional units, and the time-series length is set at 14 years 2009-2022. The focal dependent variable is ESGScore.

Table 3: Employing Pooled Ordinary Least Squares (OLS)

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	33,2604	11,8564	2,805	0,0058	***
NetIncomeAfterTaxes	-0,239430	0,0735717	-3,254	0,0014	***
TtlCmnSharesOut	0,268024	0,163143	1,643	0,1027	
TotalAssetsReported	-0,0746020	0,0819849	-0,9099	0,3645	
TotalDebtOutstanding	0,0241360	0,0364294	0,6625	0,5088	
TotalEquity	0,241134	0,146183	1,650	0,1014	
PropertyPlantEquipmentTotal	-0,0829046	0,0788708	-1,051	0,2951	
TotalRevenue	0,00581125	0,0691688	0,08402	0,9332	
CapitalExpendituresCFStmnt	0,0818802	0,0391737	2,090	0,0385	**
OperatingIncome	0,0329647	0,0967674	0,3407	0,7339	
CashandEquivalents	-0,0202523	0,0341229	-0,5935	0,5538	
WACCCostofEquity	0,0480863	0,0348580	1,379	0,1700	
PriceClose	-0,00905618	0,0427596	-0,2118	0,8326	

Mean dependent var	162,4606	S.D. dependent var	238,5719
Sum squared resid	92254420	S.E. of regression	220,8756
R-squared	0,148255	Adjusted R-squared	0,142850
F(12, 135)	12,55516	P-value(F)	6,74e-17
Log-likelihood	-12972,17	Akaike criterion	25970,33
Schwarz criterion	26042,51	Hannan-Quinn	25996,90
rho	0,800172	Durbin-Watson	0,389254

Source: own calculation

The joint test on named regressors yields a test statistic of $F(12, 1756) = 2.53479$, resulting in a p-value of 0.00256677. This indicates a statistically significant result, suggesting that the named regressors collectively have an impact on the model.

Table 4 Employing Fixed-effects

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	191,862	23,7421	8,081	<0,0001	***
NetIncomeA fterTaxes	-0,149613	0,0691024	-2,165	0,0305	**
TtlCmnShare sOut	0,186073	0,123403	1,508	0,1318	
TotalAssetsR eported	0,00759679	0,0698497	0,1088	0,9134	
TotalDebtOu tstanding	0,0405852	0,0181936	2,231	0,0258	**
TotalEquity	-0,0390767	0,119148	-0,3280	0,7430	
PropertyPlan tEquipmentT otal	-0,0549622	0,0401898	-1,368	0,1716	
TotalRevenu e	-0,0357795	0,0389767	-0,9180	0,3588	
CapitalExpen dituresCFSt mt	0,0689449	0,0258856	2,663	0,0078	***
OperatingInc ome	0,0328888	0,0459769	0,7153	0,4745	
CashandEqui valents	-0,0288061	0,0179025	-1,609	0,1078	
WACCCosto fEquity	0,0328642	0,0190249	1,727	0,0843	*
PriceClose	-0,0377042	0,0222465	-1,695	0,0903	*

Mean dependent var	162,4606	S.D. dependent var	238,5719
Sum squared resid	60471033	S.E. of regression	185,5716
LSDV R-squared	0,441697	Within R-squared	0,017027
LSDV F(147, 1756)	9,450651	P-value(F)	1,1e-138
Log-likelihood	-12570,06	Akaike criterion	25436,11
Schwarz criterion	26257,76	Hannan-Quinn	25738,56
rho	0,731543	Durbin-Watson	0,555931

Source: own calculation

Additionally, the test for differing group intercepts involves a null hypothesis that posits the groups share a common intercept. The corresponding test statistic is $F(135, 1756) = 6.83665$, with a p-value of $2.5648e-89$. This extremely low p-value strongly rejects the null hypothesis, providing evidence that the groups exhibit varying intercepts. Overall, these tests contribute valuable insights into the significance of specified regressors and the distinctiveness of group intercepts in the model.

4 Conclusion

The study covered the importance in healthcare sector and the European Union, thereby determining why it would be worthwhile to subject them to a broader analysis both vertically and horizontally.

The current evolution of business is often described as a shift from the long dominant concept of shareholder value maximisation to a more stakeholder-centric model, where the needs of multiple stakeholders, including employees, consumers, investors, communities and the Earth are taken into account. Mapping the different manifestations of purpose based on these stakeholders provides a simple way to understand how they can work together, in harmony, towards a higher purpose. The ESG framework and metrics attempt to capture this higher purpose. ESG-based business practices include adopting sustainable practices, supporting social causes and promoting ethical business behaviour. There are significant changes in ESG priorities in the business community, driven not only by pandemics but also by economic downturns, social unrest and extreme weather events. A focus on multi-stakeholder interests and ethical business practices is essential for businesses to succeed in a modern and dynamic environment.

After a thorough review of the literature, six hypotheses were formulated. These hypotheses will soon be supported by studies of other sectors, which I intend to summarise in my doctoral thesis. It is worth mentioning that some countries, namely Iceland, Norway and Switzerland, although not members of the EU, are members of the European Free Trade Association (EFTA) and actively participate in free trade agreements with EU countries, and therefore the inclusion of these countries in future research is justified.

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GREEN OR YELLOW LIGHT FOR MARKET F(L)AVOURS? THE LECTURER PERSPECTIVES OF MARKET- ORIENTED ORGANISATIONAL CULTURE IN THE CHANGING WORLD OF HUNGARIAN HIGHER EDUCATION

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This study focuses on the success factors of a Hungarian business university, highlighting an important pillar among the success criteria: a coherent and market-oriented organisational culture that can adapt to the changing conditions including transitions and sustainability-related challenges. Our research question is to what extent organisational culture helps or hinders market-oriented organisational behaviour, and to what extent it supports an organisation's success in higher education. Through the example of the Budapest Business University (BBU) the study shows how Cameron-Quinn's organisational culture model (OCAI) - with regard to market orientation - appears in the domestic university scenario. Based on our research the role of market orientation in higher education is clarified: there is a connection between the organisation's strategy, culture and market orientation, but there are different viewpoints regarding the organisational values related to market orientation. The authors argue that the immanent element of organisational functioning (i.e. the market-oriented organisational culture), fundamentally contributes to how successfully a model-changing university adapts in the market space designated for it.

Keywords:

higher education, market orientation, organisational culture, model-changing university, changing world



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1 Introduction

In the first half of the 20th century, several authors dealt with the idea of university (Whitehead (1929), Flexner (1930), Macmurray (1944)). Later, the interest increased, as significant changes took place in the institutional network and institutional system of higher education (Newman, 1965). Survival and renewal were at the centre of the organisational challenges, as universities had to meet two conditions: on the one hand, to remain loyal to the idea that gave life to the so-called *studium generale* and the spirit of the '*universitas*' seven centuries earlier, and on the other hand, to integrate into the society around them (Ashby, 1966). From the ever-increasing character of economic and business life, universities adopted certain terms (e.g. key indicator, quality assurance, return, etc.), which many researchers considered as the final bankruptcy of the classic "university" (Scott (1984), Reeves (1988), Halsey (1992)) - and these processes slowly swept away the 19th-century foundations of the university's self-image. Our study focuses on one of the most important elements of this change: the market orientation of higher education (more precisely: universities). Hungarian higher education has gone through changes, as a result of which almost all higher education institutions are forced to place greater emphasis on market orientation – among others the Budapest Business University.

2 The social environment of higher education

2.1 The macro and micro environment of higher education in Hungary

The trend analysis of the changes experienced in Hungarian higher education in the last three and a half decades and the analytical review of the higher education literature are receiving more and more attention (Polónyi-Kozma, 2020). From the literature analysis, it can be concluded that higher education - due to its strong social embeddedness - can and should be examined together with external influences (e.g. labour market, social mobility, economic efficiency, cultural values, etc.). As a result of all this, the expansion of higher education, the institutional and training structure, as well as the institutional management itself took shape (Temesi, 2016).

The internal world of the university, its groups of teaching and non-teaching staff, show remarkable organisational dynamics. The management must adapt the message of the market orientation strategy in their circles to the values shared at the organisational level, and then adapt the message and the incentives to the individual subcultures. In this way, the management can create an atmosphere of cohesion while managing the diversity of subcultures (Chandler et. al, 2021).

2.2 The Budapest Business University (BBU) in the research focus

The Budapest Business University (BBU) was established in 2000 by the merger of three former colleges (College of Commerce, Hospitality and Tourism, College of Foreign Trade and College of Finance and Accountancy). The predecessor institution of two of the three colleges were founded in 1857, while the third was founded in 1957. The former independent colleges now appear as Faculties of the university and focus on different areas of business sciences as follows: foreign trade and international business, logistics; finance, accounting and management; tourism, trade and hospitality. The institution appears at all levels of education i.e. from higher vocational education through basic education to the PhD degree. The Budapest Business University has become the institution with the third largest number of admissions, which currently provides training for around 20,000 students. From the point of view of organisational culture, the fact that Faculties stayed on their own campuses instead of being physically integrated was a significant obstacle to integration. Another step in the organisational transformation is that the BBU Senate has voted in 2021 for the change of its legal and operational model, based on which the University continues to operate as a public foundation based university.

2.3 The forms and characteristics of market orientation

The co-called "Competing Values Framework" (Cameron-Quinn, 1999) model of organisational culture has also been widely applied in higher education in recent decades. It has proven to be as a useful tool in the interpretation of market orientation. In this perspective, the organisation focuses on transactions with external actors (e.g. suppliers, customers, unions) and regulators (Cameron-Quinn, 1999). Market orientation is thus a vital set of values and processes necessary to

create higher value goods and services offered to customers (Kohli-Jaworski, (1990), Narver-Slater (1990), Ruekert (1992)).

From the beginning of the 2000s, market orientation received more attention in higher education research. In particular, researchers have proposed and tested models that, in addition to the focus of the above-mentioned authors on market orientation, also identify its antecedents and consequences e.g. Hult-Ketchen-Slater (2005), Wang et al. (2019), as well as market orientation and performance examine the mediators and/or moderators of the relationship: a spectacular result is that the institution's market orientation is an organisational capability that has a positive effect on performance (Hult-Ketchen-Slater (2005), Kirca et al. (2009)). Thus the question is: how can an organisational culture recognizing market orientation as a value be interpreted in the university sphere?

Evidently, universities have different characteristics than that of the business enterprises, since university activities are largely characterized by a knowledge-based culture and a large number of changing students. Therefore, existing market orientation scales may not be able to adequately assess the true nature of university goals and functions. Among the scales developed in the 1990s, the 21-item MKTOR scale (Narver-Slater, 1990) included customer orientation, inter-functional coordination and competitor orientation as factors, while the MARKOR scale, which initially consisted of 32 items and was later reduced to 20 (Kohli-Jaworski-Kumar, 1993) identified the generation, dissemination and responsiveness of market intelligence as the main factors of market orientation philosophy within higher education institutions.

The above mentioned market orientation scales focused more on for-profit business than on the university environment and its unique needs. In order to correct this deficiency, the University MARKOR scale was created (Hampton, 2007, Hampton et al. 2009), which measures student-centred market orientation, and based on previous works for measuring market orientation (Kohli-Jaworski-Kumar, 1993), and based on customer orientation (Brady-Cornin, 2001). Hampton (2007) modified the original 32 items of the MARKOR scale and the 15 items of the MKTOR scale - adapted to the university context. He then compared the two scales as well as the University MARKOR scale, which includes students.

3 Research questions and hypotheses

3.1 Test sample

The database for this article is based on a long series of surveys: every five years since 2011, we have assessed BBU's organisational culture using the OCAI scale and the MARKOR scale, and from this we have defined the university's organisational subcultures. (Chandler, 2015; Chandler et al., 2017, 2018; Chandler-Heidrich, 2014) Sample sizes are as follows: $n_{2011}=332$; $n_{2016}=369$; $n_{2020}=180$. Table 1. shows comprehensive demographic distributions for the three databases. This study examines the relationship between the market dimension in organisational culture and the market orientation measured by the MARKOR scale using data from three databases. Since this research question aims to investigate a cause-and-effect relationship between two statistical variables (i.e. market dimension of organisational culture and market orientations), the intrinsic dynamics within the datasets do not provide any issues (James et al., 1982):

Table 1: Sample distributions

		2011	2016	2020
sex	male	34,9	36,9	41,7
	female	65,1	63,1	58,3
age	under 25 years	1,5	1,2	0,6
	25-35 years	16,9	20,3	18,3
	35-45 years	27,1	27,7	26,1
	45-55 years	27,1	28,0	33,9
	55-65 years	21,4	22,3	18,3
	Over 65 years	6,0	0,5	2,8
tenure	less than 1 year	10,5	12,5	3,3
	1-3 years	9,9	15,8	21,1
	3-5 years	8,1	10,3	16,7
	5-10 years	20,5	16,8	18,9
	more than 10 years	50,9	44,8	40,0

The data was analysed using the following methodology, which is common and appropriate in the literature for both the OCAI and MARKOR:

- The MARKOR scale's 33 measured variables (19 student orientation, 6 competition orientation, and 8 cooperation orientation) are subjected to exploratory factor analysis by groups, with goodness of fit tested using the KMO indicator, the Bartlett test, and the measure of total variance expressed. Furthermore, each construct is intended to have a factor weight of 0.5 for the measured variables in each constructed factor, with the second greatest value not exceeding half of this number. The factors thus constructed are used to measure the market orientation of respondents. (Thompson, 2004)
- To improve data processing efficiency and reduce information granularity, market values on the OCAI scale are averaged. Since these indicators are measured on an ipsative scale, averaging does not result in considerable information loss; nonetheless, the scale range of 0-100 makes analysis challenging (Kása, 2020). As a result, using the visual binning method, three groups were formed from the sample, each with two divisions, with standard deviation regarded medium for market dimensions around the midpoint of the scale, low for respondents below this range, and high for respondents above this range. We also apply this binning process to the perceived and preferred aspects of the OCAI scale.
- After obtaining these variables, we can use analysis of variance to investigate the progression of the MARKOR factors' values inside the 3-3 groups of the binned OCAI market dimension. Specifically, we investigate if there are substantial disparities among the category means in the groups (Northcott, 2008).

Our research is based on the hypothesis that a prevailing market culture results in a more pronounced market orientation within all three market orientation groups.

3.2 Factoring MARKOR scales

The MARKOR scale variables were subjected to factor analysis by group, resulting in a total of six factors from the three groups. The factor analysis meets the statistical requirements, with a sufficiently high Kaiser-Mayer-Olkin index score in all cases (>0.7), a significant Bartlett's sphericity test ($p < 0.001$), a Total Expressed Variance (TVE) above 50%, in two cases above 60%, and a minimum factor weight of 0.6. The constructed factors are:

- Customer service: the term reflects the practice of the BBU to make student complaints handling easily accessible, transparent, and fast. In addition, BBU understands student needs and informs them of what they can expect from the institution. This approach promotes student satisfaction and trust, as well as effective communication and problem-solving within the educational institution.
- Integrative student feedback culture: the term reflects the practice of BBU to actively encourage students to give feedback, whether positive or negative, but always in a constructive way. In addition, staff also consider and respond to this feedback, which contributes to the continuous improvement of learning and teaching processes. This type of culture promotes openness, continuous improvement, and community participation in the learning environment.
- Student-centred education: the term reflects the approach of the university to focus on student satisfaction, and to put the needs of students at the heart of education. Regular student satisfaction surveys show that the institution is committed to continuously monitoring and improving the educational environment for students. This approach promotes student well-being and improved learning outcomes.
- Competitive advantage in student-focus: This term reflects the situation in which the university stands out from other colleges and universities in understanding and meeting student needs. Furthermore, the BBU's positive attitude towards other institutions' initiatives and developments indicates that it is open to innovation and continuous improvement, while maintaining the primacy of students' interests. This approach contributes to the institution's competitiveness in the education sector.

- Openness to learn and collaborate within the sector: the term reflects the attitude whereby staff and management take an active interest in the practices and developments of other higher education institutions. This type of information gathering and collaboration across the sector promotes knowledge sharing, innovation and effective working. This approach contributes to the development of the institution and to increasing its competitiveness in the education sector.
- Internal cooperation: the term reflects the approach that almost all members of the organisation are involved in promoting the image and marketing of the university. In addition, the introduction of new features and the development of the curriculum are focused on the needs of students, and the student population is always a primary consideration in decision-making. Discussing and addressing student concerns in meetings further reinforces this student-centred approach. This approach promotes institutional cohesion, student satisfaction and the overall success of the University.

The values of the constructed factors over the period under study are as follows:

- The culture of integrative student feedback increased after a means decline to a level higher than the baseline.
- The student-centred education and openness to learn and collaborate within the sector are increasing modestly but steadily.
- The culture of student complaint handling shows a steady decline
- The indicators of competitive advantage in student-centredness and internal cooperation have stagnated after a significant decline in the last period.

Table 2: Explorative factor analysis results

MARKOR group	KMO	Barlett p	TVE	Factor	No. of measured variables	min. factor loading
Student orientation	0,920	0,000	64,831	student complaint handling	5	0,610
				integrative student feedback culture	6	0,602
				student-centred education	3	0,683
Competition orientation	0,787	0,000	65,455	competitive advantage in student-centredness	3	0,656
				openness to learn and collaborate within the sector	3	0,653
Cooperation orientation	0,899	0,000	58,247	internal cooperation	8	0,688

An interesting anomaly emerges from the results after analysing the data. We investigated whether employees who have relatively low or high market values on the CVF scale, either in terms of perceived organisational culture or desired state, have a market orientation.

The results are the following:

- Employees who do not perceive the current organisational culture as market-oriented (i.e. have a low value), they have a relatively high integrative

student feedback culture, an even higher value for competitive advantage in student-centredness and an even higher value for internal cooperation.

- On the other hand, those who perceive the current organisational culture as a market-oriented one have low values for these orientations, but relatively higher values for student complaint handling, student-centred education, and openness to learn and collaborate within the sector.
- In terms of desired values that define organisational culture, the situation is similar for employees who do not desire a market culture: they have a high integrative student feedback culture, an even higher competitive advantage in student-centredness and a higher value for internal cooperation.
- On the other hand, those who have a strong desire for a market organisational culture have a very low internal cooperation, as well as a very low student-centred education, but a high integrative student feedback culture and the highest openness to learn and collaborate within the sector.

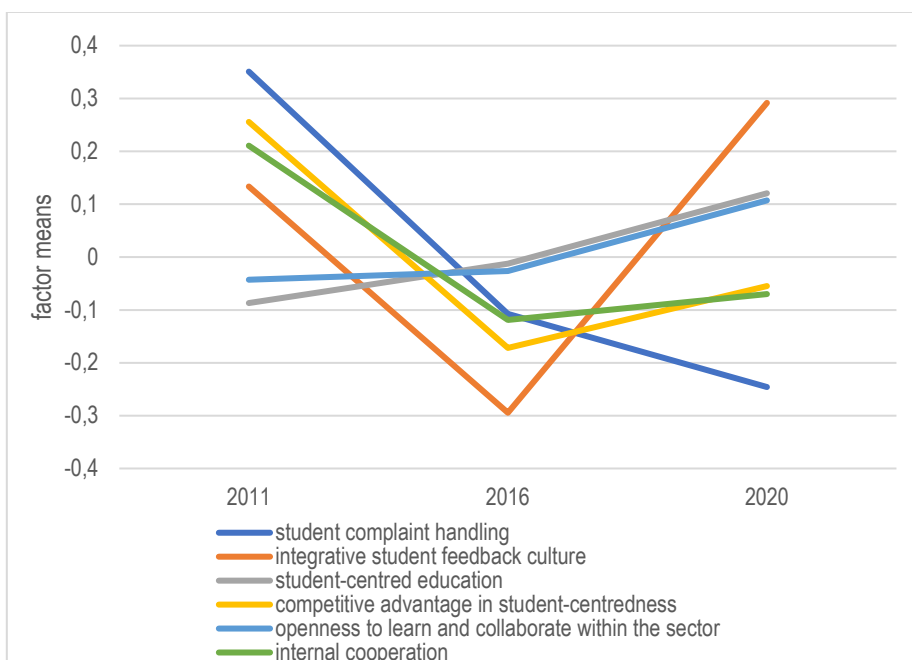


Figure 1: Means of factor scores in the examined years

Source: Own

The above characteristics are based on significant differences ($p < 0.05$).

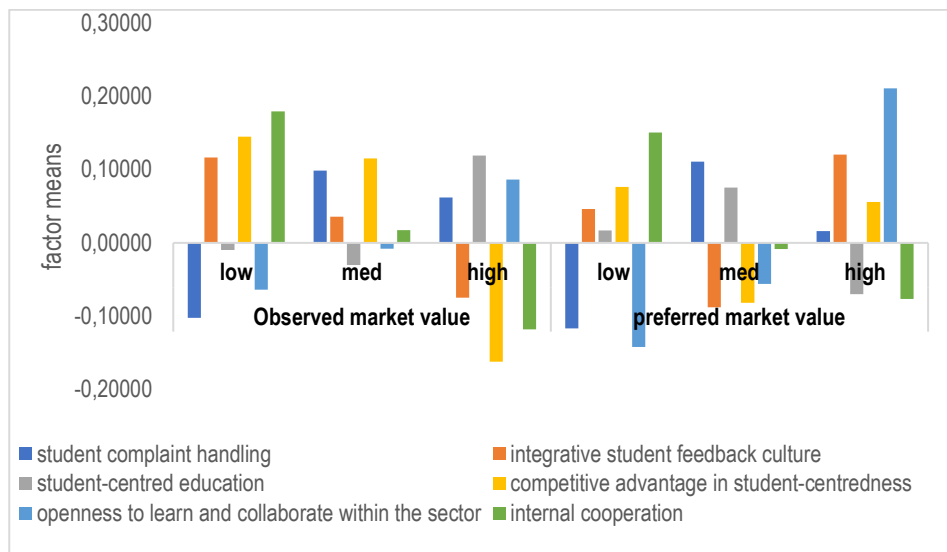


Figure 2: Means of factor scores in different market dimension groups (low/med/high)

Source: Own

4 Findings and conclusions

With the above mentioned methodological innovation of establishing a valid link between the results of the CVF questionnaire and the MARKOR scale with the aim of constructing factors within the cooperation categories, two vividly different subcultures could be identified in BBU.

One is the more internally oriented group of people, who do not consider the present organisational culture as a market-oriented one. As it is reflected in their cooperation factors (namely high integrative student feedback culture, an even higher value for competitive advantage in student-centredness and an even higher value for internal cooperation) these members desire less market-orientation in terms of competition or collaboration with competitors but stay student-focused. Their sole market perspective is based on satisfying the needs of students as customers with the collaboration of internal stakeholders.

The other counter subculture is more externally oriented, opened for competition, less student focused and also more opened to learn through collaboration with external partners. These members perceive the present organisational culture as not market-oriented enough and wish to work in a more opened culture. However, in this subculture, internal collaboration and student-orientation is not in focus.

The results raise a serious managerial dilemma for the University's leadership. Since the respondents of the research were all lecturers, no non-academic staff had been involved, therefore two opposing views of the front-line value creating members (i.e. lecturers, professors) are present at the same time. More research is needed on the demographic details of the two subcultures to start establishing some kind of a cultural harmony and shared understanding on the market-orientation of higher education. There seems to be a long road ahead.

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YOU ONLY LIVE TWICE! – THE INTERRELATIONS OF AMBIDEXTERITY AND GREEN TRANSITION

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Wineries and their managers today are increasingly demonstrating the critical role of ambidextrous leadership in balancing the maintenance of traditional winemaking methods with advancement towards green transitions. This form of leadership, which involves both exploiting existing capabilities and exploring new opportunities, is essential in navigating the complexities of modern winemaking. Ambidextrous leaders in family-run wineries excel not only in preserving the rich heritage of winemaking but also in embracing ecological innovation and sustainability. The dual capability extends to aligning the goals of the family and the business. Ambidextrous leaders skilfully manage family relationships, values and objectives while ensuring that these align with the business' growth, innovation, and environmental stewardship goals. By doing so, they create a harmonious blend of family unity and business success. This approach allows wineries to integrate respect for traditional winemaking with a commitment to environmental protection, signifying a progressive industry that honours its past while contributing positively to the future. Ambidextrous leadership in wineries thus emerges as a key factor in achieving a sustainable and successful balance between tradition and modernity, family values and business goals and environmental consciousness and industry progress.

Keywords:

family
business,
ambidexterity,
family
winery



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1 Introduction

In recent times, the concept of organizational ambidexterity has gained notable prominence in entrepreneurship and innovation research. This idea, referring to the concurrent engagement in exploratory and exploitative activities, plays a pivotal role in understanding the functioning of business entities, particularly in the context of family-run enterprises.

Family-operated businesses make up approximately two-thirds of businesses worldwide and contribute between 70-90% of the global GDP ((De Massis et al, 2015). For these enterprises, ambidexterity proves to be a particularly useful strategy to survive (Moss et., 2014), but it also presents significant challenges (Miller & Le-Breton Miller, 2006). Family businesses are characterized by making strategic decisions with a longer time horizon in mind, often thinking in terms of long-term investments (Zellweger, 2007). Their socioemotional attributes (Gomez-Meija et al, 2007) foster this long-term orientation, enabling them to leverage their long-term perspective and strategies as a competitive advantage (Miller & Le Breton Miller, 2005)

In examining family-owned wineries, one can observe numerous positive values associated with family businesses such as socioemotional and inheritable assets. These assets serve as essential support, valuable resources in sustaining the business. Our research specifically focuses the winemaking industry, chosen due to its unique blend of familial and business challenges. This industry offers a distinct perspective on addressing these challenges, formulating both short and long-term goals and the decision-making processes involved. The wine sector offers an excellent opportunity to study the characteristics of sustainable enterprises including family legacy and heritage, dynastic or generational patterns and a deep-rooted appreciation and knowledge of viticulture and nature passed down through generations.

Our study aims to present, through a case study, how certain wineries incorporate organizational ambidexterity and to evaluate its effects on their operational activities.

2.1 Exploitation and exploration

Organizational ambidexterity, defined as the concurrent pursuit of execution of exploitative and exploratory endeavours (Raisch & Birkinshaw, 2008) is acknowledged as a key determinant of corporate performance. Exploitative activities focus on quality and efficiency, enabling companies to refine and optimize their current business operations. Exploratory activities aim at uncovering new opportunities, prospects, future products, and services, etc., thereby bolstering long-term competitiveness. (March, 1991).

The concept of managerial and organizational ambidexterity is interrelated. The decision-making style and leadership approach, along with the established organizational culture, directly influence the organization's overall capability to successfully manage and integrate its immediate and strategic objectives. This ambidextrous nature also embodies dual temporal aspects: a short-term dimension reflects the organization's agility in responding to emerging challenges, while the long-term aspect focuses on sustained growth, development, and continuity.

Burns and Stalker (1961) highlight that varying environmental scenarios necessitate different organizational structures. Companies operating in stable environments tend to adopt hierarchical organizations models, whereas those in dynamic environments are more likely to function in more organic systems. Organizations need to adapt to changing environments for long-term competitiveness, which requires more flexible and organic structures. (Thompson, 1967). March (1991) points the essential balance between adequate engagement in both sufficient exploitative and explorative activities. Gibson (2004) and colleagues argue that certain organizations can simultaneously perform various activities of both natures.

The harmony between exploitation and exploration can be perceived as synergy of innovation and routine operational tasks. Innovation demands inventive, creative thinking, exploration of further opportunities and the pursuit of new horizons. In contrast, efficient business operations require attention to detail, minimization of errors, and stringent control (Levinthal & Posen, 2008). However, while the outcomes of exploitation are more immediately observable, the benefits of exploration activities are not only uncertain and unpredictable but also typically emerge over an extended period (Uotila et. al, 2009).

The goal of exploration lies in generating novel ideas, products, services, and processes, involving the integration of diverse knowledge, expertise, and “out-of-the-box” thinking (Goel & Jones, 2016). Here, the concept and capability of variety is crucial (Kammerlander et al, 2002). Increased variety fosters more creativity, as fragments of knowledge can be merged to generate new ideas and concepts (Austin, 2003). This the diversity in variety is especially significant for leaders of family businesses when making exploratory decisions.

2.2 Organizational ambidexterity in family businesses

Organizational ambidexterity holds equal importance in family-owned businesses as it does in non-family enterprises. Due to their familial nature these enterprises experience different organizational advantages and disadvantages with innovation (König et. al, 2013). Furthermore, their approach to managing innovation also tends to differ (Chrisman et.al, 2015). Their tendency towards risk aversion (Bammers, Notelars & Van Gils, 2014, De Massis & Pizzurno, 2012) makes achieving organizational innovation more challenging. They often pursue a mix of economic and non-economic goals (Chrisman et al., 2015), which can lead to significantly different behaviour that influence governance structures and consequently organizational ambidexterity. However, characteristics such as their orientation towards long-term goals (Sirmon & Hitt, 2003) can facilitate organizational ambidexterity (Miller & Miller, 2006). The temporality of goals is a critical aspect for family businesses, determining the time frame for achieving desired outcomes. Short-term goals usually focus on immediate or near future results, while long-term goals are set for a prolonged period, often spanning years or even decades. Balancing and aligning these short and long-term goals is essential for the sustainability of the business.

Leadership in these enterprises usually rests in the hands of the founder or a leading family member. Among their key responsibilities is the decision-making related innovation. The decision-making processes, influenced by internal dynamics, are pivotal determinants in a company’s pursuit of organizational ambidexterity (O’Reilly & Tushman, 1997). Such dynamics include the appropriate allocation of resources within the organization (Güttel & Konlechner, 2009), the leadership style of the leader (Gibson & Birkinshaw, 2004) and the integration of external knowledge (Gupta et al, 2006).

2.3 Balancing family and business organizational ambidexterity

In family-run businesses, aligning both time-based elements and the interplay between family and business aspects is essential. The family aspect emphasizes nurturing family bonds, relationships, upholding family values and goals, the perpetuating family unity and harmony. It includes the transmission of family values and traditions, and the encouragement of cooperation among family members. Such family values are interwoven into the company's operations, integrated within the business activities laying the cultural and ethical foundations of the enterprise.

On the business side, the focus shifts to the operational, expansion, continuity, and longevity aspects of the company. This encompasses efficient management of everyday business activities, including financial and resource management and strategic planning. It involves developing and executing long-term growth plans such as market expansion, product development and innovation, and ensuring the business's sustainability and longevity. This also involves succession planning and goals aimed at maintaining and securing stability.

Organizational ambidexterity in this context signifies the capability of the family business to synchronize family interests and goals with those of the business. This harmonization allows the company to find a balance between preserving family traditions and values and fostering business growth and innovation. This harmonious alignment of dual goals typically becomes more pronounced in the later generations of a family business (Haag et. al, 2023).

3 Methodology

Our research incorporates a case study of two wineries, involving six semi-structured interviews with leaders of the two wineries along with two additional family members from each winery. Utilizing the case study method is particularly relevant in examining the phenomenon of organizational ambidexterity as this methodology allows in-depth analysis and comprehensive examination of the specific context. The distinct and complex characteristics of organizational ambidexterity are often more pronounced in winemaking, making the case study approach especially insightful for better understanding its multifaceted nature (De Massis & Kotlar, 2014) and complexity (Eisenhardt, 2007) as well.

The selected wineries are situated in Hungary's Tokaj and Szekszárd wine regions. Hungarian viticulture has a long and rich history and tradition with regions like Tokaj, Villány and Szekszárd being celebrated for their exceptional wine-producing conditions and internationally recognized wines. The winemaking industry in Hungary is experiencing growth, encompassing a diverse range of small and medium-sized enterprises to larger wine companies.

Winery (W1) was founded in 1987, but the family has been cultivating grapes and making wines for sixteen generations dating back to 1631. Currently the cultivated area is fifty-three hectares, with an annual wine production of sixty-thousand bottles. In 2021, the number of employees was twenty.

Winery (W2) is located at the southern border of Szekszárd. the company diversified its operations beyond winemaking to include hospitality and gastronomy. The family began purchasing vineyards in 1985 constructed their estate in 1999. Since the beginning over one hundred and sixty hectares of vineyards are under their own cultivation, the annual wine production is more than 200.000 bottles.

Data collection took place between January 2022 and July 2022. In selecting the family-owned businesses for our research, the definition formulated in 2019 by the Budapest Business University's Budapest Lab Business Development Centre was applied (Kása et al., 2019). Accordingly, a business was considered a family business if it met the following conditions:

1. identifies itself as a family business, or
2. at least 51 percent of the company is owned by one family, and
3. the family participates are involved in managing the business, or
4. the family members are employed in the in the operation of the company,
or
5. the transfer of the leadership and ownership occurs partly or entirely within the family.

Another key factor in selecting samples for our study was ensuring that each family business fell under the category of a micro, small, or medium-sized enterprise (SME). This classification implies that the company that: (a) operates with a structure and

size distinct from large industrial firms; (b) employs a small number of employees; (c) holds notable importance within the regional or local economy.

To assess and analyse organizational ambidexterity, we established specific codes reflecting the leader’s activity related to organizational or familial goals.

Table 1: Codes for the leader’s ambidextrous activity

Winery	Exploitative activity codes	Explorative activity codes
Winery 1 (Tokaj region: Mád)	Related to organizational goals	Related to organizational goals
	Related to family goals	Related to family goals
Winery 2 (Szekszárd region)	Related to organizational goals	Related to organizational goals
	Related to family goals	Related to family goals

Source: own editing

4 Analysis

Organizational ambidexterity – defined as the integration of exploration and exploitation capabilities – manifests in two distinct forms in the businesses studied. The first form revolves around the pursuit of discovering new opportunities and innovation, emphasizing change, risk taking, and creativity. Secondly, exploitation focuses on the efficient use of existing resources and the optimization and refinement of current business models and processes.

Leaders in these businesses demonstrate the ability to synchronize both short and long-term goals, as well as to align the needs and the resources of the business and the family. Acknowledging the widely accepted view in literature that in first generation family businesses, the goals, entrepreneurial orientation, and mindset predominantly mirror the leader’s personality, aims, and competencies (Zellweger & Sieger, 2010), it becomes clear that the organization’s ambidextrous capability reflects the leader’s own ambidexterity. The number and complexity of goals is also greater due to inclusion of the family-oriented objectives; thus, leaders face the additional task of managing family-related considerations. This dual thinking and ability were especially noticeable in the approach of the leader of the second winery (W2), which manifested in the following ways:

- a. Efficient and rapid decision-making
- b. Innovation skills: *“We do not know what future holds, so it’s more about searching for the right path”* (I34)
- c. Persistence: *“I’m going to Florida and conducting wine tastings”* (I34)
- d. Intuitive and analytical thinking: *“80% of the wines we ship in containers are stand quality, for five-euro wines. The middle category 10 % are high quality and another 10% are extra premium. and now we have just sent a container to Florida.”* (I32)
- e. Creativity and problem-solving: *“The processes are faster now, I don’t have to taste a hundred barrels every month myself, someone else does that, because I have a lot of other things to do. Tasks are distributed.”* (I32)
- f. Continuous change management
- g. Combined management of traditional and new resources: *“I handle the exports, I am constantly on the road., I write the grant applications, handle the implementation after approval, the accounting and the financing.”* (I32)
- h. Efficient allocation of organizational resources between existing business activities and new opportunities, and proper alignment of family-sourced and external human resource, such as in the marketing department.
- i. Emotional intelligence in balancing family- and business-related goals: *“There’s the statue of the grandfather in the cellar, holding a bunch of grapes, and his picture is in the restaurant. We tell about our history in the magazine we look back on. It’s important to mention that we’re not a first-generation winery. This winery, this family farm, has a significant history.”* (I32)

In the businesses studied, the leaders’ abilities are crucial in balancing the goals of the business and the family. The leaders’ ambidextrous abilities are reflected in the dual capabilities of the organizations, where due to the increased number of family goals, leaders need to handle additional tasks and responsibilities. In one of the wineries (W2) the ambidextrous ability of the leader manifests in multiple areas, including efficient and rapid decision making, analytical skills, resilience, intuitive thinking, creativity and problem-solving, continuous change management and the integration of traditional and new resources. This leadership versatility extends to the effective allocation of resources, including the alignment of family-sourced and external human resources. Equally important is the leader’s emotional intelligence which plays critical role in maintaining and honouring the family’s history, values, and traditions.

Among the responsibilities of the leaders of both wineries decision-making related to innovation stands out, which is partly observed through the appropriate management of resources. They maintain a balance between current production activities and innovations. Furthermore, the leaders demonstrate remarkable adaptability, which involves flexibility in responding to varying situations. This includes, for example in case of Tokaj winery (W1), the diverse use of the Furmint grape variety, such as in the production of Aszú wine and the creation of dry white wines, which involve adapting to current market preferences and trends while also maintaining traditional Aszú production.

In the Szekszárd winery (W2), a notable strategy involves the integration of external knowledge and experts. This is reflected in their approach to understanding market analysis and adoption of sustainable practices and improvements in areas like spraying techniques, packaging, and quality control processes.

In the family-owned wineries we examined, the concept of ambidexterity related to family goals involves a harmonious combination of exploratory and exploitative activities, which is crucial in their management approach. For the first winery (W1) exploration is demonstrated through ongoing updates and continuous modernization of marketing strategies and constant development of the product portfolio (such as introducing truffle products and their own coffee brand featuring homegrown ingredients), and business expansion. These exploratory efforts are key in adopting sustainable practices and establishing of a long-term vision that resonates the family's values and goals.

On the exploitative side, the focus is on maximizing the use of existing resources, expertise, knowledge, and relationships. At winery 1 (W1) this includes the application of generations of accumulated winemaking and viticulture knowledge and experience. Such exploitation helps the family uphold their reputation for high-quality products and strengthen their market position. For both wineries, leveraging family connections and mutual relationships with local communities is essential for ensuring long-term stability and sustained growth.

In the wineries we analysed, both dynamic exploration and adaptive exploitation coexist, providing a stable foundation for future development and growth while preserving their unique identity and building a devoted customer base.

The shift towards environmentally sustainable practices, such as the introduction of organic viticulture, requires a sensitive approach that ambidextrous leadership provides. Organic viticulture and other eco-friendly practices are complex processes that seek a balance between traditional methods and environmental consciousness, ecological awareness, making exploitation and exploration particularly significant in the context of winemaking.

At Winery 1 (W1) the adherence of traditional winemaking methods handed over generations was prominently observed. With a heritage in viticulture and winemaking dating back to the 16th century, these methods serve not only to preserve the quality of the Aszú wine but also uphold the cultural legacy and heritage of the Tokaj wine region. Ambidextrous leaders in this context must skilfully balance the preservation of longstanding traditions with the incorporation of contemporary, innovative solutions.

The commitment to environmental sustainability extends green practices like improved water management, utilisation of renewable energy, minimizing harmful chemicals use. This approach not only reduce environmental impact but also contribute to the wineries' long-term sustainability. This approach enables a balance between respecting traditional winemaking methods and a dedication to environmental stewardship.

5 Conclusions

The role of ambidextrous leadership is becoming ever more crucial in family-owned wineries, where it is necessary to strike a balance between preserving traditional winemaking traditions and transitioning towards green, environmentally friendly practices. This type of leadership is increasingly essential in navigating the complexities of modern winemaking. In our study, we used the case study method to illustrate how leaders of certain wineries exercise and apply their ambidextrous abilities, with a special focus on green transition and its implications for their business operations.

Table 2: Ambidextrous ability in family businesses

	Exploration	Exploitation
Ambidexterity related to organizational goals	Fostering future market competitiveness	Generating immediate profit
	identifying business opportunities	Boosting operational efficiency
	Acquisition of new industry-specific knowledge	Utilizing existing knowledge and experience
	Securing external financial resources	Relying on patient capital
	Innovating product and organizational innovation	maintaining established products and conventional processes
	EU funding	
Ambidexterity related to family goals	Planning for family development	Capitalizing on family resources and skills
	Succession planning	Preservation of family traditions and values
	Articulating a clear mission	Drawing on family knowledge and experience
	Participating in external training programs	Leveraging family connections
		Supporting of the family

Source: own editing

In our study of the wineries, we observed that ambidextrous leadership combines traditional and modern, eco-friendly environmentally conscious practices. This approach enables the wineries to uphold their heritage and identity, while also committing to environmental stewardship and the well-being of future generations. Ambidexterity, as an important element in family wineries, is characterized by two key aspects: a short-term dimension, highlighting the business’s ability to adapt to immediate challenges and changes, and a long-term dimension, focusing on overall growth and development. Our findings indicate that in addition to aligning temporal goals, there is also a crucial integration of familial and business aspects. The family dimension concentrates on family relationships, values, goals, and preserving family units, while the business dimension is centred on managing day-to-day operations and fostering business growth.

Ambidextrous capability is necessary bivalent attribute for a successful family business, not only referring to the ability to simultaneously manage present and future tasks but also to combine emotional and rational perspectives. For leaders, the dilemma and challenge lie in reconciling the conflicting demands of exploratory and exploitative activities, especially since preserving family traditions and values often aligns more with exploitation strategies. Meanwhile, fostering innovation and change, and engaging the next generation require more exploratory efforts.

Literature often cites characteristics such as long-term orientation, single-person leadership, and a milder organizational control (Sirmon & Hitt, 2003) as facilitators of ambidexterity in family businesses. Long-term orientation supports the simultaneous pursuit of stability while concurrently keeping innovation in focus. This focus can help balance current activity optimization with the identification of new opportunities and prospects. Single-person leadership style enables flexibility and quick decision making may limit innovation processes and strategic flexibility. Softer control approach, on the other hand, encourages experimentation and creativity, fostering a more relaxed work environment, which allow employees to try out new ideas.

This approach of the wineries reflects a progressive, forward-thinking attitude within the industry, likely enabling adaptation to evolving changing market conditions and societal expectations. Such ambidextrous leadership equips wineries to positively engage in sustainable practises while honouring their rich heritage.

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LIFE CYCLE ANALYSIS OF THE EUROPEAN BANKING SECTOR'S ESG PERFORMANCE

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Business stakeholders are becoming more involved in environmental, social, and governance (ESG) aspects. There is an increasing awareness in the financial services industry of the importance of incorporating ESG factors into strategies, processes, and financial tools to generate value over the medium and long run. While a vast body of literature examines the connection between ESG factors and company performance, only a few studies have specifically investigated the financial services industry, often employing linear models. This research specifically examines the ESG performance of the financial services industry. It utilizes a life-cycle framework to analyze the patterns and relationships of European companies in the sector. This analysis is conducted using linear panel regression models. The study's conclusions serve as crucial benchmarks for investment managers and policymakers. The findings illustrate that superior, enhanced ESG performance can bolster the financial success of industry participants.

Keywords:

ESG,
bank,
life
cycle
analysis

1 Introduction

The impact of businesses on society and the environment beyond the economy has been debated since the mid-20th century. Business enterprises, embedded in society and the physical environment with concentrated decision-making power and therefore of great importance in many ways, affect the natural and physical environment, society, and the lives of those who interact with them. Following a period of quiet economic growth in the second half of the last century, the importance of environmental problems and the social impacts of business activities have been highlighted as social responsibility, business ethics, and the relationship with the environment have grown beyond financial indicators and become embodied in a growing concern for sustainability. Studies and organisations are using sustainability, CSR, and ESG more than ever. The above terms are often used synonymously. Despite similarities, there are important differences. Overall, the terms have different meanings. Perhaps the broadest of the three terms is sustainability. Definitions of sustainability are endless. Sustainability encompasses CSR, ESG, and other concepts. Financial services CSR, ESG, and sustainability concerns are growing due to regulation compliance, market expectations, and societal influence. These issues are crucial to financial services companies' long-term success, risk mitigation, and opportunity discovery.

This study evaluates the banking sector's environmental, social, and governance (ESG) performance, maturity, and life cycle ESG considerations. Which companies have best implemented ESG practices and the ESG rating system? Does ESG performance correlate with financial performance metrics at different maturity levels? We start by examining sustainability and ESG performance, metrics, and prior empirical findings to answer these questions. We will then introduce the dataset and methods, draw conclusions, and propose a feasible implementation.

2 Sustainability and ESG performance

2.1 Definitions

Sustainability is the process of running and advancing to meet the needs of the current generation while protecting the Earth's life-sustaining system, which is vital to future generations (Griggs et al., 2013). Sustainable development integrates

economic, social, environmental, and resource factors for long-term viability. It needs thorough consideration and contemplation on all these levels. The phenomenon links current and future generations, making it forward-looking (Soppe, 2004). The phrase ESG originated in 2004. Three components underpin ESG. Environmental criteria, represented by E, include the company's energy use, waste, resources, and their effects. Finally, it covers climate change and carbon emissions. A company's social criterion is its reputation and relationships in the communities and institutions where it operates. S encompasses diversity, inclusion, and labor Relations. Corporate governance involves adapting methods, controls, and procedures to manage and make effective decisions in line with the law and to satisfy external stakeholders. ESG codifies all this for investors and shareholders in a transparent and quantitative method to compare companies. It helps the company communicate its environmental and social goals in a practical way. Planning ESG values and measurements is company-specific. Even with robust ESG factor data and reporting, some organizations may implement qualitative ESG incentive targets. ESG stakeholder goals and values must be chosen to meet targets, improve stakeholder value, and not be window dressing or greenwashing (Kay et al., 2020).

As mentioned, company aims and missions have changed greatly throughout the recent century. In the past, investors paid mostly for physical assets to buy land, but today corporations are valued for intangibles like reputation, company culture, and customer loyalty. Public opinion of firms has also changed from financial market participants to social and environmental actors. ESG suggests a trade-off between short-term rewards and long-term value. ESG-performing companies perform better in ecologically and socially related areas and give higher expected returns to its legitimate shareholders, proving that doing good pays off. Material bad occurrences are more frequent in underperforming companies. Poor ESG performance can cause double-digit market cap losses (Huang, 2022).

2.2 Performance metrics

In the 2010s, corporations developed ESG performance indicators to measure goals. This system is popular because it comprehensively evaluates companies' sustainability efforts and results. It goes beyond sustainability as an investor risk and provides insights into corporate sustainability for most stakeholders in corporate operations. ESG indicators focus on sustainability risks and maturity. If stakeholders

have genuine concerns and expectations about sustainability and ESG performance indicators accurately and effectively measure business organizations' sustainability performance, then corporate ESG maturity can predict medium- and long-term success and efficiency. Commercial banks' role in the monetary system, the economy, and financial stability cannot be overstated. This alone necessitates an industry analysis. Through lending, banks connect with many economic actors and help start and grow businesses. Thus, banks may benefit from ESG studies of corporate clients. The current study examines banks' ESG maturity and internal financial ratios.

The size of a company can be measured by market capitalization, assets, employees, or board of directors. Studies have consistently found a positive correlation between commercial bank size and ESG rating. Big banks have more resources to execute ESG activities, which may improve ESG scores and performance (Jaiwani & Gopalkrishnan, 2023). Due to their regulatory background, larger banks have produced more detailed sustainability reports for longer periods. They can now focus on sustainability issues for a longer time (Lamanda & Tamásné Vóneki, 2024). The life cycle approach suggests that a bank's ESG rating improves as it spends more time on sustainability issues. As a company grows, its stakeholders grow, increasing the need for responsibility, visibility, and awareness.

Thus, ESG disclosure increases (El Khoury et al., 2023). The average major financial institution has been more proactive and engaged in ESG efforts for longer, improving their ESG performance. To meet investors' and regulators' latest standards, banks often overinvest in ESG initiatives (Michael et al., 2023). Board size and composition matter: larger boards with female and independent directors perform better in ESG maturity (Gurol & Lagasio, 2023). Some studies also suggest that ownership structure and bank size may affect ESG activities (Jaiwani & Gopalkrishnan, 2023).

Early research on ESG maturity and financial performance has found conflicting results. Contrary to expectations, social ESG practices have hurt financial performance but improved efficiency (Jaiwani & Gopalkrishnan, 2023). One possibility is that banks' ESG scores negatively affect their financial performance. Less profitable banks publish more ESG information and prioritize its improvement to offset their poor financial performance (El Khoury et al.). Performance changes

show that banks' sustainability performance improves as sustainability initiatives and ESG programs grow. However, this does not necessarily improve financial performance, even over time. The complexity of isolating additional influences makes this difficult to study (Ahmed et al., 2019). A different study finds a positive correlation between ESG reporting and bank profitability. This suggests that banks that outperform in ESG have better financial results (Gurol & Lagasio, 2023).

3 Analysis of the data set

3.1 Presentation of the data set and ESG rating methodology

The study focused on a population of 181 businesses included in the Refinitiv Eikon database. These organizations were classed in the banking sector under Financials / Banking & Investment Services / Banking Services / Banks. All of them were located in the European Union and were operational in 2023 (as of the query date: 13 December 2023). The examination of ESG life cycle attributes, utilizing their data, concentrates on the timeframe spanning from 2013 to 2022. Out of the total of 181 banks, only 4 were registered during the period being studied. This means that 177 banks were already operating in 2013. Additionally, 110 banks did not have any ESG ratings for any of the years being reviewed. There were only 2 banks that fell into both of these subpopulations. As a result, 74.5% of the total population (68 banks) were able to be analyzed from an ESG perspective without any bias caused by changes over time. Therefore, we have chosen to focus our further analysis solely on these banks.

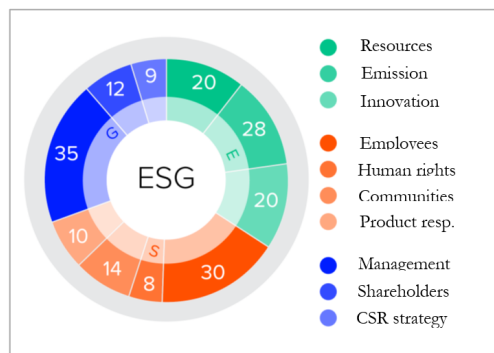


Figure 1: ESG assessment sub-domains in Refinitiv's assessment methodology

Source: Refinitiv, 2022

Refinitiv employs around 630 company-level variables to enter into its ESG assessment model, which evaluates and classifies sustainability risk. To account for the unique characteristics of each sector, the indicators used are limited to those specific to the industry. In all instances, the ESG values are derived from the 186 most relevant indicators to the industry, with a weighting selected for the sector. The input indications that constitute the pillars can be categorized into ten groups, enhancing the evaluation context's complexity (Figure 1). In addition to the ESG composite indicator value, the scores for each particular pillar are also published on the output side. The allocation of weight to the several pillars in the composite indicator is likewise distinctive to each sector: the significance of the environmental and social pillars differs among industries, whilst the governance pillar remains constant across all sectors. The pillars and the composite indicator output are evaluated on a scale of 0 to 100 (Refinitiv, 2022).

Based on an analysis of 68 companies, it can be inferred that the ESG composite indicator and the rank correlation between the pillars indicate that the overall evaluation of the sector being studied is primarily influenced by the social and governance pillars. This means that the significance of sustainability factors, which affect both the financial performance of banks and their impact on the environment, is predominantly interpreted within these areas. It is comprehensible, considering the overall significance of corporate governance and the sector's substantial involvement in the economic process, which can have significant social consequences. However, the sector's direct environmental impact is relatively minor compared to sectors like transportation or energy. Nevertheless, the robust and noteworthy association between the scores of the pillars indicates that the methodology views sustainability programs as an intricate system.

Out of the 68 farms surveyed, 66.2% (45) had a consistent ESG score for all 11 years. The number of individuals who have obtained certification (ESG rating) is consistently growing each year. The descriptive statistics depicted in Figure 2 indicate that the companies that initially fulfilled the ESG reporting criteria maintained their certification in the following years. Only one bank had missing data for a year after obtaining certification, suggesting a sustained dedication to ESG initiatives.

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. xtdescribe
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ID:	1, 20, ..., 3735	n =	68
Year:	2013, 2014, ..., 2022	T =	10
Delta(Year) = 1 unit			
Span(Year) = 10 periods			
(ID*Year uniquely identifies each observation)			

Distribution of T_i:							
min	5%	25%	50%	75%	95%	max	
1	2	6	10	10	10	10	

Freq.	Percent	Cum.	Pattern
45	66.18	66.18	1111111111
6	8.82	75.0011111
5	7.35	82.3511
3	4.41	86.76111
3	4.41	91.18	...111111
2	2.94	94.121111
1	1.47	95.591
1	1.47	97.06	...1111111
1	1.47	98.53	..11111111
1	1.47	100.00	(other patterns)
68	100.00		XXXXXXXXXX

Figure 2: Descriptive statistics

Source: Own

Furthermore, the influence of the changing regulatory landscape is apparent, alongside societal expectations. This is demonstrated by a significant rise in the use of sustainability reporting in non-financial reporting during the late 2010s. As a result, there has been a notable increase in the number of companies that qualify for ESG assessment (Figure 3).

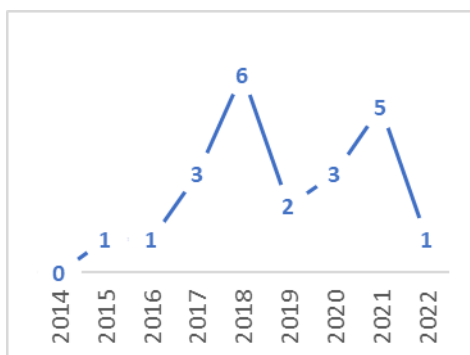


Figure 3: Number of first-time ESG-certified organizations in the population for a given year

Source: Own

Simultaneously, one could contend that creating an information system for ESG rating is highly intricate and demanding endeavor that requires substantial resources. Out of the 110 banks that were already in operation in 2013, only 46 were ESG certified (meaning they reported their environmental, social, and governance practices) in that year. In the following 10 years, out of the 131 new institutions, only 22 managed to establish an ESG framework and obtain certification.

3.2 The time dimension of ESG initiatives

In order to assess the development of ESG maturity, we examined the data of banks that were assessed for each year within the specified period, searching for recurring trends. By analyzing the entities' scores over time, it is evident that the rating scale used in Refintiv's developed methodology is appropriate. The scores of each entity are spread out across the scale, and this distribution is proportional. However, it should be noted that the distribution does not follow a normal pattern based on statistical tests (Figure 4). The scores for the environmental leg exhibit significant variation when compared to the other two pillars. The diagram also demonstrates that overall ESG maturity results in substantial enhancements in the social and governance aspects. However, for the environmental aspect, the evolving expectations and limited range of effective initiatives limit the potential for considerable advancements in this domain.

Based on the results, sustainable and responsible tourism prioritises environmental and natural sustainability over social sustainability, culture, ethics, and destination care. This highlights the significance of the 'E' pillar in ESG, which is also evident in other sectors.

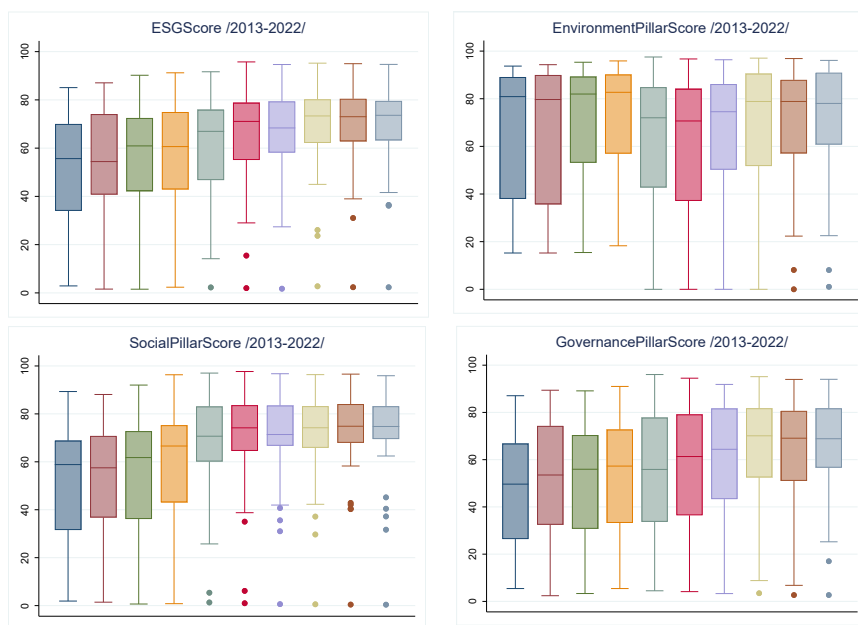


Figure 4: Box plot of the composite indicator and the scores of the pillars for each year

Source: Own

Variable	Mean	Std. dev.	Min	Max	Observations
ESGScore overall	61.45651	21.46191	1.525472	95.74035	N = 450
between	19.19802	2.171675	90.28753		n = 45
within	9.971829	14.45325	88.12234		T = 10
Enviro-e overall	66.64265	27.06048	0	97.53115	N = 450
between	24.16542	8.644335	95.04658		n = 45
within	12.64939	17.78306	114.8584		T = 10
Social-e overall	64.25688	22.59861	.3861998	97.67497	N = 450
between	19.40472	.9000333	91.28672		n = 45
within	11.90384	-.2303826	93.75473		T = 10
Govern-e overall	57.79159	24.04703	2.407407	96.0329	N = 450
between	21.14427	3.739116	88.44745		n = 45
within	11.83811	19.13753	94.88768		T = 10

Figure 5: Descriptive statistics for the panel

Source: Own

The composite indicator outputs and variable values of the pillars exhibit an approximate average of 60 on a continuous scale ranging from 0 to 100. Among the pillars, the environmental pillar exhibits the highest average, while the management

pillar demonstrates the lowest average. The variance, which represents the variation in individual scores, is greatest for the environmental pillar. This means that the scores in this area are the most diverse, as demonstrated in Figure 5. The scores are dispersed throughout the entire measuring scale based on the minimum and maximum scores. By utilizing the panel data structure, it was feasible to examine the degree of variation in organization's ratings compared to peers and their own scores over time. Regarding the former (between), the indicator value (Standard deviation) is significantly higher. This means that even though the scores of the companies change from year to year, each entity has unique characteristics that confirm the suitability of the individual valuation approach. The observed banking sector exhibits a low variance in capturing changes across the observation period. However, notable fluctuations in scores can still be noticed, even within a short timeframe. The ESG composite indicator scores per firm improved by an average of 2.06 points per year, with a standard deviation of 6.30, as determined by the difference between consecutive years. When comparing scores from years that are further apart, the average positive change in ESG scores per unit of time is nearly constant. However, the variability of the change is growing. The fixed-effect linear panel model also confirms that a larger number of rated years results in a significantly higher ESG score: the completion of ESG initiative year on year results in a higher ESG score by 2.3 points on average, *ceteris paribus* (Figure 6).

. xtreg ESGScore ESGScoreOld, fe						
Fixed-effects (within) regression				Number of obs	=	450
Group variable: ID				Number of groups	=	45
R-squared:				Obs per group:		
Within = 0.4423				min	=	10
Between = .				avg	=	10.0
Overall = 0.0955				max	=	10
corr(u_i, Xb) = -0.0000				F(1,404)	=	320.45
				Prob > F	=	0.0000
ESGScore	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
ESGScoreOld	2.306426	.1288432	17.90	0.000	2.053139	2.559713
_cons	48.77117	.7994509	61.01	0.000	47.19956	50.34277
sigma_u	19.19802					
sigma_e	7.8504523					
rho	.85673985	(fraction of variance due to u_i)				
F test that all u_i=0: F(44, 404) = 59.80				Prob > F = 0.0000		

Figure 6 - Fixed effect panel model with ESG score as a dependent variable and number of years rated as an explanatory variable

Source: Own

3.3 ESG and financial performance

A strong correlation was observed between the ESG index and companies' total assets (Figure 7). This might be construed as a sign that bigger corporations, which often possess greater resources and prominence, might have a higher ability or willingness to invest in and execute ESG projects. This may be attributed to increased public scrutiny, the possibility of greater effects on sustainability objectives, or a more robust financial capacity to allocate resources towards ESG policies. It indicates that the size of a corporation, as determined by its total assets, may be related to its dedication to and success in environmental, social, and governance aspects.

. xtreg ESGScore TotAssets, fe						
Fixed-effects (within) regression			Number of obs	=	419	
Group variable: ID			Number of groups	=	42	
R-squared:			Obs per group:			
Within	=	0.0179	min	=	9	
Between	=	0.3432	avg	=	10.0	
Overall	=	0.2804	max	=	10	
corr(u_i, Xb) = 0.1877			F(1,376)	=	6.84	
			Prob > F	=	0.0093	
ESGScore	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
TotAssets	1.48e-11	5.65e-12	2.62	0.009	3.67e-12	2.59e-11
_cons	55.77523	2.327763	23.96	0.000	51.19816	60.35229
sigma_u	16.125222					
sigma_e	9.819837					
rho	.72947494 (fraction of variance due to u_i)					
F test that all u_i=0: F(41, 376) = 26.00				Prob > F = 0.0000		

Figure 7: Fixed effect panel model with ESG score as a dependent variable and Total assets as an explanatory variable

Source: Own

We also analyzed the relationship between corporations' operating cash flow, capital expenditures (CAPEX), dividend distribution, and their ESG ratings. The European banking sector exhibited no meaningful correlation in any of these instances. Nevertheless, we discovered a noteworthy outcome regarding the weighted average cost of capital and profit after tax. The latter behaviour is unexpected but may also be unique to the sector. Putting profit after tax in context is challenging because banks use legal accounting practices to stabilize it artificially (Takács et al., 2020). We

observed a substantial positive correlation, while the explanatory capability was small. The feeble yet substantial positive correlation for total liabilities is even more surprising. This implies that companies with greater debt may be allocating resources towards ESG activities to advance their expansion plans or bolster their public image. This suggests that there is recognition that implementing robust environmental, social, and governance (ESG) standards can result in more favourable financial conditions for lenders who are increasingly taking sustainability considerations into account when making loan choices. It could also suggest that companies use their debts to fund sustainable initiatives that enhance their ESG ratings (Figure 8).

```

. xtreg ESGScore TotLiab, fe
Fixed-effects (within) regression      Number of obs   =    419
Group variable: ID                    Number of groups =    42

R-squared:                             Obs per group:
  Within = 0.0161                       min =          9
  Between = 0.3385                       avg =         10.0
  Overall = 0.2760                       max =         10

corr(u_i, Xb) = 0.2247                    F(1,376)       =    6.17
                                           Prob > F       =   0.0134

```

ESGScore	Coefficient	Std. err.	t	P> t	[95% conf. interval]
TotLiab	1.42e-11	5.72e-12	2.48	0.013	2.96e-12 2.55e-11
_cons	56.33007	2.227955	25.28	0.000	51.94925 60.71088
sigma_u	16.316801				
sigma_e	9.8284916				
rho	.733767	(fraction of variance due to u_i)			

```

F test that all u_i=0: F(41, 376) = 26.16      Prob > F = 0.0000

```

Figure 8: Fixed effect panel model with ESG score as a dependent variable and Total Liabilities as an explanatory variable

Source: Own

4 Conclusion

The study's findings indicate that the identified characteristics particular to the life cycle and the strong relationships between individual performance metrics and the ESG indicator yield a practical conclusion. If an organization acquires an ESG certification, they will maintain the certification in subsequent years. This analysis includes firms who were still active during the last year of the study, ensuring that factors such as dissolution or transformation do not influence the results. Therefore, it can be concluded that as time progresses, the likelihood of a firm having or having

had an ESG certification increases. The correlation between total assets, total liabilities, and ESG scores implies that organisations' financial size and dedication to sustainability are closely linked for professionals in the field. Companies should use their financial resources to improve their ESG programs. This can positively impact their reputation, risk management, and attractiveness to investors. For banks, implementing sustainable financing methods brings societal and environmental benefits and offers strategic advantages by improving their competitive position and aligning with global sustainability trends. This demonstrates the growing significance of the ESG phenomena.

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UMETNA INTELIGENCA: NOVI ZAPOSLENEC V SLOVENSKEM NACIONALNEM GOSPODARSTVU?

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Začela se je nova tehnološka revolucija! Umetna inteligenca (UI) lahko popolnoma spremeni vse vidike človeškega življenja. V tem prispevku bomo razpravljali o uvajanju umetne inteligence v slovenski zasebni sektor in o tem, kako to področje, ki združuje računalništvo in robustne podatkovne zbirke, omogoča reševanje problemov. Z uporabo večstopenjskega postopka zbiranja podatkov smo lahko opredelili več oblik umetne inteligence, ki so trenutno prisotne v slovenskem zasebnem sektorju. Rezultate empirične raziskave smo ovrednotili z intervjujem s strokovnjakom, ki uporablja orodja, podprta z umetno inteligenco, za celovitejše razumevanje prednosti in morebitnih posledic uvajanja umetne inteligence v zasebnem sektorju. Glede na našo raziskavo je pričakovati, da bo umetna inteligenca v bližnji prihodnosti z odpravo potrebe po človeškem dejavniku ukinila več poklicev v slovenskem zasebnem sektorju. Po drugi strani pa naj bi se pojavili novi poklici, ki bodo temeljili na človeškem dejavniku, ki bo sodeloval z umetno inteligenco in ne proti njej.

Ključne besede:

umetna
inteligenca,
strojna
inteligenca,
strojno
učenje,
tehnološka
revolucija

ARTIFICIAL INTELLIGENCE: A NEW EMPLOYEE IN SLOVENIA'S NATIONAL ECONOMY?

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A new technological revolution has begun! Artificial intelligence (AI) has the potential to completely revolutionize every aspect of human life. In this paper, we'll discuss the implementation of artificial intelligence in Slovenia's private sector and how this field that combines computer science and robust datasets enables problem-solving. Utilizing a multi-step data collection process, we were able to identify several forms of artificial intelligence currently present in Slovenia's private sector. The results of the empirical research were evaluated through an interview with a professional who utilizes AI-assisted tools for a more comprehensive understanding of the advantages and eventual consequences of implementing artificial intelligence in the private sector. According to our research, artificial intelligence is expected to put an end to several professions in Slovenia's private sector by eliminating the need for human factors in the near-distant future. On the other hand, new professions are expected to emerge and will be based on the human factor working with artificial intelligence and not against it.

Keywords:

artificial
intelligence,
machine
intelligence,
machine
learning,
technological
revolution

1 Introduction

When we use the term artificial intelligence (AI) today, in most cases, it's perceived as a relatively new concept related to information and communication technologies (ICT). Artificial intelligence is one of the oldest and broadest fields of computer science that deals with mimicking the functions required for real-life problem-solving and building that interact, learn, and think just like a real human being would. Artificial intelligence (AI) is a relatively newer term. In its initial phases of research and development, it was known simply as "machine intelligence" (MI) (Poole et al., 2010) in stark contrast to human intelligence (HI) (Russell & Norvig, 2010).

Artificial intelligence is currently rising in popularity due to its unique technical capabilities which are primarily based on the concept of machine learning (ML). Machine learning (ML) is a segment of artificial intelligence-driven by the development of new statistical learning algorithms that were complemented by large amounts of quality data (Abadi et al., 2016). The aim of ML and AI is to evolve into actual software capable of mimicking learning from previous experiences and using available information to mimic active decision-making/problem-solving (Holzinger et al., 2019).

This unique field that combines computer science and robust datasets to enable problem-solving was named: "artificial intelligence" by John McCarthy in 1956 (known as the father of AI). But why are we developing artificial intelligence, and do we need it to improve our lives? According to Poole of the University of Cambridge, the answers can be traced back to ancient civilizations. Throughout history, human beings have been developing technological solutions to improve and model themselves. The earliest traces of human innovation can be found in ancient China, Egypt, and Greece. Innovation has always been the main engine for improving standards of living throughout human history. (Poole et al., 2010).

As AI-assisted tools gain in popularity, across the world, industries and companies are racing to scale up their AI capacities. Artificial intelligence has the unique potential to completely revolutionize the way we do business and conduct our lives. It is considered by many to be the most important technology for the development of the 21st century. With the potential for serious technological, economic, social, and strategic implications, many governments have started adopting national AI

development strategies legal rules, and regulations to take proper advantage of the technology's vast potential (Heumann & Zahn, 2018). As is the case with most modern ICT technologies, the cost of AI-assisted software is gradually decreasing with constant developments and updates. This means that more and more businesses are getting the opportunity to tap into this new venture and integrate AI-assisted software with their own ICT infrastructure and systems to gain a competitive advantage. With the global rush to implement AI-assisted software and the shortage of experts in the field, companies are facing several problems in several areas from human resources management (HR) to information and communications technologies (ICT) (Painoli & Datrika, 2021).

Innovating and incorporating any new form of technology is highly disruptive to business operations because it makes existing ICT infrastructure and systems obsolete. Nevertheless, business must evolve and develop to meet the demands of a dynamic and constantly changing global market. The development and successful integration of AI-assisted software is the basis for enhanced performance of all other technologies and the evolution of modern industries. At the business level, some of the notable benefits of successfully integrating AI-assisted solutions are the rapid unveiling of patterns in big data, speedy visualization and analytics, improved product design, delivering meticulous insights, etc. The potential long-term benefits of successfully integrating AI-assisted solutions include the development and evolution of new services, expansion of business operations, improved performance, cost-effectiveness, etc. (Soni et al., 2019).

Despite the extraordinary potential that AI possesses, a large percentage of companies in Europe still reject incorporating it as a tool. According to the national statistics study on the use of AI in European Union member states conducted by Eurostat in 2022, only about 8% of companies surveyed have incorporated some form of AI-assisted software. According to Eurostat 2022, the company size and the use of AI-assisted software are positively correlated. In Austria, 92% of small companies, 85% of medium-sized companies, and 74% of large companies have not yet considered incorporating AI-assisted software (Statistik Austria, 2021 & Grünbichler, 2023). In contrast, 58% of Chinese companies, 57% of India's companies, 48% of Canadian companies, and 25% of United States companies are actively using AI-assisted software in their business operations (Cardillo, 2023).

Despite AI's potential in business, why is its deployment in European Union countries so low? The answers may lie in some of AI's potentially negative effects on the labor market. Over the years, many concerns have been raised by political officials and labor unions about the potentially negative consequences of implementing AI-assisted tools and solutions on a mass scale in businesses. There is growing concern that incorporating AI in markets would in turn make the labor markets unstable, cause stunt wage growth, and cause a long-term secular decline in both the labor markets and economies. The development of AI in the following decades and the effects its implementation can have on the global economy and societies have the potential to rival the great Industrial Revolution of the 19th century (Ekwueme et al., 2023).

According to West & Allen, despite a widespread lack of familiarity, AI is a technology that is currently transforming every aspect of human life. AI is a wide-ranging tool that enables people to rethink how they integrate information, analyze data, and use the resulting insights to improve decision-making. AI is not some kind of futuristic phantasy, but rather something that is already here and being integrated with and deployed in a variety of sectors such as finance, national security, health care, criminal justice, transportation, and smart cities. There are numerous examples where AI already is making an impact on the world and augmenting human capabilities in significant ways (West & Allen, 2018).

When it comes to our country of interest, according to the Slovenian Artificial Intelligence Society (SLAIS), research into the development of AI began in Slovenia in 1972 at the Computer Science Department of the Jozef Stefan Institute (JSI) in Ljubljana and continued at the Faculty of Computer and Information Science (FRI), University of Ljubljana. At the Jozef Stefan Institute, an AI research group was founded in 1979 and incorporated into an AI laboratory in 1985. In 1995, the Department of Intelligent Systems was established by merging of the Artificial Intelligence Laboratory and the Language and Speech Technology Laboratory. At the FRI, the AI Laboratory was founded in 1981. Both research groups (at JSI and FRI) were led by Professor Ivan Bratko and closely cooperated. Both groups were successful and grew in terms of achievements, employed and newly trained researchers, international collaborations, and projects (SLAIS, 2023).

As is the case in other countries, in August 2020, the Slovenia government released a draft of a national program promoting the development and use of AI in the Republic of Slovenia by 2025 (NpUI). The NpUI aims to reinforce human resources in AI along three lines using the following actions: 1) updating formal educational curricula at all levels providing AI-related knowledge and skills, 2) supporting professionals in acquiring AI skills at work, 3) raising general awareness, understanding and knowledge of AI in the entire population.

The Slovenian Government aims to update the education system, from primary school to secondary level, to include relevant digital and computational thinking topics, and promote and integrate AI-related topics into tertiary-level curricula. The objective is to provide future generations with the necessary skills and competencies in AI and to anticipate labor market trends (Slovenia, 2020 & AI Watch, 2020).

2 Methodology

2.1 Purpose of research

The purpose of this research is to gain a better understanding of the effects of deploying AI-assisted and based software in companies and businesses that make up Slovenia's private sector.

2.2 Research design

This research was a multistep data collection process divided into two phases. In the first phase, a detailed literature review was carried out with the aim of better understanding the origins and effects of deploying artificial intelligence in companies and organizations. The information obtained from our literature review was interpreted by our working professional (active user of AI assisted and based software) who also provided her opinion on the effects of deploying AI-assisted software in privately owned companies and businesses that make up Slovenia's private sector.

2.3 Qualitative research in Slovenia

The interviewee was selected based on her professional experience in the relevant field and availability. The interview was arranged and conducted live in November of 2023 in Ljubljana (Slovenia) and lasted for one hour (60 minutes). The interviewee allowed the interview to be recorded on a voice recorder. The recorded tape was analyzed to write an accurate interview transcript that was returned to the interviewee for evaluation. The interviewee deemed the transcript to be accurate and legitimate.

2.4 Research tools development (interview)

The interview for this research consisted of five questions related to the field in question. The interview questions were composed based on modern and relevant professional literature in the relevant field with assistance from an automated AI-assisted chat service (ChatGPT).

3 Interview with an active user of AI based tools

According to our interviewee, artificial intelligence (AI) is becoming a critical component responsible for enhancing the strategic goals of companies that make up the private sector. AI's role in modern companies is primarily transformative. It offers companies the benefit of enhanced efficiency, customer satisfaction, data-driven decision-making, innovation, and overall competitive advantage. As AI continues to evolve, its integration into business strategies is likely to deepen, offering even more opportunities for growth and innovation.

Some of the challenges companies face when implementing AI-assisted tools include proper integration of AI platforms and frameworks with the existing IT infrastructure and systems, maintaining and updating AI solutions which must be carried out by a dedicated team of experts in the field, shortage of skilled professionals that grasp the potential of AI tools, potential resistance from employees fearing job displacement, eventual ethical barriers, etc. AI systems require large amounts of high-quality data. Poor data quality or lack of relevant data can hinder AI performance.

Integrating AI-assisted tools into existing IT infrastructure can be complex and disruptive and requires a high degree of proficiency and technical skill to execute properly. Since AI technology is still in its early development stage and is relatively new, one of the issues most companies are facing now is the shortage of qualified/skilled professionals who can develop and manage AI systems. Larger companies that work with artificial intelligence are tackling this issue by sending their employees on specialized training programs, external experts, or partnering with AI service providers. The costs of implementing AI-assisted tools are also one of the major challenges that companies face. One has to keep in mind that AI-assisted tools are an investment and should be treated as such by the company management. Companies need to address several key legal and ethical issues to ensure that their AI tools are deployed responsibly and in compliance with legal regulations and ethical standards.

With AI often relying on large sets of personal data, maintaining the privacy and security of this data is crucial. Organizations should adhere to data protection laws like GDPR and implement robust cybersecurity measures. For European companies, they must operate by obeying the EU AI Act. Determining who is accountable for the decisions made by AI systems is essential. Organizations should establish clear guidelines on accountability, ensuring that AI systems are monitored and managed by qualified personnel. Staying updated with and adhering to the evolving regulatory landscape governing AI is important. Organizations should actively engage with regulators and policymakers to understand and influence how AI is governed. AI in the private sector is expected to have a significant impact on the workforce, affecting various industries and job roles in different ways.

The key to future business success lies in proactive planning, investing in employee development, and fostering an adaptable, learning-oriented workforce. According to our interviewee, AI represents an opportunity for developing new job profiles and evolving the existing ones. According to her professional experience, all industries and jobs are susceptible to disruption and as AI continues to reshape industries, job descriptions need to evolve to reflect new realities. Organizations should focus on creating clear, dynamic job descriptions that capture the growing role of AI, while also emphasizing the irreplaceable value of human skills and creativity.

Successful implementation of AI-assisted tools in a company depends on a combination of strategic planning, stakeholder engagement, leadership skills, and open communication. The company itself must have clearly defined objectives and its leadership a more than solid understating of the potential risks and benefits of implementing AI-assisted tools. Open and transparent communication with employees and all parties involved is essential.

4 Discussion

A new digital revolution that will rival the great Industrial Revolution of the 19th century has begun. Artificial intelligence (AI) has the potential to completely revolutionize every aspect of modern human life. As all major changes have their deep roots, so does artificial intelligence. Contrary to popular belief, the concept of artificial intelligence dates back to the 1950s when the term was coined by John McCarthy (known as the father of AI). Since its inception, the purpose of developing artificial intelligence as a field of information and communications technologies (ICT) was to simply test the feasibility of mimicking human creativity and thinking processes. The results of the initial research and developments in the field were described as: “machine learning” (one of the vital components of modern artificial intelligence).

Modern artificial intelligence is a field of ICT that combines robust datasets, algorithms, and machine learning to enable problem-solving by mimicking human thought processes. Realizing its unique and lucrative financial potential, software development companies worldwide are working on further development and integration of AI-assisted components into software-based solutions. In modern business, performance is the name of the game. Every business owner is looking for ways to increase productivity and cut down on operational expenses. The integration of artificial intelligence with existing and basing developing software on it allows for just that.

As our interviewee stated: “Artificial Intelligence is becoming a critical component in aligning with and enhancing the strategic goals of businesses in the private sector. As technology continues to evolve, its integration into business strategies is likely to deepen, offering even more opportunities for growth and innovation.”

It has to be pointed out that the concept of implementing AI-assisted tools and developing future software on it is not equally popular worldwide. Asian countries such as China and India (which represent future tech giants) have a high AI implementation rate in businesses. Artificial intelligence requires large amounts of data to operate which is something that China and India can provide. On the other hand, European businesses seem to show more resistance due to the potentially negative implications of implementing AI-assisted tools in modern workplaces.

The fear of AI-based software eliminating the need for a human impute is real and justified. AI's unique technological qualities such as "machine learning" are already redefining certain professions. To counter the potentially negative effects of implementing AI-assisted and based software, many governments have passed national strategies regulating the development and implementation of AI in modern workplaces.

The research and development of artificial intelligence has its roots in Slovenia as well. The first research and development centers were formed back in the 1970s and remain active to this day. The Slovenian Government aims to update the education system, from primary school to secondary level, to include relevant digital and computational thinking topics, and promote and integrate AI-related topics into tertiary-level curricula. The objective is to provide future generations with the necessary skills and competencies in AI and to anticipate labor market trends.

5 Conclusion

The purpose of this research is to gain a better understanding of the effects of deploying AI-assisted and based software in companies and businesses that make up Slovenia's private sector. According to our literature review, artificial intelligence (AI) is a revolutionary field of computer science that is currently redefining many aspects of modern business. AI is a field of ICT that combines robust datasets, algorithms, and machine learning to mimic human creativity and thought processes and utilize them for industrial purposes.

According to our interviewee, artificial intelligence is slowly becoming a critical component responsible for enhancing the strategic goals of companies that make up the private sector. It offers companies the benefit of enhanced efficiency, customer

satisfaction, data-driven decision-making, innovation, and overall competitive advantage. As AI continues to evolve, its integration into business strategies is likely to deepen, offering even more opportunities for growth and innovation. Successful implementation of AI-assisted tools in a company depends on a combination of strategic planning, stakeholder engagement, leadership skills, and open communication. The company itself must have clearly defined objectives and its leadership a more than solid understating of the potential risks and benefits of implementing AI-assisted tools. Open and transparent communication with employees and all parties involved is essential.

Since its inception in the late 1950s, research and development of artificial intelligence has moved up significantly. AI is currently being integrated with existing search and work engines to provide a more simplified and personalized experience for the user. Software development companies are integrating and basing their tools on AI to provide more cost-efficient, integrative, customizable, and productive solutions. Such AI-based software solutions are currently eliminating the need for human impute in certain professions. On the contrary, new professions based on utilizing AI-assisted and based tools are emerging along with new possibilities.

Throughout this research, we came to an interesting realization that research into artificial intelligence has been continuously carried out in Slovenia since the late 1970s. Slovenia pretty much follows European Union-level trends in implementing AI-assisted and based tools in businesses and has imposed strict legal regulations on the matter. The Slovenian Government aims to update the education system, from primary school to secondary level, to include relevant digital and computational thinking topics, and promote and integrate AI-related topics into tertiary-level curricula. The objective is to provide future generations with the necessary skills and competencies in AI and to anticipate labor market trends.

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Appendix

Interview

1. Strategic Alignment:

How do you see artificial intelligence aligning with the overall strategic goals of businesses in the private sector? Can you provide examples of how AI has been effectively integrated into existing business strategies?

2. Challenges and Solutions:

What are the key challenges that organizations face when implementing AI in their operations, and how can these challenges be effectively addressed? Are there specific tools or approaches that you find particularly effective in overcoming these obstacles?

3. Ethical Considerations:

As AI becomes more prevalent in the private sector, what ethical considerations do you think organizations need to take into account? How can businesses ensure that their AI applications are deployed responsibly and in compliance with ethical standards?

4. Impact on Workforce:

How do you foresee the integration of AI impacting the workforce in the private sector? Are there specific industries or job roles that are more susceptible to disruption and what measures can organizations take to mitigate negative impacts on employees?

5. Adoption and Implementation Strategies:

What strategies have you observed to be successful in facilitating the adoption of AI technologies within private sector organizations? Are there specific best practices or lessons learned that you would recommend for a smooth and effective implementation of AI programs and tools?

POMEN PODNEBNEGA ZAKONA ZA ZELENI PREHOD

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Vključevanje ciljev zelenega dogovora EU v evropsko in nacionalno zakonodajo je bistvenega pomena za sprejemanje in izvajanje družbenih odločitev na področju nizkoogljičnega krožnega gospodarstva in podnebno nevtralne celine. Uresničitev podnebnega cilja EU glede zmanjšanja emisij EU za vsaj 55 % do leta 2030 je postala z evropskimi podnebnimi pravili pravno obvezna za države članice. Države članice EU so obvezne sprejeti novo zakonodajo, da bi uresničile ta cilj in dosegle podnebno nevtralnost EU do leta 2050. V Sloveniji za področje zelenega prehoda daje ključne usmeritve in zavezujoče pravne okvire predlog podnebnega zakona. Določbe zakonskega predloga vključujejo ukrepe za zmanjševanje emisij toplogrednih plinov in za prilagajanje podnebnim spremembam ter ekonomske in finančne instrumente, potrebne za zeleni prehod.

Ključne besede:

zeleni
dogovor,
podnebna
kriza,
evropska
zakonodaja,
javna
razprava,
podnebni
zakon

THE MEANING OF THE CLIMATE LAW FOR THE GREEN TRANSITION

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Integrating the objectives of the EU Green Deal into European and national legislation is essential for the adoption and implementation of social decisions in the area of a low-carbon circular economy and a climate-neutral continent. Achieving the EU's climate target of reducing EU emissions by at least 55% by 2030 has become legally binding for member states under European climate rules. EU member states are obliged to adopt new legislation in order to realize this goal and achieve climate neutrality of the EU by 2050. In Slovenia, the draft climate law provides key guidelines and binding legal frameworks for the area of the green transition. The provisions of the legal proposal include measures to reduce greenhouse gas emissions and to adapt to climate change, as well as economic and financial instruments necessary for the green transition.

Keywords:

green
deal,
climate
crisis,
European
legislation,
public
debate,
climate
law

1 Uvod

Med ključna sredstva za uresničevanje evropskega zelenega dogovora¹ in dolgoročne podnebne strategije Slovenije do leta 2050² uvrščamo tudi Podnebni zakon.

Zakoni namreč posegajo v bistvene družbene odnose in povezujejo ljudi in njihove organizacije v različne oblike združevanja. Z zakonskim urejanjem postane družbeni odnos tudi pravni odnos oziroma pravno razmerje. V tem razmerju so udeleženci med seboj povezani s pravicami in dolžnostmi, v okviru katerih dosegajo namene svojega povezovanja. Pravna institucionalizacija družbenih odnosov zagotavlja njihovo relativno trajnost ter s tem za udeležence določeno predvidljivost in varnost.

Zato tudi za področje zelenega prehoda daje ključne usmeritve in zavezujoče pravne okvire predlog podnebnega zakona. Ta določa pravice in obveznosti fizičnih in pravnih oseb pri prilagajanju podnebnim spremembam. Določbe zakonskega predloga vključujejo ukrepe za zmanjševanje emisij toplogrednih plinov in za prilagajanje podnebnim spremembam ter ekonomske in finančne instrumente, potrebne za zeleni prehod. Vsebina evropskih in nacionalnih političnih dokumentov o prilagajanju podnebnim spremembam se prenaša v zavezujoče in iztožljive pravne norme predloga podnebnega zakona.

Delovno besedilo predloga Podnebnega zakona je jeseni 2023 pripravilo Ministrstvo za okolje, podnebje in energijo in ga posredovalo v javno obravnavo, ki je trajala do 15. novembra 2023. V tem okviru je bila izvedena tudi javna predstavitev, v kateri so – poleg strokovnjakov iz državne in lokalne uprave - sodelovali številni predstavniki civilne družbe oziroma nevladnih organizacij, gospodarstva in raziskovalnih organizacij.

¹ Evropski parlament je 24. 6. 2021 sprejel evropska podnebna pravila, ki zavezujejo države EU k zmanjšanju izpustov toplogrednih plinov za 55 odstotkov do leta 2030 in doseganju podnebne nevtralnosti do leta 2050. (Dyrhaug, Kurze, 2023) V nadaljevanju je bila sprejeta evropska zakonodaja na področju podnebja in energije, na koncu 9. oktobra 2023PA še revidirana direktiva o energiji iz obnovljenih virov in uredba o letalskem prometu. S tem je bila zaokrožena zakonodajna dejavnost v okviru programa »Pripravljeni na 55«.

² Resolucija o Dolgoročni podnebni strategiji Slovenije do leta 2050, Ur. l. RS 119/21 in 44/22- ZVO-2.

2 Podnebni zakon v javni razpravi

Ob zavedanju, da daje Podnebni zakon zavezujoči okvir za izvajanje podnebnih politik ter za izpolnitev cilja podnebne nevtralnosti do leta 2050 je v smislu sodelovalne in posvetovalne (participativne in deliberativne) demokracije dan velik poudarek vsebini zakona že v predparlamentarni fazi njegovega sprejemanja³. Blaženje podnebnih sprememb in prilagajane nanje bo namreč potekalo prav glede na pravna načela in pravna pravila Podnebnega zakona.

2.1 Funkcije javne razprave

Sodelovanje javnosti že pri pripravi predpisov ima najprej pomembno informacijsko funkcijo. Z različnimi pojavnimi oblikami razpravljanja javnosti o določenih vprašanjih, ki se urejajo z zakonom (ali drugim predpisom), se naslovniki predpisov seznanijo s predvidenimi spremembami. Zato državni organ, ki je pripravljal osnutek zakona tega objavi na svojih spletnih straneh, organizira predstavitve in okrogle mize o predlaganih spremembah, zbere pripombe zainteresirane javnosti. Poleg tega k transparentnosti zelo veliko prispeva medijsko poročanje o predlaganih rešitvah in dilemah, ki jih prinaša nova pravna ureditev.

V tesni povezavi z informacijsko vlogo javne razprave je funkcija aktivacije želenega (pravno konformnega) ravnanja. V javni razpravi se (bodoči) naslovniki predpisov tudi pripravijo oziroma animirajo za njihovo poznejše izvajanje. Nova pravna ureditev, ki jo bo prinesel predpis, naj se nato čim bolj dosledno izvaja v praksi. Javno mnenje torej spodbudi državljane k želenim vzorcem družbenega obnašanja. Javno mnenje pa se dopolnjuje s svobodnim medosebnim in medskupinskim komuniciranjem ljudi, zato ga tudi ni mogoče v celoti nadzorovati, saj del javnega mnenja nastaja spontano, v neposrednih stikih med ljudmi in na podlagi lastnih izkušenj vsakega izmed njih. V delu javnosti se torej odvijajo zunajinstitucionalni procesi, na katere politični režim ne more vplivati.

Naslednja funkcija javne razprave je legitimacijska. Vladajoče družbene skupine si prizadevajo tudi prek javne razprave razložiti in utemeljiti politični režim oziroma

³ »V predparlamentarnem delu zakonodajnega procesa potekata pripravljanje in oblikovanje zakonskega osnutka in predloga.« (Igličar, Bačlija Brajnik, 2023, str. 7).

njegove ukrepe. Tako je mogoče pridobivati državljane za podporo predlagani (novi) pravni ureditvi.

2.2 Zakonodajna sled

K zagotavljanju transparentnosti zakonodajnega procesa prispeva še t. i. zakonodajna sled. Le-ta zagotavlja transparentnost pri podatkih o interesnih skupinah in njihovih lobistih, ki so vplivali na vsebino sprejetega zakona. Lobiranje kot metoda delovanja interesnih skupin oziroma civilne družbe v procesu sprejemanja zakonodaje je lahko dopolnitev demokratičnosti tega procesa, če poteka v skladu s pravnimi in etičnimi pravili.

Zakonodajna sled⁴ prispeva k večji transparentnosti postopkov odločanja, še posebej če seznam vplivov opremimo z informacijo o stališčih, ki so jih posamezni zastopniki interesov vnašali v zakonodajni postopek. S tem se povečuje legitimnost tega postopka ter omogoča, v odprtem in pluralističnem dialogu, na katerega se opira demokratični sistem, tudi večja strokovnost politike in procesov sprejemanja splošnih pravnih aktov. Za potrebe slovenske zakonodajne politike ter procesov pripravljanja in sprejemanja predpisov pa kaže ta prizadevanja nadgraditi in razširiti dokument o zakonodajni sledi s podatki o vseh deležnikih procesa nastajanja zakonov in odlokov iz civilne družbe oziroma splošne in strokovne javnosti, ministrstev oziroma občinskih uprav, vlade in poslancev.

Za seznanjanje javnosti s predlogom Podnebnega zakona je Ministrstvo za okolje, podnebje in energijo pripravilo še posebno javno predstavitev⁵. Ob organiziranih posvetovanjih, delavnicah in medresorskih posvetih ter drugih načinih sodelovanja javnosti, nastajanje Podnebnega zakona sledi zahtevam sodobne deliberativne demokracije.

⁴ Izraz zakonodajna sled (legislative footprint) izvira iz Resolucije Evropskega parlamenta iz leta 2008 (UL C 271 E, 12. 11. 2009) in pomeni »...okvirni seznam, priložen Poročilu Parlamenta, registriranih zastopnikov interesov, s katerimi so bila opravljena posvetovanja in so imeli vpliv pri pripravi poročila«.

⁵ 8. 11. 2023.

3 Podnebna in družbena kriza

Zaradi povečevanja emisij toplogrednih plinov in vztrajnega globalnega segrevanja smo soočeni s podnebno krizo. Porast povprečne svetovne temperature z vsemi svojimi posledicami za naravo in družbo postavlja pod vprašaj dosedanja razvojno in gospodarsko paradigmo. Podnebna kriza pa je le eden izmed vidikov intenzivnega spreminjanja sveta v začetnih dveh desetletjih 21. stoletja.

3.1 Posledice kriznega stanja

Krize nastanejo pogosto zaradi dejavnikov, na katere človek nima neposrednega vpliva, kot so naravne nesreče ali nalezljive bolezni. Večkrat pa so kompleksne krize posledica objektivni okoliščin in človekovega delovanja, na primer na področju gospodarstva z modelom intenzivne industrializacije in pretiranimi posegi v naravno okolje. Slabšanje ugodnih razmer za proizvodno dejavnost navadno odmeva na socialnem področju s poslabšanjem materialnega in družbenega položaja velikega števila ljudi. Vse to se dotakne tudi političnih institucij. Temu se pridružuje kriza vrednot in morale, vse do t. i. krize smisla. Za slednjo nekateri družboslovci iščejo vzroke v procesih modernizacije, pluralizacije in sekularizacije⁶.

Kriza pomeni težaven, zapleten in nevaren položaj, v katerem se pojavi vsesplošno poslabšanje življenjskih pogojev posameznikov in skupin v primerjavi s prejšnjim obdobjem. V družbi se v obdobju krize pojavijo hude motnje glede na njeno dosedanje rutinsko delovanje. Dogodki, ki ogrožajo ustaljeni način življenja na gospodarskem, socialnem, zdravstvenem, okoljskem in kulturnem področju imajo negativen vpliv na družbeni red in povzročajo nelinearno družbeno dinamiko. Posledica tega je negotovost in nepredvidljivost družbenih odnosov, kar vodi v nestabilnost in manjšo predvidljivost pri vzpostavljanju odnosov med ljudmi in delovanju oblastnih organov. Občutki negotovosti in nezadovoljstva destabilizirajo družbeni ustroj.

⁶ Prim.« Berger, Luckmann, 1999, str. 29: »Z gotovostjo pa lahko trdimo, da v visoko razvitih industrijskih deželah, torej tam, kjer je modernizacija najbolj napredovala in je moderna oblika pluralizma najbolj prišla do izraza, redi vrednot in zaloge smisla niso več skupna last vseh pripadnikov družbe.«

3.2 Pravni odzivi na krizo

Posledica tega je tudi slabšanje normativne integracije in to tako v tistem delu, ki izpostavlja »ponotranjenost« (interiorizacija) vrednot in norm v zavesti vsakega posameznika, kot v tistem delu, ki zahteva skladnost med večinskimi družbenimi vrednotami in pravnimi normami. Ob širjenju nezadovoljstva z obstoječim normativnim sistemom, se v kriznem obdobju pojavljajo tudi novi vzorci družbenega obnašanja in novi modeli upravljanja skupnih zadev, ki predvidevajo stabilizacijo razmer in vključujejo tudi preobrazbo normativnih okvirov. Vendar dokler se novi normativni okviri ne zasidrajo v družbeni zavesti, stari vzorci družbenega obnašanja pa izgubljajo na moči, se kriza pojavlja tudi v razvrednotenju vrednot in norm (anomija). Takrat pravni sistem izgublja svojo družbeno funkcijo stabilizacijskega (homeostatičnega) mehanizma, ki zagotavlja pravnim subjektov varnost in predvidljivost pri vzpostavljanju družbenih odnosov. Zaradi kompleksnosti družbenih pojavov oziroma povezanosti vseh delov sodobnih družb se torej pojavljajo krizne razmere tudi na področju pravne regulacije in pravne države na sploh (Schulte, 2011, str. 42).

Toda kljub temu ravno pravni sistem – ob slabitvi religioznih in moralnih pravil – »...ustvari pogoje za vsakodnevno življenje, v katerem lahko ljudje shajajo brez nadrejene in skupne morale.« (Berger, Luckmann, 1999, str. 33). Zato je pravni sistem pogosto edina oporna točka, ki vsaj v minimalnem obsegu omogoča delovanje družbe in njenih institucij v kriznih razmerah. Obenem pa pravni sistem ponudi tudi institucionalne okvire in pravila ravnanja za izhode iz krize. V to funkcijo pravnega sistema je vpet tudi Predlog podnebnega zakona.

Dosedanji primeri za ravnanja državljanov v kriznih razmerah z uporabo pravnih sredstev za zaščito podnebja (Klimaschutz) so lahko ustavne pritožbe v Nemčiji⁷ ali t. i. podnebne tožbe na Nizozemskem⁸. Na splošno je uporaba pravnih sredstev za zaščito podnebja v porastu v vseh državah (Baer, 2023, str. 232). Aktualni primer za institucionalizacijo novega načina ravnanja ljudi in njihovih organizacij glede varovanja okolja v Sloveniji pa je oblikovanje novih pravnih pravil v procesu sprejemanja podnebnega zakona.

⁷ Sklep nemškega Zveznega ustavnega sodišča (Bundesverfassungsgericht), 24. 3. 2021

⁸ Podnebna tožba (Klimaklage) na Nizozemskem proti koncernu Shell 26. 5. 2021

4 Položaj (podnebnega) zakona v nacionalnem pravnem sistemu

4.1 Zakon kot splošni pravni akt

V pravni teoriji je zakon definiran kot splošni pravni akt z najvišjo močjo, ki ga sprejme predstavniški organ v zakonodajnem postopku. Pri tem materialna opredelitev zakona poudarja njegovo splošnost in abstraktnost (Pavčnik, 2020, str. 246). Zakon ne sme urejati konkretnih oziroma posamičnih primerov, temveč le določene tipe vedenja in ravnanja pravnih subjektov. V začetku moderne dobe je že Rousseau v svojem znanem delu *Družbena pogodba* (1762) poudarjal, da je zakon izraz splošne ljudske volje, zato ne zahteva splošnosti le za predmet zakonskega urejanja, temveč tudi za zakonodajalca⁹. S tem so bile začrtane osnovne smeri zakonodaje v evropskem kontinentalnem pravnem sistemu, kjer je postal zakon osrednji formalni pravni vir. V anglo-ameriškem pravnem sistemu pa je mesto osrednjega pravnega vira še vedno ohranila sodna odločba.

Za opredeljevanja zakona je treba upoštevati tudi formalni vidik zakona. Ta zajema organ, ki zakon sprejme in postopek po katerem je zakon sprejet. Celovita definicija poudarja, da zakon vsebuje splošne in abstraktne pravne norme, s katerimi so določene pravice in dolžnosti pravnih subjektov (materialni vidik) in da ta normativni akt sprejema predstavniški organ v vnaprej določenem zakonodajnem postopku.

Splošnost norme pomeni, da njen naslovljenec ni individualiziran, temveč je označen zgolj z neko lastnostjo, ki se nanaša na vnaprej nedoločeno število subjektov. Abstraktnost pravne norme pa kaže na vnaprej zamišljen in predviden dejanski stan. Pravi zakon zato ureja s tipskimi pravnimi pravili vedenje vnaprej nedoločenega števila pravnih subjektov za življenjske situacije, ki bodo nastopile po sprejemu zakona.

Zato je v evropski kontinentalni pravni kulturi potreba po celovitem in sistematičnem urejanju družbenih razmerij najbolj zadovoljena s splošno naravo

⁹ "Toda kadar vse ljudstvo odloča o vsem ljudstvu, tedaj upošteva le samo sebe; in če takrat nastane kak odnos, je to odnos med celotnim predmetom z enega vidika in celotnim predmetom z drugega vidika, tako da ne pride do nobene delitve celote. Tedaj je predmet, o katerem odločamo, obči, kakor je obča volja, ki o njem odloča. In to dejanje imenujem zakon." (Rousseau, 1960 str. 101).

zakona (Novak, 2023, str. 352) in z načelom, da je edino z zakonom dopustno podeljevati pravice in nalagati obveznosti pravnim subjektom. Te posegajo zlasti v sfero svobode in premoženja, tako da zakon ureja bistvene okoliščine človekovega položaja v družbi. To daje zakonu posebno veljavo v pravnem in političnem sistemu, saj zajema najpomembnejše pravne norme, drugi pravni viri pa naj potem zakon le razčlenjujejo in (v okviru zakonskih določb) dopolnjujejo.

Slovenski pravni sistem dosledno sledi navedenemu teoretičnemu pogledu, čeprav je omenjena usmeritev v slovenski ustavi nerodno formulirana¹⁰ ter kljub posledici, ki večkrat privede do kazuistične zakonodaje ali (nesmotrnega) zakonskega določanja norm izrazito tehnične narave. Tej nevarnosti se mora izogniti tudi podnebni zakon. Seveda je to odvisno tudi od zapletenega vprašanja, kdaj imamo opraviti s konstituiranjem novih pravic in dolžnosti, kdaj pa le z razčlenjevanjem že konstituiranih pravic in določanjem načina njihovega izvrševanja.

4.2 Materialna in formalna moč zakona

Materialna moč zakona kaže na njegovo izvajanje v družbeni praksi, medtem ko formalna moč pomeni, da se lahko veljavni zakon spremeni samo z novim zakonom. Materialna moč zakona je odvisna ne le od doslednega spoštovanja zakonodajnega postopka, temveč v veliki meri tudi od njegove vsebinske skladnosti z interesi večine članov globalne družbe, kar pogojuje bolj ali manj dosledno spoštovanje zakonskih določb v praksi. Uresničevanje zakona pomeni, da se pravne norme iz sveta idej (law in books) preselijo v dejansko vedenje in ravnanje pravnih subjektov v fizičnem, realnem svetu (law in life).

Formalna moč zakona je izražena skozi njegovo mesto v določenem pravnem sistemu ter skozi pravilo o prednosti kasnejšega zakona pred prejšnjim¹¹. Zadnji zakon odpravi vse prejšnje zakonske predpise, ki so urejali isto področje družbenih odnosov. Pri tem naj zakon A-1razveljavlja zakon A in ne več zakonov¹². Navedeno

¹⁰ Ustavno normo " Pravice in obveznosti državljanov ter drugih oseb lahko državni zbor določa samo z zakonom" (87. čl. Ustave RS) bi gramatikalno lahko razlagali tako, da kadar o pravicah in obveznostih državljanov odloča državni zbor, to počne pač samo v obliki zakona; vendar kadar o pravicah in obveznostih odloča kakšen drug organ – na primer vlada – pa to ureja ta organ pač z drugimi akti – vlada na primer z uredbo itd., saj ni eksplicitno in nedvoumno rečeno, da pravice in obveznosti v državi določa le državni zbor.

¹¹ Lex posterior derogat legi priori.

¹²To je lahko opravičljivo le kot izjema v izrednih razmerah. Npr. Zakon o interventnih ukrepih za odpravo posledic poplav in zemeljskih plazov iz avgusta 2013 (Ur. l. RS 95/23), ki 1. spreminja in dopolnjuje določbe več drugih

splošno pravilo je razčlenjeno še naprej, glede na to ali je sprejet nov splošni ali specialni zakon, saj kasnejši specialni zakon izključuje prejšnjega splošnega le na svojem področju, ne ukine pa splošnega zakona v celoti¹³. V ta razmerja bo vstopil tudi sistemski Podnebni zakon, ko bo treba opredeljevati njegov odnos do npr. Zakona o varstvu okolja, Zakona o celostnem prometnem načrtovanju, Zakonu o infrastrukturi za alternativna goriva itd.

V hierarhični zgradbi slovenskega pravnega sistema zavzema zakon mesto osrednjega pravnega vira. Z njim morajo biti v skladu vsi drugi splošni in posamični pravni akti, sam pa mora izhajati iz ustave, mora pa biti skladen tudi z načeli mednarodnega prava in ratificiranimi mednarodnimi pogodbami¹⁴. S polnopravnim članstvom Slovenije v Evropski uniji¹⁵ pa so ustanovitvene pogodbe ter uredbe in direktive Evropske unije zavezujoče za slovenskega zakonodajalca, saj ima pravni sistem Evropske unije prednost pred nacionalnim pravnim sistemom.

5 Vpetost Podnebnega zakona v evropsko zakonodajo

V Sloveniji je do 1. maja 2004 zakonodajno pristojnost imel izključno Državni zbor Republike Slovenije. S polnopravnim članstvom Slovenije v Evropski uniji pa je izvrševanje dela te suverene pravice sprejemanja zakonov prenešeno na organe Evropske unije¹⁶.

V teh procesih se kvalitativno spreminja vloga nacionalnega zakonodajalca (parlamenta). S prenosom izvrševanja dela suverenih pravic na organe EU, se tako zmanjšajo »postavodajne« pristojnosti slovenskega zakonodajnega organa (Državnega zbora) na področjih prenesenih pravic, čeprav na teh področjih preko ustreznih postopkov lahko vpliva na odločitve v zakonodajnih telesih EU (Svet

zakonov, 2. določa odstopanje od določb nekaterih drugih zakonov in 3. določa začasne ukrepe na številnih področjih, povezanih z naravno nesrečo.

¹³ Lex posterior specialis non derogat legi priori generali.

¹⁴ 8. čl. Ustave RS: " Zakoni in drugi predpisi morajo biti v skladu s splošno veljavnimi načeli mednarodnega prava in z mednarodnimi pogodbami, ki obvezujejo Slovenijo. Ratificirane in objavljene mednarodne pogodbe se uporabljajo neposredno."

¹⁵ Republika Slovenija je s 1. majem 2004 postala polnopravna članica Evropske unije.

¹⁶ Zakon o ratifikaciji »pristopne pogodbe« med Slovenijo in članicami EU, Ur. l. RS 3/04 –MP- z dne 10. 2. 2004; 3.a čl. Ustave Republike Slovenije: »Slovenija lahko z mednarodno pogodbo, ki jo ratificira državni zbor z dvotretjinsko večino glasov vseh poslancev, prenese izvrševanje dela suverenih pravic na mednarodne organizacije, ki temeljijo na spoštovanju človekovih pravic in temeljnih svoboščin, demokracije in načel pravne države, ter vstopi v obrambno zvezo z državami, ki temeljijo na spoštovanju teh vrednot.«

Evropske unije in Evropski parlament). Ob prenosu izvrševanja dela zakonodajne suverenosti na institucije Evropske unije je torej Slovenija – prek svojih predstavnikov v teh institucijah – udeležena v procesih odločanja oziroma procesih sprejemanja evropskih predpisov.

5.1 Zakonodajni akti Evropske unije

Pogodba o Evropski uniji, kot je bila spremenjena z Lizbonsko pogodbo¹⁷, določa, da so zakonodajni akti Evropske unije tisti akti, ki so sprejeti po zakonodajnem postopku. Po rednem zakonodajnem postopku Evropski parlament in Svet skupaj sprejemata uredbe, direktive ali sklepe na podlagi predloga Komisije.

V pravnem sistemu Evropske unije se pravice in dolžnosti, ki veljajo neposredno za njene državljane in druge pravne subjekte, določajo z uredbo (regulation). Uredba v Evropski uniji ima enako vlogo kot zakon v nacionalnih pravnih sistemih, tako da neposredno nadomešča zakonodajo posameznih držav članic (Moussis, 1999, str. 46) oziroma je zavezujoča v celoti in se neposredno uporablja v vseh državah članicah¹⁸. Z uredbami poteka unifikacija pravnega sistema v članicah. Uredbe sprejema na predlog Evropske komisije Svet Evropske unije skupaj z Evropskim parlamentom. V pravnem oziroma zakonodajnem sistemu Evropske unije je tako poudarjena strokovnost, ki se kaže v demonopolizaciji parlamenta pri zakonodaji oziroma pri oblikovanju in sprejemanju uredb kot osrednjih (sekundarnih) pravnih virov Evropske unije.

Direktiva (a directive) , pa zagotavlja harmonizacijo pravnih sistemov držav članic. Direktiva je nekakšen "okvirni zakon Skupnosti« (Moussis, 1999, ibidem). ki ga morajo članice upoštevati pri svoji nacionalni zakonodaji. Direktiva torej zavezuje vsako državo članico glede rezultatov, ki jih je potrebno doseči, oziroma glede cilja, vendar prepušča nacionalnim organom izbiro oblike in metod. S tem se ob vsebinsko enakih pravnih normah, lahko uveljavljajo še specifike posameznih nacionalnih pravnih sistemov.

¹⁷ Lizbonska pogodba je – po ratifikaciji v vseh državah članicah Evropske unije - pričela veljati 1. 12. 2009. Državni zbor Republike Slovenije je Lizbonsko pogodbo ratificiral 29. 1. 2008.

¹⁸ 288/2 člen Pogodbe o delovanju Evropske unije, katere spremembe in dopolnitve so bile določene s 1. členom Lizbonske pogodbe.

5.2 Prioriteta evropskega prava

Pri učinkovanju evropskega pravnega sistema velja načelo primarnosti evropskega prava uveljavljeno skozi delovanje Sodišča Evropskih skupnosti in eksplicitno razglašeno kot 17. Izjava o primarnosti k Pogodbi o Evropski uniji. To načelo določa, »...da imajo v skladu z ustaljeno sodno prakso Sodišča Evropske unije pogodbe in pravo, ki jih Unija sprejme na podlagi pogodb, prednost pred pravom držav članic...«¹⁹ Skupno evropsko pravo je torej pred nacionalnim pravnim sistemom, kar z drugimi besedami praktično pomeni, da morajo biti vsi pravni akti v Sloveniji skladni z zakonodajnimi akti Evropske Unije.

Poenotenje in izenačevanje pravne nadstavbe evropske globalne družbe oziroma Evropske Unije poteka torej po dveh poteh. Ta dva načina se uveljavljata kot unifikacija (uredba) in harmonizacija (direktiva) prava. Navedena dva načina poenotenja pravnega sistema (unifikacija, harmonizacija) ostajata v bistvu nespremenjena tudi po Lizbonski pogodbi. Na žalost ni bila sprejeta Pogodba o Ustavi za Evropo²⁰, ki je uvajala namesto uredbe evropski zakon ter namesto direktive evropski okvirni zakon.

Ob tem kaže biti pozoren tudi na pravno zavezujočo naravo sodb Sodišča evropskih skupnosti v smislu dopolnjevanja evropskih zakonodajnih aktov (Craig, de Burca, 2008, str. 72). Sodbe Sodišča Evropskih skupnosti sicer nimajo narave sodnega precedensa, vendar oblikujejo ustaljeno sodno prakso, ki se vzdržuje v odločitvah tega sodišča. Poleg tega Sodišče prispeva k skladnemu in enotnemu razlaganju evropskega prava. To je še posebej vidno, kadar se na Sodišče obrnejo za predhodno mnenje nacionalna sodišča, ko uporabljajo predpise evropskega prava. V takšnem primeru imajo razlage Sodišča splošni (erga omnes) učinek.

Odločilna je še norma, ki zavezuje države članice k sprejemu vseh ukrepov nacionalnega prava, ki so potrebni za izvajanje pravno zavezujočih aktov Evropske Unije²¹, kar zopet zagotavlja usklajenost nacionalnega pravnega sistema z evropskim

¹⁹Tej izjavi je dodano Mnenje pravne službe Sveta z dne 22. junija 2007, ki med drugim pravi:« Iz sodne prakse Sodišča izhaja, da je primarnost prava Evropske skupnosti temeljno načelo zakonodaje Skupnosti...Dejstvo, da načelo primarnosti ne bo vključeno v prihodnjo pogodbo, nikakor ne spreminja obstoja tega načela in sedanje sodne prakse Sodišča.»

²⁰ Pogodba o Ustavi za Evropo je bila leta 2005 zavržena na referendumu v Franciji in na Nizozemskem.

²¹ 291/1. člen Pogodbe o delovanju Evropske unije, spremenjene z Lizbonsko pogodbo.

pravom. V primeru nasprotja med pravom Unije in pravom držav članic, prevlada pravo Unije. Sodišče EU sicer nima pristojnosti, da bi razveljavilo določbe nacionalnega prava, ki so v nasprotju z evropskim pravom, toda nacionalna sodišča morajo v primeru navedenega nasprotja uporabiti določila prava EU, namesto določb nacionalnega prava.

Navedeno odvisnost in povezanost obeh pravnih sistemov mora imeti pred očmi tudi zakonodajna politika. Le-ta mora na evropski ravni paziti, da ne prekorači dogovorjenih pristojnosti evropskih institucij, na nacionalni ravni pa morajo zakonodajalci spoštovati - ob siceršnji prirejenosti obeh pravnih sistemov – načelo prednosti evropskega prava. Pri tem evropska uredba nadomesti nacionalno zakonodajo in se uporablja neposredno, tako da se lahko posamezni pravni subjekti nanjo neposredno sklicujejo v postopkih pred sodišči. Naslovniki direktive, ki so zavezujoče glede postavljenega cilja, pa so države članice. Le-te morajo svojo zakonodajo uskladiti (harmonizirati) z direktivami oziroma jih implementirati v nacionalno zakonodajo.

6 Upoštevanje evropskih predpisov v Podnebnem zakonu

V primeru Podnebnega zakona jer prenos izvrševanja predpisov Evropske unije izveden na dva načina.

6.1 Evropske podnebne direktive in uredbe

Najprej se v slovenski pravni red prenašajo direktive o vzpostavitvi sistema za trgovanje s pravicami do emisije toplogrednih plinov v Uniji, o geološkem shranjevanju ogljikovega dioksida, o določitvi metod izračuna in zahtev glede poročanja o kakovosti motornega bencina in dizelskega goriva, o spodbujanju uporabe energije iz obnovljivih virov, o informacijah o ekonomičnosti porabe in emisijah CO₂ v zvezi s trženjem novih osebnih vozil. Za uresničevanje vsebine navedenih direktiv lahko Podnebni zakon samostojno določi oblike in metode.

Za evropske uredbe pa lahko Podnebni zakon uredi le način njihovega izvajanja, ker se ti akti uporabljajo neposredno. To so uredbe o upravljanju energetske unije in podnebni ukrepov (11. dec. 2018), o vključitvi emisij toplogrednih plinov in odvzemov zaradi rabe zemljišč, spremembe rabe zemljišč in gozdarstva v okvir

podnebne in energetske politike (30. maj 2018), o zavezujočem letnem zmanjšanju emisij toplogrednih plinov za države članice v obdobju 2021 do 2030 (30. maj 2018), o snoveh, ki tanjšajo ozonski plašč (31. okt. 2009), o flouriranih toplogrednih plinih (16. april 2014), o vzpostavitvi Socialnega sklada za podnebje (16. 5. 2023), o vzpostavitvi okvira za doseganje podnebne nevtralnosti (30. jun. 2023), o vzpostavitvi okvira za spodbujanje trajnostnih naložb (18. jun. 2020).

Sladno z navedenimi evropskimi predpisi ter ratificiranimi in objavljenimi mednarodnimi pogodbami²² Podnebni zakon vzpostavlja zakonodajni okvir za izvajanje politik, ki zadevajo podnebne spremembe. Osrednji cilj zakona je zato razogljičenje oziroma doseganje podnebne nevtralnosti do leta 2050. S tem bi povečali odpornost družbenih in naravnih sistemov na vplive podnebnih sprememb.

6.2 Slovenski podnebni zakon

Za razumevanje in razlago zakona ter njegovo uporabo²³ so pomembna njegova uvodna načela. Načelo komplementarnosti zavezuje državo in občine pri sprejemanju politik in ukrepov k upoštevanju gospodarskih, družbenih in okoljskih posledic njihovega izvajanja. Podnebne politike morajo upoštevati na naravi temelječe rešitve in prispevati k ohranjanju biodiverzitete. Z vključevanjem strokovne in širše javnosti se vzpostavlja podnebni dialog, ki vodi k čim bolj domišljenim ukrepom. Prehod na podnebno nevtralnno gospodarstvo mora upoštevati državljane in območja, ki bi jih ta prehod lahko nesorazmerno prizadel ter tudi ranljive skupine in na splošno pri vseh ukrepih upoštevati ustavne pravice. Poleg tega Podnebni zakon ponavlja načelo »onesnaževalec plača«, saj mora proizvajalec emisij toplogrednih plinov nositi bremena onesnaževanja okolja.

V nadaljnjih poglavjih vsebuje Podnebni zakon pravna pravila za sprejemanje strategij ter energetskih in podnebnih načrtov. Posebej zakon določa organizacije na področju podnebnih sprememb. Sledi opredeljevanje ukrepov za zmanjševanje

²² Zakon o ratifikaciji Pariškega sporazuma, Ur. l. RS - Mednarodne pogodbe, št. 16/16 in 6/17.

Pariški sporazum temelji na Okvirni konvenciji Združenih narodov o spremembi podnebja, ki ima za cilj ohranitev dviga povprečne globalne temperature občutno pod 2 °C v primerjavi s predindustrijsko dobo oziroma, da se dvig temperature omeji na 1,5 °C v primerjavi s predindustrijsko dobo, saj bi se tako občutno zmanjšala tveganja in učinki podnebnih sprememb

²³ Prim: »V bistvu pravnega sistema leži antinomija, povzročena vsled dualizma: pravo kot tekst in pravo kot proces interpretacije in izvrševanja tega teksta.« (Pitamic, 2019, str. 46)

emisij toplogrednih plinov in ukrepov na področju rabe zemljišč. Določbe o trgovanju s pravicami do emisij toplogrednih plinov so povezane s sistemom za monitoring, evidencami in poročanjem ter ekonomskimi in finančnimi instrumenti²⁴. Posebej so opredeljena pravila za ravnanje s fluoriranimi toplogrednimi plini in ozonu škodljivimi snovmi ter posebne zahteve za biogoriva. Ker se bodo morali vsi deležniki t. im. zelenega dogovora pri svojem delovanju ravnati v skladu z normami Podnebnega zakona, je za ugotavljanje upoštevanja zakonskih določb predviden upravni, inšpekcijski in finančni nadzor.

Za izvajanje določb podnebnega zakona bo potrebna visoka stopnja pravne zavesti. Ob zavedanju po vedno večji kritičnosti državljanov oziroma njihovo manjšo pripravljenost za dosledno ravnanje po zakonih. To postane še posebej vprašljivo, kadar imajo državljanji občutek, da so določeni zakoni krivični oziroma slabi, se pravi, da imajo ti zakoni nizko stopnjo legitimnosti. V slovenskih razmerah se je kritičnost do take vrste zakonov izrazito povečala v zadnjih treh desetletjih, saj se je konformnost v smislu brezpogojnega pokoravanja vsakršnim zakonom zmanjšala od dvotretjinskega deleža koncem sedemdesetih let prejšnjega stoletja, preko ene polovice koncem osemdestih let, na eno tretjino koncem devetdesetih let in v začetku 21. stoletja. Zato bo moral Podnebni zakon stremeti k visoki stopnji legitimnosti, kar bo zagotavljalo njegovo dejansko učinkovitost in preprečevalo razkorak med normativnim in stvarnim.

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²⁴ Npr. t. im. Eko-sklad.

DIGITALNI KOPILOT V PROJEKTNEM MANAGEMENTU: VKLJUČITEV CHATGPT V 4PM

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V tem prispevku, opisujemo proces integracije ChatGPT v sistem za upravljanje projektov, imenovan 4PM, ki ga je razvilo podjetje Arctur. Ta integracija predstavlja pomemben korak v evoluciji projektnega managementa, saj združuje napredno umetno inteligenco ChatGPT z obstoječimi orodji in metodologijami. Osredotočili smo se na vsak korak razvoja integracije, od začetnih idej do končne izvedbe, in raziskali, kako lahko ChatGPT služi kot digitalni kopilot, ki asistira pri različnih fazah projektnega managementa. S praktičnimi primeri demonstriramo, kako je ta integracija izboljšala učinkovitost, olajšala proces odločanja in optimizirala komunikacijo med člani ekip. Ta prispevek ne le ilustrira, kako umetna inteligenca lahko spreminja tradicionalne pristope k vodenju projektov, ampak tudi ponuja vpogled v našo vizijo prihodnosti, kjer tehnološke inovacije nadgrajujejo obstoječe prakse in odpirajo nove možnosti za povečanje učinkovitosti v projektne managementu. Prispevek prikazuje, kako lahko integracija umetne inteligence ustvari bolj povezan, intuitiven in odziven sistem za upravljanje projektov, kar prinaša bistvene prednosti vsem vpletenim.

Ključne besede:

ChatGPT,
digitalni
kopilot,
integracija,
umetna
inteligenca,
management

DIGITAL CO-PILOT IN PROJECT MANAGEMENT: INTEGRATING CHATGPT IN 4PM

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In this post, we describe the process of integrating ChatGPT into a project management system called 4PM, developed by Arctur company. This integration represents a significant step in the evolution of project management, as it combines the advanced artificial intelligence of ChatGPT with existing tools and methodologies. We focused on every step of the integration development, from initial ideas to final implementation, and explored how ChatGPT can serve as a digital copilot, assisting in various stages of project management. With practical examples, we demonstrate how this integration has improved efficiency, facilitated decision-making processes, and optimized communication among team members. This article not only illustrates how artificial intelligence can transform traditional approaches to project management, but also offers insights into our vision of the future, where technological innovations enhance existing practices and open new possibilities for increasing efficiency in project management. The article shows how the integration of artificial intelligence can create a more connected, intuitive, and responsive project management system, bringing substantial benefits to all involved.

Keywords:

ChatGPT,
digital
assistant,
integration,
Artificial
Intelligence,
management

1 Uvod

V dobi tehnološkega napredka, kjer digitalne inovacije preoblikujejo naš način dela, se soočamo z novimi izzivi in priložnostmi. Vključitev umetne inteligence, kot je ChatGPT, v sisteme za upravljanje projektov predstavlja eno od teh revolucionarnih sprememb. Članek se osredotoča na integracijo ChatGPT v projekt 4PM, ki ga je razvilo podjetje Arctur, in raziskuje, kako lahko ta tehnologija deluje kot digitalni kopilot v projektne managementu.

Vsaka tehnična revolucija prinaša dvome in negotovosti, ChatGPT ni izjema. Pogosto se ti dvomi rodijo iz napačnih reakcij sistemov ali vprašanj glede varnosti. Še posebej tehnični strokovnjaki, vajeni "von Neumannovega" načina mišljenja, se morajo prilagoditi na "probabilistični" način razmišljanja, ki je osnova umetne inteligence. Ta premik paradigme od tradicionalnega "preberi in se nauči" do "vprašaj in prejmi odgovor" predstavlja temeljno spremembo v načinu, kako pristopamo k reševanju problemov.

Razumevanje, da uvajanje te tehnologije ni zgolj tehnično vprašanje, ampak izziv na ravni celotnega podjetja, je ključnega pomena. IT oddelki igrajo pomembno vlogo, vendar integracija umetne inteligence vpliva na vse aspekte poslovanja.

Naš pristop zajema uporabo umetne inteligence za nadomeščanje ali nadgradnjo posameznih funkcij, kot so navigacija in uporaba aplikacije v obliki govornih navodil ali avtomatizacijo enostavnih procesov. Veliko bolj zahtevno je razmišljanje o tem, kako lahko AI nadomesti ali ustvari nove informatizirane procese z malo ali brez programiranja. To vključuje razvijanje rešitev, ki niso le tehnične izboljšave, ampak tudi omogočajo bolj intuitivno, odzivno in povezano upravljanje projektov.

2 Proces razvoja integracije

2.1 Projektno vodenje in 4PM

4PM je spletna rešitev za vodenje projektov, ki podpira upravljanje s kadri, časom, sredstvi in rezultati, spremljanje in vrednotenje izvajanje projekta, upravljanje s tveganji in spremembami ter reševanje morebitnih konfliktov in problemov.

4PM nudi podporo za načrtovanje projektnih aktivnosti (terminsko, logično, po kadrih, obremenitve) in skupinsko delo (komentarji in e-pošta). Upravljanje s sredstvi je ažurno (stroški, prihodki) in vključuje prilagodljive funkcionalnosti za spremljanje realizacije (sprotno opozarjanje na morebitna odstopanja, zamude, poraba sredstev) in poročanje (o porabi časa, sredstev).

2.2 Raziskovanje kopilota v vseh fazah projektnega managementa

Raziskovanje vloge kopilota v projektnem managementu razkriva, kako ChatGPT lahko pomembno prispeva k uspešnosti projektov v vseh njihovih fazah. V začetni fazi projekta ChatGPT deluje kot orodje za avtomatizacijo, ki zbiranje in analizo informacij naredi učinkovitejše, hkrati pa nudi podporo pri oblikovanju projekta in sestavi ekipe. Sposobnost generiranja začetnih načrtov in interaktivnega vodenja skozi začetne korake projekta je ključna za postavitev temeljev uspešnega projekta.

Med fazo načrtovanja ChatGPT nadaljuje z dodajanjem vrednosti s svojo sposobnostjo avtomatiziranja razvoja podrobnih projektov, optimizacije virov in svetovanja glede proračuna. Njegova vloga pri identifikaciji tveganj in upravljanju sprememb je neprecenljiva, saj pomaga zagotoviti, da so načrti projekta robustni in prožni. Interaktivni kontrolni sezname in opomniki, ki jih ChatGPT lahko ustvari, so ključni za ohranjanje organizacije in zagotavljanje, da so vse ključne naloge in roki dosledno upoštevani.

V fazi izvedbe in nadzora kopilot prevzame bolj dinamično vlogo, ki vključuje dnevno upravljanje, koordinacijo, avtomatizacijo poročanja o napredku in podporo pri odločanju. Njegova zmožnost hitrega reševanja problemov in interakcije z deležniki omogoča tekoče izvajanje projektov. V zaključni fazi projekta kopilot pripomore k oceni končnih rezultatov, pripravi zaključnega poročila in zbiranju povratnih informacij, ki so ključne za izboljšave prihodnjih projektov.

2.3 Priprava in spoznavanje priložnosti

Pri uvajanju tehnologije ChatGPT v sistem 4PM smo se osredotočili na razumevanje, kako bi uporabniki to tehnologijo lahko najbolj učinkovito izkoristili. Začetni korak je bil prepoznati, kako se ChatGPT lahko vključi na nivoju uporabnika in kako izbrati prve funkcionalnosti, ki bi bile koristne.

Za boljše razumevanje potreb uporabnikov smo zasnovali vprašalnik kot orodje za zbiranje mnenj in predlogov. Vprašalnik je uporabnikom predstavil hipotetični scenarij, v katerem so bili brez dostopa do 4PM in so morali napisati pet navodil za asistenta, ki upravlja s 4PM. Ta pristop je uporabnike prisilil k razmisleku o svojih ključnih delovnih aktivnostih in o izvajanju le-teh s pomočjo digitalnega asistenta, ki ima dostop do 4PM, koledarja, e-maila in drugih orodij. Analiza odgovorov je pokazala, da je razumevanje pogostosti določenih aktivnosti ključnega pomena. Enako kot vloge na projektih so bile pomembne vrste projektov in tudi sponzorji teh projektov. To je pokazalo, da je potrebno upoštevati tudi individualne značilnosti projektov, uporabnikovih videnj projekta in vključenih deležnikov.

Iz zaključkov smo izpeljali, da moramo ChatGPT prilagoditi tako, da lahko podpira različne vrste projektov in vloge uporabnikov. Prilagajanje se ne nanaša le na specifične ukaze ali naloge, ampak tudi na sposobnost ChatGPT, da uporabi prompte (sprožilce), ki jih uporabnik sam oblikuje. To pomeni, da lahko uporabniki ustvarijo prilagojene prompte, ki ustrezno opisujejo njihove potrebe in pričakovanja od digitalnega asistenta. Na ta način ChatGPT ne deluje samo kot orodje, ampak kot partner, ki se lahko prilagodi dinamičnemu in raznolikemu okolju projektnega managementa.

Tehnično gledano je integracija ChatGPT v 4PM vključevala razvoj vmesnikov, ki omogočajo učinkovito komunikacijo med ChatGPT in različnimi komponentami 4PM. Razvili smo API vmesnike za dostop do podatkov o projektih, uporabniških vlogah in specifičnih aktivnostih. ChatGPT je bil programiran, da razume te podatke in jih uporabi pri oblikovanju odgovorov, ki so prilagojeni zahtevam uporabnikov.

Naš pristop k vključitvi ChatGPT v 4PM je bil osredotočen na uporabniško izkušnjo in prilagodljivost. S pomočjo vprašalnikov in analize odgovorov smo oblikovali vsebine, ki ne le olajšuje vsakodnevno delo uporabnikov, ampak tudi omogoča bolj intuitivno in odzivno upravljanje projektov. Prilagodljivost ChatGPT omogoča, da se digitalni kopilot prilagaja specifičnim zahtevam projekta in uporabnika.

3 Implementacija

Ko smo določili osnovne funkcionalnosti in možnosti prilagajanja ChatGPT, smo prešli na fazo implementacije. V tej fazi smo bili pozorni na zbiranje povratnih informacij od uporabnikov, da bi zagotovili, da je integracija ChatGPT v 4PM ustrezno naslovila njihove potrebe. Povratne informacije so bile bistvene za nadaljnje izboljšave in prilagoditve sistema.

3.1 Vsebinski del

V okviru sistema za upravljanje projektov 4PM, ki zdaj vključuje ChatGPT, vsak projekt oblikuje svojo konfiguracijo vedenja. To omogoča, da se umetna inteligenca prilagaja specifičnim potrebam in zahtevam.. V projektu razvoja programske opreme se bo ChatGPT osredotočil na sledenje napak, razvojne časovnice in upravljanje tehnične dokumentacije, medtem ko se bo za gradbeni projekt fokus preusmeril na logistiko, upravljanje materialov in varnost.

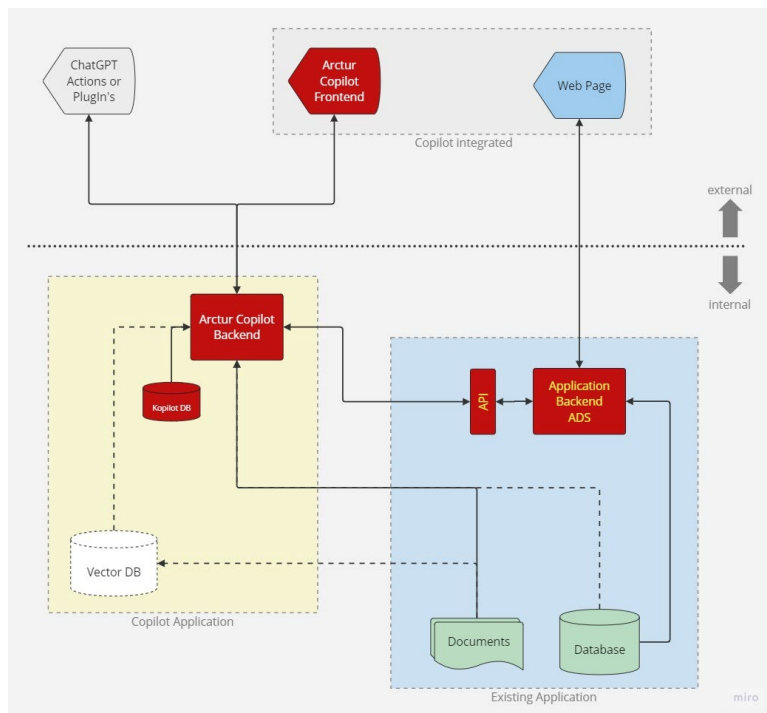
Vsak član projekta ima dodatno možnost nastaviti individualne preference za interakcijo s ChatGPT. Te nastavitve omogočajo članom, da prilagodijo AI svojim delovnim navadam in osebnim preferencam. Tako lahko programer nastavi, da prejema redna obvestila o spremembah na nalogi izdelave specifikacij, medtem ko projektni menedžer lahko daje prednost informacijam o splošnem napredku projekta.

ChatGPT v sistemu 4PM lahko opravlja tudi avtomatizirane preglede aktivnosti v projektu, kot je na primer tedensko preverjanje, če so vsi člani ekipe oddali svoja poročila. Če poročila niso oddana, sistem samodejno pošlje e-poštna obvestila s povezavo za vpis komentarjev. Sposobnost sistema, da se uči iz interakcij in se prilagaja potrebam projekta, prinaša nov nivo učinkovitosti in prilagodljivosti v upravljanje projektov.

3.2 Arhitektura in varnost

Arhitekturno je naša rešitev na Sliki 1 zasnovana tako, da se integrira z obstoječimi aplikacijami preko splošne Arctur Kopilot zaledne aplikacije (Backend). Ta uporablja posebej prilagojene API-je, ki so usklajeni z obstoječimi funkcionalnostmi aplikacij.

Poleg tega ponuja možnost iskanja vsebin znotraj dokumentov ali neposredno preko poizvedb v podatkovno bazo, kar je še posebej uporabno v primerih, ko se soočamo z zastarelimi aplikacijami ali kadar je potrebna povečana učinkovitost. Uporabniki lahko z aplikacijo komunicirajo preko intuitivnega vizualnega vmesnika (Frontend) ali pa neposredno preko ChatGPT vmesnika, kar omogoča dodatno prilagodljivost in učinkovitost komunikacije.



Slika 1: Groba arhitektura integracije 4PM in ChatGPT

Vir: Lasten

Varnostna strategija pri integraciji ChatGPT v sistem za upravljanje projektov 4PM se začne z mehanizmom začasne potrditve identifikacije. Po vzpostavitvi komunikacije s kopolotom, mora uporabnik pridobiti potrditev identifikacije preko alternativnega kanala, kot je npr. elektronska pošta. Vsa komunikacija poteka v zaprtih kanalih, kar zagotavlja zasebnost in varnost občutljivih informacij. Vsi API klici, ki jih izvede digitalni kopolot, vključujejo identifikacijo uporabnika.

Pred premikom v produkcijsko fazo je ključno izvesti vprašalnik za oceno tveganja. V ta namen se uporabljajo tudi posebej oblikovani deli promptov, ki se vedno dodajo v vsako komunikacijo in preprečujejo nezaželeno ali nevarno obnašanje ChatGPT. Za ohranjanje visoke ravni varnosti se shranjujejo vse interakcije s ChatGPT, skupaj z zahtevami in rezultati. Aktivno se spremlja vsebina komunikacije za izdelavo povzetkov in ocenjevanje morebitnih nevarnih vsebin. Ta pristop omogoča nenehno izboljševanje varnostnih protokolov in prilagajanje sistema trenutnim potrebam in tveganjem. S tem se ne samo ščiti podatke in procese, temveč se tudi gradi zaupanje uporabnikov v tehnologijo.

3.3 API vmesnik

API vmesnik je ključen element integracije ChatGPT v sistem 4PM. Zasnovan je za napredno obdelavo zahtev, s poudarkom na fleksibilnosti in natančnosti. Ko uporabnik izrazi zahtevo, vmesnik uporabi iskalnik Elasticsearch, da najde relevantne projekte, naloge, uporabnike ali druge entitete, ki jih obvladuje aplikacija. Namesto tradicionalnega pristopa z uporabo ID-jev entitet, ta način izdelave API vmesnikov omogoča uporabniku, da vnese splošne izraze v naravnem jeziku. Če iskanje vrne več kot en rezultat, API vmesnik vrne omejen seznam najboljših možnih odgovorov, ki so jasno oštevilčeni. To uporabniku omogoča, da izbere najbolj ustrezen rezultat iz seznama. Pomembno je, da API vmesnik v tej fazi išče potrditev od uporabnika. Če prvotno iskanje ne vrne nobenega odgovora, API vmesnik nadaljuje z zbiranjem informacij od uporabnika.

4 Konkretni primeri

Integracija ChatGPT v sistem 4PM je prinesla izboljšave v več ključnih aspektih projektnega managementa. Pri odločanju kopolot prispeva k boljši preglednosti s sposobnostjo avtomatiziranega ustvarjanja poročil o stanju na projektu. V komunikaciji med ekipami ChatGPT odlično služi kot orodje za povzemanje komentarjev in zagotavljanje večjezičnosti. Sposobnost analiziranja in povzemanja diskusij v projektih omogoča članom, da pridobijo ključne informacije, brez potrebe po prebiranju dolgih tekstov. Skupaj te funkcije predstavljajo pomembno nadgradnjo v upravljanju projektov, ki združuje napredno tehnologijo in praktično uporabnost za izboljšanje delovnih procesov in povečanje produktivnosti.

4.1 Učinkovitost

V okviru integracije ChatGPT v sistem 4PM smo se osredotočili na izboljšanje učinkovitosti pri upravljanju ur članov ekip. Konkretni primer prikazan na Sliki 2, ki ga obravnavamo, je omogočanje uporabnikom, da preko kopolota enostavno komunicirajo, komu in na katero nalogo naj se dodelijo planirane ure. V praksi to deluje tako: ko uporabnik želi dodeliti ure članu ekipe, preko kopolota izrazi to željo.

The screenshot shows the 4PM web application interface. On the left is a navigation menu with options like 'splošni pregled', 'moje naloge', 'moji sestanki', etc. The main area is divided into three panels: 'moje naloge' (tasks), 'koledar - vnos ur' (calendar), and a chat window titled 'copilot'. The chat window shows a conversation where the user asks for help adding hours to a project, and the copilot suggests adding 10 hours to the 'BikePath 3000' project. Below the chat, there are buttons for 'Action B.2' and 'Action C.3.1'. At the bottom of the chat, there is a prompt: 'Opišite kaj želite da 4PM copilot naredi.'

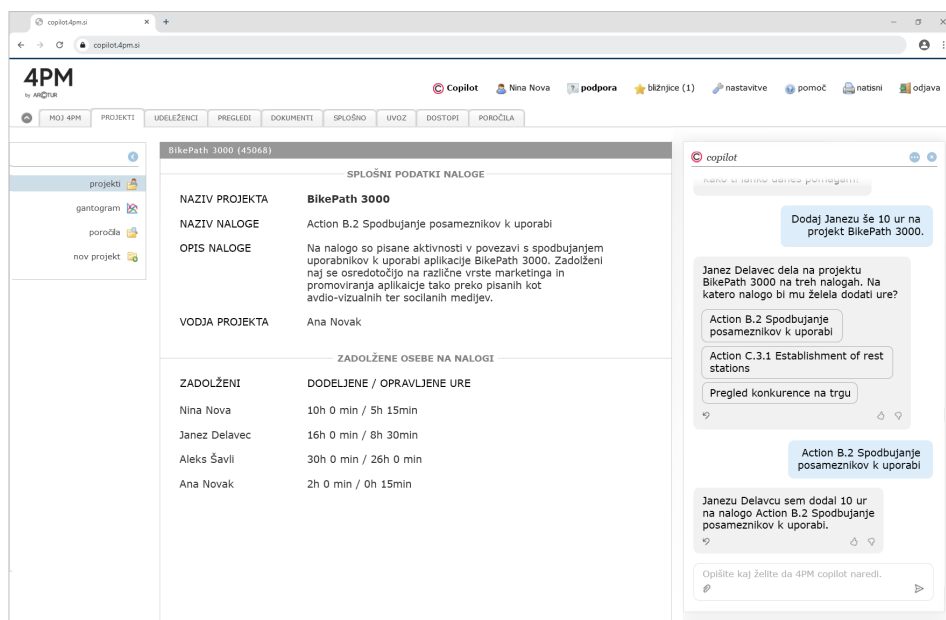
Slika 2: Dodajanje planiranih ur člana na projekt

Vir: Lasten

Sistem nato, če je potrebno, postavi dodatna vprašanja za pojasnilo – na primer, na katero točno nalogo naj se ure dodelijo, ali kateri specifični član ekipe je mišljen, če prvotna določitev ni bila dovolj jasna (Slika 3).

Ta primer ne samo prikazuje, kako lahko integracija umetne inteligence poenostavi in pospeši procese v projektne managementu, ampak tudi odpira pot za nadaljnje inovacije v interakciji med človekom in sistemom.

Za uresničitev te funkcionalnosti smo razvili tri ločene API-je: prvi je namenjen preverjanju in iskanju specifičnih nalog znotraj projekta, drugi se osredotoča na preverjanje in iskanje oseb znotraj organizacijske strukture, tretji pa je namenjen vpisu ur. Čeprav bi bilo mogoče vse tri funkcionalnosti združiti v en, bolj kompleksen API, smo se odločili za modularni pristop. Ta namreč omogoča večjo fleksibilnost in ponovno uporabnost posameznih komponent v različnih kontekstih znotraj sistema.



Slika 3: Potrditev sistema o dodeljenih urah

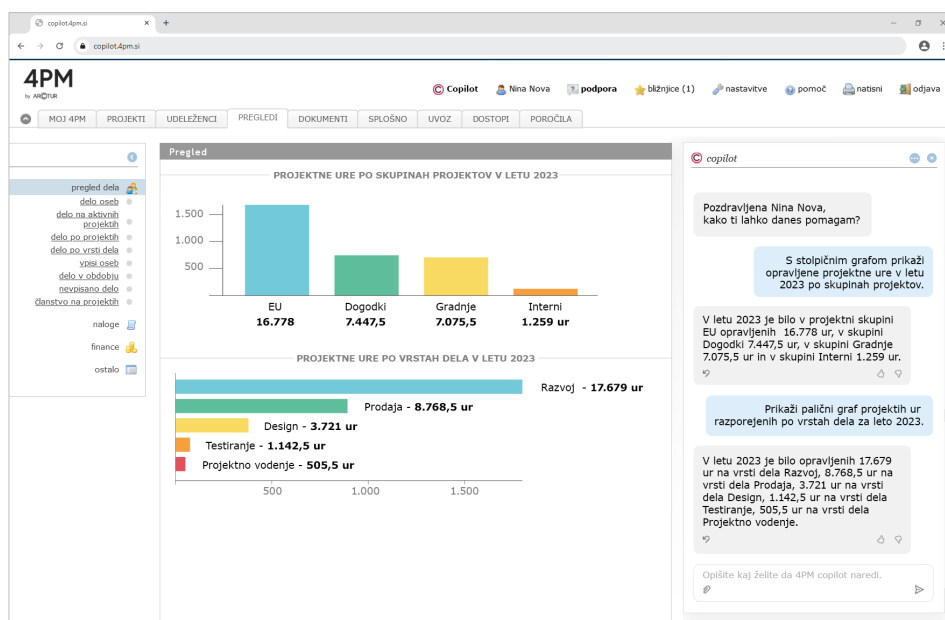
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4.2 Pomoč odločanju

V tem odstavku se osredotočamo na enega od ključnih vidikov integracije ChatGPT v 4PM – olajšanje procesa odločanja skozi inovativno poročanje o stanju na projektih (Slika 4). Z uporabo kopilota, smo omogočili uporabnikom, da v enostavnem naravnem jeziku komunicirajo s sistemom za upravljanje projektov. To predstavlja prelomnico v interakciji z zapletenimi podatkovnimi nizi, saj

tradicionalno poročanje pogosto zahteva predhodno znanje specifičnih ukazov ali zapletenih vmesnikov.

Za doseganje tega cilja smo razvili serijo API-jev, ki omogočajo poizvedbe po različnih domenah podatkov. Ti API-ji služijo kot most med naravnim jezikom, ki ga uporabnik uporablja, in strukturiranimi podatkovnimi nizi, ki so shranjeni v sistemu 4PM. Ta metoda zagotavlja da so informacije, ki jih prejmejo uporabniki, vedno relevantne in prilagojene njihovim specifičnim potrebam.



Slika 4: Poročanje o stanju na projektu

Vir: Lasten

4.3 Oplemenitena komunikacija

Posebej smo bili pozorni na izboljšanje komunikacije med ekipami. Konkreten primer tega je izdelava povzetkov dejavnosti, rezultatov in dokumentov na projektu. Sistem omogoča uporabnikom, da z uporabo naravnega jezika enostavno oblikujejo zahteve ter tako brez tehničnega znanja intuitivno komunicirajo s sistemom.

Poleg tega sistem omogoča uporabnikom, da po generiranju povzetka prilagodijo njegov obseg, ga prevedejo v različne jezike ali ga delijo z drugimi člani ekipe. To zagotavlja, da so vse relevantne informacije dostopne in razumljive za vse udeležence projekta, ne glede na njihovo tehnično ozadje ali jezikovne preference.

Za uresničitev te funkcionalnosti smo razvili poseben API, ki omogoča pridobivanje vseh informacij o projektu, ki jih nato obdelata ChatGPT in generira relevantne povzetke. Uporabnik lahko na primer pošlje zahtevo kot: "Pripravi povzetek vseh aktivnosti in rezultatov projekta X za zadnji teden." Sistem nato analizira zahtevo, izvleče potrebne informacije iz baze podatkov projekta in ustvari strukturiran povzetek (Slika 5).

The screenshot displays the 4PM project management dashboard. The main content area is divided into several sections:

- moje naloge**: A list of tasks with details such as "Priprava na sestanek / splošno" (30.5.2023, -201 dni) and "WP 2 / Development" (30.9.2023, -109 dni).
- koledar - vnosi ur**: A calendar view showing time entries for various dates, with a highlighted entry for Wednesday, 17.1.2024.
- pregled vpisov ur**: A bar chart showing time entries for the period 15.1.2024 - 20.1.2024. The legend includes: projektjno delo (yellow), neprojektjno delo (blue), odsotnost (red), and koriščene nadure (green).
- pristotnost**: A section with buttons for "PRIHOD", "ODHOD", "KOSILO", and "PRIVATNI IZHOD".
- chat**: A chat window titled "copilot" containing a generated summary: "Projekt BikePath 3000 je v izvajanju, naloge zagona in razvoja prototipa aplikacije so uspešno zaključene. Vodja projekta Ana Novak poroča o napredku v razvoju delujoče aplikacije, ki se odvija kot načrtovano. Stroški razvoja so v okviru planiranih." Below the chat is a "Prenesi Končno poročilo projekta." button and a "kopiraj" button.

Slika 5: Povzetek dogajanja in stanja na projektu

Vir: Lasten

5 Zaključek

V času pred nastopom generativne umetne inteligence (AI) smo se kot družba soočali z izzivom učenja računalniških jezikov, da bi lahko komunicirali z našimi digitalnimi orodji. S prihodom tehnologij, kot je ChatGPT, se je ta paradigma obrnila; računalniki so se začeli učiti in razumeti naš jezik.

Pri integraciji tehnologij, kot je ChatGPT, v sisteme, kot je 4PM, je eden največjih izzivov razumevanje, kako in kje začeti ta proces, v aktivnost mora biti vključena celotna organizacija, manjši poudarek je na tradicionalnem programiranju. Razvojne ekipe morajo razumeti, kaj potrebujejo in kako se ChatGPT obnaša, da lahko ustrezno pripravijo API vmesnike in druge tehnične integracije.

Najpomembnejša lekcija, ki smo jo pridobili iz tega procesa, je, da je potrebno enostavno začeti. S tem zaključkom poudarjamo, da je vključitev generativne umetne inteligence v projektni management ne le inovativna, ampak nujna za napredek in uspeh v hitro spreminjajočem se tehnološkem svetu.

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MAPPING OF DIGITAL COMPETENCE FRAMEWORKS USED IN PRACTICAL SETTINGS

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This article presents our analysis of digital competence frameworks as used in practical settings. Our objective was to evaluate the acknowledgement of digital competence in practical settings and analyse its implementation through digital competence frameworks. The analysis consists of temporal analysis, geographic distribution analysis and the analysis of groups, targeted by identified frameworks. We identified 70 frameworks through means of mainstream search engine queries. Our findings underscore global recognition of digital competence as a crucial and current concept in practical settings.

Keywords:
digital,
frameworks,
practice,
review,
competence

1 Introduction

Digital competence is being increasingly acknowledged as an integral part of contemporary society, as digitalization of all dimensions of our lives grows. (Broadband Commission, 2022) Within the European Union digital competence is considered as one of eight equally important key competencies that collectively contribute to a successful life in society. These are regarded as competencies “all individuals need for personal fulfilment and development, employability, social inclusion, sustainable lifestyle, successful life in peaceful societies, health-conscious life management and active citizenship. (Council Recommendation 2018/C 189/01, 2018)

Scientific literature devotes significant attention to digital competence in terms of second level digital divide. (Lythreatis et al., 2022) This phenomenon not only perpetuates societal inequalities but also has the potential to intensify them. (Ragnedda, 2017) The interrelation between digital competence extends beyond a unidirectional perspective, acknowledging not only the need for individual's competence in response to the increasing digitalization but also the role of digital competence in addressing societal challenges. Such instance is evident in the digitalization of healthcare, where a wider accessibility of healthcare is anticipated among other benefits. (Maier et al., 2021) However, successful implementation of digital healthcare solutions requires not only access to technology but also a competent workforce capable of effectively utilizing this technology. (Nazeha et al., 2020)

Regarding the importance of this topic, we set out to examine the practical implementation of the digital competence concept. This research was done as a part of broader research project exploring the interconnectedness between digital competence, green competence, and sustainability of healthcare. This article presents our analysis of digital competencies frameworks employed in practice, whether by governmental bodies or private organizations. It does so through means of temporal distribution, target audience and geographic distribution.

2 What is a digital competence framework?

Digital competence is a highly complex phenomenon that spans various fields and tasks. (Ala-Mutka, 2011) Scientific literature as well as grey literature offer many different definitions for digital competence (Sánchez-Canut et al., 2023), however in this article we adopt the definition proposed by Ferrari et al. that defines digital competence as a “set of knowledge, skills, attitudes, abilities, strategies and awareness that is required when using ICT¹ and digital media.” (Ferrari et al., 2012) Two key dimensions which contribute to its complexity are the dynamic nature of the concept across different fields and its evolution over time due to dynamic nature of digital technologies. Moreover, there seems to be a lack of consensus in scientific literature regarding the terminology used, with terms like “digital competence”, “digital skills”, “digital literacy”, and “digital capability” being used interchangeably. (Sánchez-Caballé et al., 2020) For this article, we will use the term “digital competence” as it best depicts the efficiency of performing tasks within a setting that involves digital technologies. We also believe it encompasses all other terms used.

In this article we adopt the definition of a framework as “a repository or a model that identifies, enlists, structures, and organizes competencies into meaningful categories...” (Nazeha et al., 2020). While the original definition includes the condition of being “developed via a systematic methodology or a relevant, established organization”, we omit this aspect as we perceive it too vague.

In summary we define digital competence framework for the purpose of this article as a repository or a model that identifies, enlists, structures, and organizes sets of knowledge, skills, attitudes, abilities, strategies, and awareness required when using digital technology into meaningful categories.

¹ Information communication technologies

3 Methods

The study was conducted in three phases.

The initial phase was literature review. We used Web of Science and Scopus to identify prominent articles on digital competence frameworks. The goal of this phase was to create theoretical foundation and set inclusion and exclusion criteria based on definitions of relevant terms. Included were all findings meeting the definition of framework, as outlined in the theoretical background, irrespective of its form (either presented in a single document or dispersed across a functionally connected website). We included all findings where competence in using digital technologies were covered in at least one part of the framework. Included were only last updates of frameworks. We excluded all frameworks which we found to only exist as scientific articles without practical implementation. We excluded all frameworks which were found to have an updated version or a version overwriting it (as stated either in the framework itself or associated webpage).

In the second phase we utilized Google as primary search engine and Google Scholar as secondary search engine to identify frameworks meeting the defined criteria. We conducted all searches in December 2023. The first round of searches was conducted with queries »digital competencies framework«, »digital competence framework«, »digital skill framework« and »digital literacy framework«. In the second round of searches, we incorporated terms derived from the studied frameworks (e.g., healthcare, teacher, school, employment, sustainability). In the third round of searches, we extended the queries to include names of major countries on which we obtained no data insofar. In the fourth round of searches, we changed search settings to Slovenian, English, German and Croatian language and search region to Slovenia, Switzerland, Austria, Liechtenstein, Germany, Croatia, Bosnia and Herzegovina and Serbia. Results obtained from Serbia were written in Cyrillic script (which the researcher cannot read) and were thus not included in the article. The search continued until no new results were obtained with a rational amount of effort.

The use of mainstream search engines, as opposed to traditional systematic literature identification methodologies, was used intentionally to capture frameworks most likely being actively used in practical contexts.

In the final phase we extracted data through examination of identified frameworks and their associated websites. Data relevant to our research questions were systematically documented in an Excel spreadsheet.

While we assert the adequacy of our methodology for our intended purpose, we acknowledge two significant limitations. Firstly, relying only on one search engine may yield narrow or biased results. Secondly, the search was limited to languages understood by the researcher performing it (Slovenian, English, German and Croatian), limiting identification of frameworks published in other languages.

4 Results

A total of 70 frameworks were identified spanning different fields, time frames, geographical regions, and other parameters.

4.1 Temporal distribution

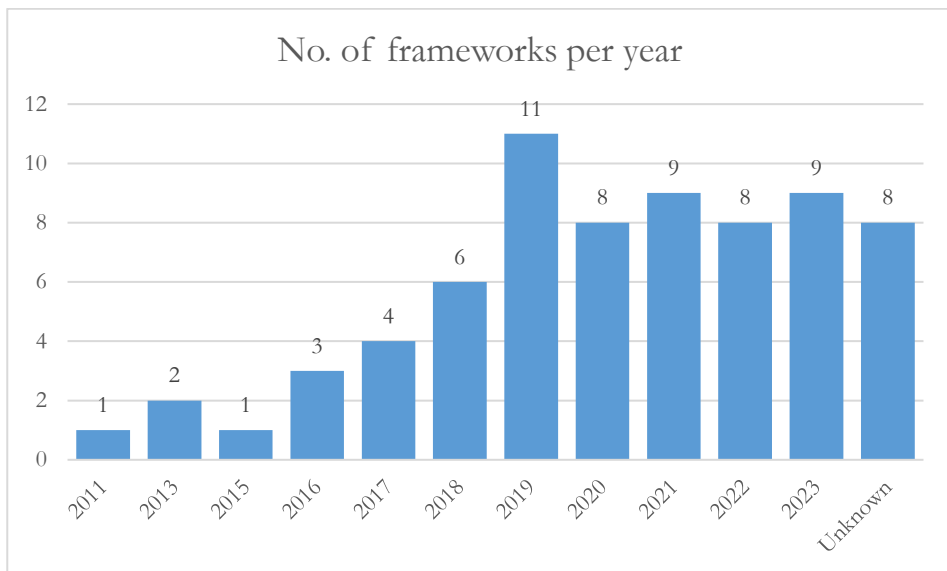


Figure 1: No. of frameworks per year

Source: Own

Figure 1 displays the temporal distribution of identified frameworks, revealing an upward trend with a peak in 2019. Notably we could not obtain data² on the last update for 8 frameworks, representing more than 11% of the total sample.

4.2 Target audience

Table 1: Number of frameworks per target group

Education	27
General	21
Healthcare	13
Workforce	3
Accounting	1
Business and technology professionals	1
Mobile phone users	1
Organizations	1
Public sector officials	1
Youth workers	1

Table 1 depicts audience categories for which the frameworks were developed. Larger groupings can be further broken down into smaller, more specific subgroups. For instance, within the group “Education”, subgroups include audiences like students, teachers, university staff, curriculum subject specialists, trainers, school leaders etc. Within the group “Healthcare”, subgroups include audiences like nursing, caregivers, pharmacy workforce, psychologists, etc.

² A rough estimation could be made for most, but doing this would disrupt the data

4.3 Geographic distribution

Table 2: Number of frameworks per region

NGB ³	17	Kenya	1
UK	15	Nigeria	1
EU	13	Norway	1
USA	7	Singapore	1
Australia	6	South Africa	1
Canada	3	Switzerland	1
India	1	Tasmania	1
Indonesia	1		

Table 2 illustrates the geographic distribution of the identified frameworks. Many frameworks are not geographically restricted; this includes those that are considered global or those developed by private organizations without a specific regional focus. In the UK, EU, Canada and Australia, frameworks are either general or linked to specific regions. In the UK region specific frameworks are linked to England, Scotland, and Wales. Within the EU, identified region specific frameworks are linked to Slovenia, Croatia, Austria, Ireland, and Spain. In Canada, identified region specific frameworks are linked to Quebec and British Columbia. In the USA, region specific frameworks are affiliated with Baltimore, Maryland, or Seattle. Australia's non region specific frameworks are linked to universities.

5 Discussion

Our analysis shows the global recognition of digital competence as an important present-time topic, aligning with findings from previous studies. (Radovanović et al., 2020) Despite language constraints in our methodology, we linked frameworks to 12 different regions spanning 5 continents. Governments, both at different levels and internally, are implementing digital competence frameworks into their agendas, which is further echoed by private for-profit and non-profit organizations, who implement digital competence frameworks to achieve their organizational goals.

³ Not geographically bound

Analysing geographic distribution, the UK government stands out for its active role, for not only has the region been associated with a relatively large number of frameworks in our sample, but a major part of frameworks was issued by governmental bodies or affiliated organizations.

Worth noting is the systematic approach to the implementation of digital competence frameworks within the EU, where on behalf of the European Commission, the Joint Research Centre implemented The Digital Competence Framework for Citizens (DigComp). DigComp aims to establish a common understanding of digital competence. (Vuorikari et al., 2022) While member states are not obligated to implement DigComp, it's use is widespread, as many member states adapt it to suit their specific requirements, due to its comprehensive nature and rigorous methodology. (Carretero et al., 2018) Our analysis revealed nine frameworks from five EU member states. Four of these frameworks, originating from Slovenia (Javrh et al., 2018), Croatia (Žuvić et al., 2016), Austria (BMDW, 2021), and Spain (INTEF, 2017), explicitly reference DigComp as their foundational framework. The EU holds an extensive network of frameworks and digital learning toolkits grounded in DigComp, as articulated in "DigComp into Action". (Carretero et al., 2018) Importantly, the recognition of DigComp as a framework of significant quality is not confined to EU. Several frameworks from regions outside the EU also reference DigComp. (Wedlake et al., 2019) This broad recognition underscores the impact and credibility of DigComp within the field of digital competencies.

The temporal analysis shows that 45 out of 70 frameworks within our sample were released or updated either in 2019 or later. Adding the frameworks of which we could not determine the exact release date, but can be dated after 2019 from cited reference, more than 50% of frameworks within our sample are no older than four years at the time of writing. Some frameworks or their associated web pages state the date of their future revision which additionally shows a general awareness of the dynamic nature of the concept.

From the analysis of target group distribution of our sample "education", "general", "healthcare" and "workforce" emerge as four leading fields of digital competence framework implementation. Standing out is education, suggesting that these frameworks are primarily utilized for the purpose of learning, with educational institutions, particularly schools, being the primary facilitators. This claim is

underscored by the notion that a significant number of frameworks within our sample were introduced by universities.

Our sample delineates healthcare as a second significant area of interest, revealing a recognition of the impact of inefficient digital processes on the healthcare sector. Interestingly, there is a limited diversity of frameworks tailored to specific professions. Despite the dynamic nature of digital competence across different fields, our analysis only identified frameworks specifically designed for accounting professionals, business and technology professionals, public sector officials, and youth workers, besides healthcare. This limited range shows potential gaps in the development of profession-specific digital competence frameworks.

6 Conclusion

In conclusion, our analysis of digital competence framework shows their global recognition and importance in practical settings. It is evident that a diverse range of entities worldwide consider the concept current and vital. Notably, we observed a significant focus on education as a target audience of digital competence frameworks. Our work contributes to the understanding of real-world significance of digital competence, moving beyond theoretical models.

Two major limitations in our research methodology should be noted. Firstly, the reliance on a single search engine, specifically Google, might give biased results. Secondly, the language constraints of our searches conducted in English, Slovenian, Croatian, and German narrow the results which should be extended to a larger set of languages. However, these limitations provide potential possibilities for further research. For instance, incorporating snowballing search strategies on various frameworks and review articles could present a more comprehensive picture.

Our future research will delve into a more detailed analysis of each framework's content. Additionally, a comparative analysis of the components of these frameworks will be conducted. These steps aim to build a comprehensive foundation upon which we aspire to show their relation to green competencies and sustainability.

Acknowledgements

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Data availability statement

Full excel spreadsheet including hyperlinks to frameworks and associated webpages is available upon request.

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AI AND INTERNAL AUDIT, REPORTING TRANSFORMATION

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The recent emergence of OpenAI and ChatGPT has brought numerous advantages for the professions of accountants and auditors, but at the same time numerous risks, threats and challenges. GPT's ability to understand, predict and generate human-like text has turned the technology into a clear foundation that redefines and shapes a wide range of activities, including internal auditing. GPT models have rapidly evolved from their initial roles in simple text generation to complex applications. Their ability to understand language and context, generate coherent and relevant text, and learn from vast amounts of data makes them ideal for tasks such as compiling internal audit reports. Internal audit reports summarize key findings and identify risks that need to be remedied for the audit committee, CEOs and senior management. However, writing and presenting such reports takes a lot of time, and using GPT can help significantly with that. The subject of the paper is a comprehensive review of a wide range of AI, internal audit, reporting transformation. The main conclusion points to the growing responsibility of internal auditors with the widespread use of generative artificial intelligence services to support audit reporting. Internal auditors must be aware of the risks and challenges brought by the new technology, based on artificial intelligence, which requires clear training and thematic areas incorporated into the curricula in the process of certification of internal auditors.

Keywords:

internal
audit,
reporting,
accounting,
chat GPT,
AI

1 Introduction

The professions of accountants and auditors have benefited greatly from the recent development of artificial intelligence (hereinafter AI) based on the OpenAI and ChatGPT, but there are also significant dangers, threats, and obstacles involved. GPT's capacity to comprehend, anticipate, and produce writing that is human-like has made the technology a certain foundation that redefines and shapes a variety of tasks, including internal auditing. From their early uses in straightforward text production to more sophisticated applications, GPT models have developed quickly. Their aptitude for comprehending language and context, producing meaningful and well-organized prose, and gaining knowledge from a plethora of data sets them up for jobs like internal audit report compilation. Reports from internal audits highlight important discoveries and point out hazards that senior management, CEOs, and the audit committee need to address. However, utilizing GPT can greatly assist with the time-consuming nature of producing and presenting such reports. The GPT service is an AI-inspired and guided solution with a comprehensive and pervasive set of features and capabilities designed to handle defined queries. It is generally defined as software that in its application environment provides numerous opportunities for organizations, primarily to use at least a fraction of the power of advanced artificial intelligence for various activities. Key features include text generation, conversational AI capabilities and natural language understanding, which can be tailored to specific needs. The Association of Internal Auditors states that internal auditors can use services such as OpenAI or Azure Copilot to develop a new GPT service without writing any software code, following a four-step process (Sakthiswaran, 2024).

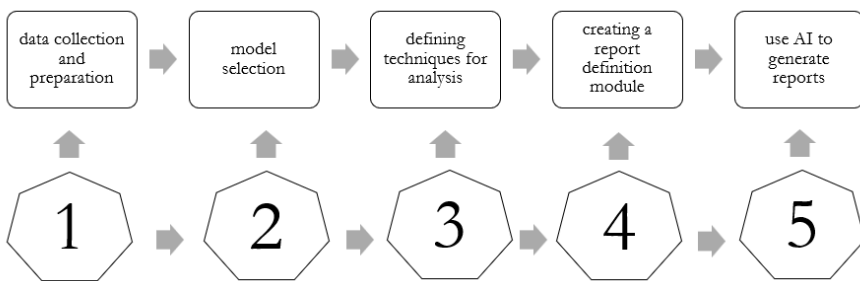


Figure 1: How to use AI in the internal audit

Source: Own

The first step is to collect and prepare data. Internal audit staff should start by collecting a dataset of previous internal audit reports and cleaning and formatting that data to ensure that the data is consistent and relevant. For ease of processing, auditors should identify and label key elements such as audit findings, recommendations, management responses, and follow-up actions. After choosing the right GPT model, internal auditors should define the parameters of the model by defining the data set for the audit report. This includes defining parameters for understanding the specific language, format and content typically found in audit reports within a specific organizational context.

After that, it is probably necessary to define an analysis module that should essentially be able to learn from historical audit reports and provide insight into key elements. It can identify frequently reported issues, track the status of historical recommendations, and highlight areas of frequent risk. Natural language processing techniques will play a significant role in this module. The next step should include creating a report generation module. This module will use the GPT model to contribute to the creation of internal audit reports. The defined model will be loaded with data from ongoing audits, and as such will have a wide range of capabilities to generate draft reports that include findings, risk assessments and recommendations, all in a coherent and professional language (Ali, et al., 2023).

Finally, the final step must include the secure deployment and use of AI to generate reports. Although the previous steps are not straightforward to create custom GPT services, it is essential for internal auditors to understand how and where these applications store and process data to ensure security. GPT is an emerging technology and as such could introduce new risks that need to be addressed before being implemented. The subject of the paper is a comprehensive review of a wide range of AI, internal audit, reporting transformation.

2 Data collection and preparation

Bearing in mind the fact that organizations all over the world are rapidly moving towards the adoption of systems based on artificial intelligence, the question arises as to who in such situations controls the risks that such a situation brings, and whether the persons in charge of control use artificial intelligence. Arguably, the human population is currently at a historical tipping point where open-source AI

algorithms and models are now easily accessible, and these models perform better than people can with accuracy. Artificial intelligence-based systems have been around for a while. These days, businesses incorporate the newest features into their workflows. Internal auditors need to exercise extreme caution when it comes to the organization's data collecting, data consent, security, privacy, bias, accuracy, and compliance with regulations, among many other issues. To address the new possibilities of artificial intelligence, internal audit staff may need to reframe their roles in the organization (Jakovljevic, 2022c).

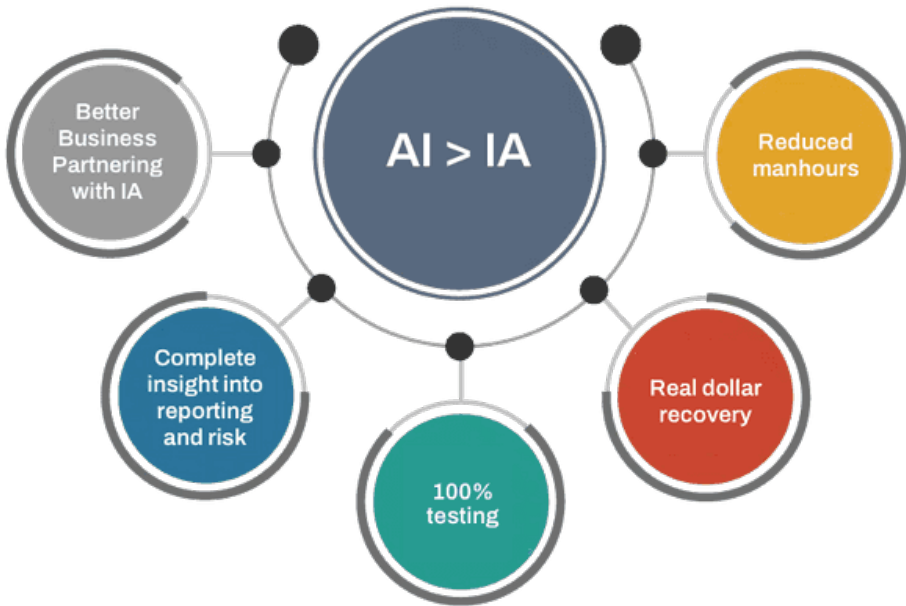


Figure 2: How AI helps internal audit departments to work smarter

Source: <https://thinkrisk.ai/how-ai-helps-internal-audit-departments/>

The Institute of Internal Auditors AI Audit Framework defines the role of internal audit in AI as assisting a company in determining, comprehending, and communicating the degree to which AI will impact the company's capacity to generate value, either favorably or unfavorably. This perspective, it is necessary to pay attention to where systems based on artificial intelligence are being used, as well as where they are being developed or planned for more use. It is very important to determine where artificial intelligence is used by reviewing how the systems are used

in the organization. These environments are essential for enabling AI research, and gaining a quick grasp of how they support AI use cases is a useful way to obtain data that can be used to evaluate risks and dangers. This understanding can also reveal the use of AI in the background, where AI use cases develop outside of the organization's pre-defined rules and procedures (Jakovljevic, 2021a).

Internal auditors should check for guidelines that require the company to evaluate AI systems' repeatability and stability, reporting results that are irreversible and useless. Internal auditors ought to search for a governance framework that permits AI systems to make decisions that are repeatable and consistent, by considering the abundance of data and information available. When the input data is marginally changed, the decision made by a stable AI-based system does not vary dramatically. The principle of fairness is directly related to basic human rights. Artificial intelligence systems should empower everyone, regardless of other preferences.

Auditors should look for proof that the governance structure guarantees that parties' use of AI in internal auditing does not violate these rights. Information systems specialists must test and address any biases generated by the data set in order to ensure that these procedures are set up correctly and that AI-based decision-making and prediction systems operate as intended. Information systems specialists can be checked by auditors to make sure the system is being populated with data that accurately reflects the features of the total population, not just a part of it. It is imperative to ascertain whether groups including information systems specialists adequately represent a range of viewpoints and beliefs.

3 Model selection

With growing interest in generative artificial intelligence, the best way for internal auditors to locate usage is to consider which applications are boosting productivity the algorithmic capabilities of text, code, images, speech, and video. Currently, internal audit departments are adopting generative artificial intelligence because such models are very useful for languages, allowing them to improve the functionality of their texts and adapt them to several different specific purposes. Even packaged AI-based system solutions with pre-trained models can have complex interactions with an organization's multiple business processes. Internal audit teams must help organizations understand where and how AI-based system solutions are being used

to ensure security, compliance, and quality. Achieving this requires a timely response from the internal audit team.

Effective governance requires accountability, which is a particular challenge in relation to artificial intelligence, bearing in mind that there are usually multiple parties involved and it is often not clear which indicators are adequate. A key indicator of the success of an artificial intelligence system is its predictive ability. Usually, application developers and system administrators are evaluated based on how well their systems forecast. The most predictive AI systems, meanwhile, might employ methods and algorithms that reduce the system's transparency. Stated differently, the artificial intelligence principles may not be adhered to by the system that most accurately forecasts the result.

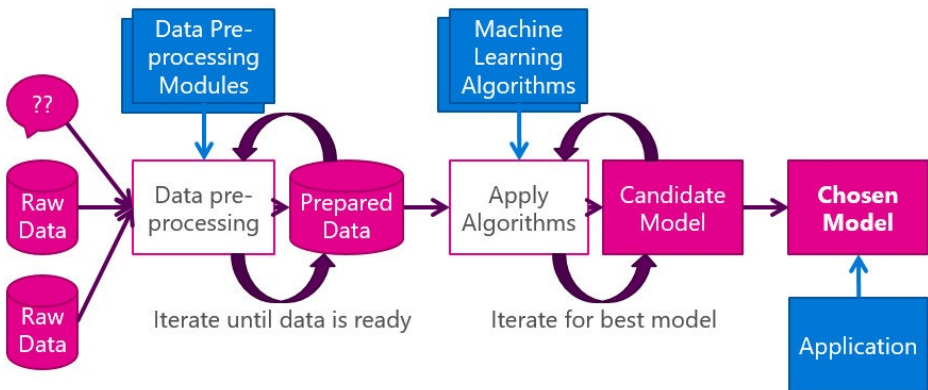


Figure 3: AI model selection process

Source: <https://www.linkedin.com/pulse/from-data-processing-till-model-selection-machine-payam-mokhtarian/>

Auditors should think about if procedures are in place to explicitly account for who oversees each component of the AI system to determine whether an efficient governance structure is in place to promote accountability. Everyone need to define what each person is responsible for and what they measure. Therefore, internal auditors must check whether the results are consistent with artificial intelligence principles, such as building appropriate algorithms.

4 Defining techniques for analysis

Different topics and engagements of the internal audit department can find meaningful use of their own artificial intelligence systems to more simply and adequately realize activities that are unique to their specific needs. If the system that uses artificial intelligence in internal audit work is a product and subject to updating and maintenance by an external organization, internal auditors must ensure that the external organization regularly conducts audits of its artificial intelligence management activities, primarily in information systems audit. Such an AI governance review should start by identifying all AI applications that the organization has deployed and is using.



Figure 4: Next generation of internal audit

Source: https://www.itmagazine.ch/artikel/74760/Next_Gen_of_Internal_Audit_.html

Information on the system's purpose, installation date, service affiliation, internal and external users, third-party service providers, and whether each system is assigned a unique identification number should all be included in this list. Experience in practice has shown that the demands of interested parties for technical explanations vary significantly in different organizations. However, certainly in order for internal auditors to assess whether there is an effective management framework that supports the previously expressed views, they should check whether there is a process for translating technical information into non-technical information, whether there is stakeholder feedback that allows internal auditors to assess whether there is an appropriate level of transparency and understanding, whether there are

reliable communication channels for stakeholders to provide feedback, and whether this (Jakovljevic, 2022d).

Internal auditors must timely understand solutions based on artificial intelligence, to adequately assess their functionality and participation in its formation. Many solutions use algorithms that learn and change over time, meaning they start with data that is fed into that learning process. Artificial intelligence technology can be an excellent tool that will contribute to organizations to use their resources more strongly and use all the potentials they possess, but, from the perspective of internal audit, there must be clear and unambiguous guarantees that the technology will be used appropriately. For internal auditors to properly assess the diversity of data sources and growing volumes of data, it means that internal auditors need to properly manage a wide range of unstructured and structured data sources.

Internal auditors must be careful and consider how system solutions based on artificial intelligence are integrated into other solutions. When using large language models there is a risk that these models produce and falsifying information that does not directly correspond to the input data provided. Every company uses different types of data, and every internal audit team needs to be aware of inappropriate biases in that data. It is important for internal auditors to understand how data flows and how it is used in developing algorithms and models (Liao, et al., 2024).

5 Creating a report definition module

As organizations increase their reliance on artificial intelligence, internal auditors must evaluate oversight of these applications with a focus on governance principles. With the increasing focus on AI governance, internal auditors need to determine how they can assess whether AI governance is well designed and effectively implemented. By providing a timely answer to the question of whether the use of artificial intelligence in their organization is in accordance with predefined rules and standards of AI management for responsibility, transparency, and fairness, and above all, privacy, and security.

Technological progress in recent years has caused an increase in the application of technology based on AI in many different activities and spheres of life to improve the quality of people's lives. All artificial intelligence (AI) programs share the capacity

to interpret information and make decisions by simulating human intelligence. The necessity for AI monitoring has increased as a result of these possibilities. AI governance offers structures and methods to direct end-to-end applications in accordance with company objectives, user requirements, legal and regulatory requirements, and moral conduct. Like other domains of governance, internal auditors can precisely specify inside the entities they serve to ascertain whether AI governance is adequately conceived and executed (Jakovljevic, 2021b).

Like human decision-making, AI systems can make choices that are counter to their objectives, which could endanger your business and negatively impact your users and stakeholders. As artificial intelligence technologies advance rapidly, the internal audit process in which it is incorporated may be compromised, which then requires a long and deliberate process of verification and supervision. An internal audit in the field of artificial intelligence management can contribute to bridging this gap.

A few recognized experts suggest the use of voluntary labeling for low-risk applications of artificial intelligence that would be used in internal audit work. Such a labeling system would allow internal auditors to inform stakeholders that their products were created with reliance on artificial intelligence and that they have an appropriate level of reliability because of monitoring and auditing the management of artificial intelligence. Because such information would be readily available and clearly highlighted, it would not be subject to regular review by regulatory agencies. Internal audit audits in artificial intelligence management can increase the confidence of stakeholders in internal audit reports and the information they are based on and contain (Nickolau, 2023).

However, there are currently no common AI principles as different sectors have specific operational needs and evolving technologies. Management therefore depends on each organization's objectives. Quite simply, there is a very broad spectrum of diversity when looking at the activities of organizations that have internal audits and the data that internal auditors work with, both in terms of confidentiality, and in terms of availability and the possibility of disposal and processing. However, internal auditors should ensure that, as part of good governance, the organization has clearly stated objectives that will help achieve its mission and that the principles of internal auditing using artificial intelligence are aligned with those objectives (Jakovljevic, 2022a).

Additionally, internal audit requires clear and well-defined procedures and policies to ensure that the use of artificial intelligence is consistent with these principles. Auditors should apply artificial intelligence principles when auditing management practices. From a transparency perspective, internal auditors must ensure that control systems provide stakeholders with access to accurate, timely, and relevant information. Internal auditors must be able to continually provide stakeholders with appropriate and reasonable explanations for decisions made by technical and non-technical AI systems based on their needs and preferences. Having immediate access to accurate and relevant information does not necessarily mean that it can be understood. This requires technical stakeholders to help non-technical stakeholders understand why and how AI systems make decisions and how this impacts internal audit planning, execution, and reporting (Fernandes, 2022).

6 Use AI to generate reports

From the standpoint of cybersecurity, attackers can alter the output data by injecting malicious data. Significant behavioral deviations may result from system solutions based on artificial intelligence if certain problematic illogicalities are present. A satisfactory level of data quality and model comprehension is crucial when reprocessing biases as part of an algorithm. Even if bias is a natural component of possible outcomes, it is important to make sure that there are enough procedures and controls in place to eliminate bias toward unfavorable outcomes. Artificial intelligence, especially generative artificial intelligence, provides a significant opportunity for progress in numerous activities, with an all-pervasive significant increase in efficiency in business and the development of innovative products, services, and solutions (Wang, et al., 2024).

The internal audit team should support the organization in identifying and mitigating associated risks as it adopts AI and begins to reap its benefits. Artificial intelligence comes with a number of concerns, some unique to particular industry. To be able to see and assess risks from the application of artificial intelligence in a timely manner, the internal audit function must focus on the program and on the domains of primary risks, and sometimes this is not quite possible, especially when the internal audit alone in its activities and procedures of planning, implementation and audit reporting uses systems based on artificial intelligence. Then an internal audit review

by other auditors or experts for information systems and information security is necessary (Jakovljevic, 2022b).

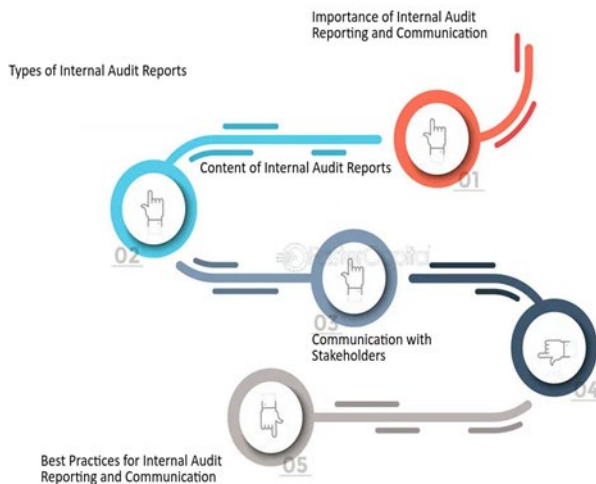


Figure 5: Internal audit process

Source: <https://fastercapital.com/keyword/internal-audit.html>

If we discuss the security of data and systems based on artificial intelligence, and above all the information that such systems generate to stakeholders, auditors should look for a governance framework that can access, monitor, and mitigate the potential risk of AI-driven outcomes that would cause security concerns. Experiential practice cites an example that testifies to the fact that timely determination of whether there are processes is important for continuous monitoring of system security. Through the intentional execution of cases intended to fool the algorithmic decision-making model into producing false results, competitive testing looks for flaws and evaluates the resilience of the model. This approach uses a tracking algorithm in conjunction with these examples to track model performance (Agundo, et al., 2024).

The goal of data poisoning patrols is to apprehend any external attacker or hostile insider who tries to manipulate the data used to train an algorithm to impair the performance of an AI model. Under such circumstances, internal auditors can verify if procedures, like human intervention, are in place to handle unforeseen hazards brought on by artificial intelligence systems' imprecise forecasts. Privacy concerns arise because large amounts of data can be used to re-track and de-anonymize

personal information. The freedom of users to choose who can access and use their data is safeguarded by appropriate data privacy management. Data is shielded from unwanted access by effective administration of security measures for artificial intelligence system infrastructure. (Wang, et al., 2024).

For an auditor performing an AI governance internal audit to assess whether there is an AI governance framework that supports data privacy and the security when assessing the AI system architecture, the auditor may start by looking into the existence of protection mechanisms, data encryption procedures, and authentication standards from the removal of data. Before evaluating if these procedures and standards satisfy stakeholder demands and industry standards, the auditor should confirm that there are monitoring tools and standards in place for tracking system access, recording data, and making algorithm modifications.

7 Conclusion

Internal auditors should keep several challenges and key considerations in mind while building custom GPT services. Above all, they should pay attention to privacy and data security. Ensuring the confidentiality and security of data during and after the audit process is extremely important. The GPT Service must comply with relevant data protection laws and organizational policies. Internal auditors should ensure that data sets and databases used for analysis are limited to authorized users and that all changes are adequately recorded and controlled to ensure integrity, as well as data reliability. Internal auditors should regularly examine the model for bias and inaccuracy. They need to continuously update the dataset and retrain the model to maintain its relevance and reliability. Internal auditors should understand the potential risks of using GPT tools in their organization. As GPT technology evolves, so do threats and potential risks. Persons engaged in internal audit work should be aware of these risks and their potential impact on their organizations and at the same time be trained to effectively use tools based on GTP technology (Sandu, et al., 2022).

When we talk about internal audit, as a function that uses artificial intelligence, the establishment of artificial intelligence management is only the first step in the demanding process of building a system that will function properly and with a satisfactory level of reliability. It is essential to regularly check that such a system is

working properly and to ensure that improvements are implemented over time. If the AI governance framework is not evaluated at sufficient time intervals and in a timely manner, this could in certain situations increase the risk of negative impacts from unintended outcomes of AI (Agudo, et al., 2024).

Having an fake insights administration framework connected to inner review work, without satisfactory information of the people locked in in inside review work, around whether the framework is working as planning, can make an environment with the nearness of a untrue sense of certainty, diminishing the watchfulness and readiness of inner inspectors, and an master in data frameworks and data security. Bearing in intellect that review destinations may incorporate the viability and proficiency of an AI framework, the unwavering quality of the utilize of data created by the framework, and compliance with appropriate laws and controls, inner evaluators have a key part to impartially survey AI administration whereas maintaining a strategic distance from clashes of intrigued.

Integrating the GPT model into internal audit functions represents a significant step forward in the use of artificial intelligence for improved risk assessment and reporting. By automating and deepening the process of analysis and report generation, internal audit functions can surely achieve greater accuracy, efficiency, and clarity of expression. However, it is essential to approach this integration with a thorough understanding of the technical, ethical, and operational implications to fully exploit its potential. When all the above is considered, the future of GPT in internal audit is promising, demonstrating significant potential and a wide range of usable features, with clear extensions to predictive analytics, real-time risk monitoring and interactive audit management systems.

As artificial intelligence technology continues to evolve, its impact on internal audit functions can indeed become more sophisticated and integrated into organizational governance and risk management strategies. The main conclusion points to the growing responsibility of internal auditors with the widespread use of generative artificial intelligence services to support audit reporting. Internal auditors must be aware of the risks and challenges brought by the new technology, based on artificial intelligence, which requires clear training and thematic areas incorporated into the curricula in the process of certification of internal auditors.

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VPLIVI PODNEBNIH SPREMEMB NA ERGONOMIJO DELOVNEGA OKOLJA

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Sobivanje človeka z naravo je tesno povezano s fizikalnimi parametri okolja v katerem živi in dela. Pri tem je ključni proces ta, da človeški organizem vzdržuje toploto ravnovesje človeka z okolico. Temperatura zraka, relativna in absolutna vlažnost zraka, hitrost gibanja zraka, temperatura sevanja sten in oblečenost človeka, so ključni fizikalni parametri, ki vplivajo na ugodje človeka v bivalnem ali delovnem okolju. Zaradi vse pogostejših ekstremnih vremenskih pojavov se tudi na delovnih mestih soočamo z izzivi priprave ustreznih pogojev dela, ki izvirajo iz fizikalnih parametrov okolja. Višje toplotne obremenitve telesa vodijo do zmanjšane produktivnosti in povečane utrujenosti, s tem se pa povečuje tveganje za pojav zdravstvenih težav. Spreminjajoče se podnebne razmere postavljajo delodajalce pred nove izzive pri zagotavljanju varnosti in zdravja pri delu. Prispevek se osredotoča na prepoznavanje potrebnih ergonomskih prilagoditev v notranjih delovnih okoljih, v katerih v poletnih mesecih temperatura zraka lahko preseže predpisane vrednosti. Ugotovitve izpostavljajo zahteve po celovitem pristopu k izvajanju tehničnih, organizacijskih in osebnih zaščitnih ukrepov za oblikovanje optimalnih pogojev za delo v spreminjajočih se podnebnih razmerah.

Ključne besede:

podnebne
spremembe,
delo,
toplota,
zdravje,
ergonomija

IMPACT OF CLIMATE CHANGE ON THE ERGONOMICS OF THE WORK ENVIRONMENT

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The coexistence of humans with nature is closely linked to the physical parameters of the environment in which we live and work. The key process here is that the human organism maintains a thermal balance between man and his environment. Air temperature, relative and absolute humidity, air movement speed, radiation temperature of walls and human clothing are the most important physical parameters that influence human well-being in a living or working environment. The increasing frequency of extreme weather events also presents workplaces with the challenge of creating suitable working conditions based on the physical parameters of the environment. Increased heat stress on the body leads to reduced productivity and increased fatigue, which increases the risk of health problems. Changing climatic conditions present employers with new challenges in ensuring health and safety in the workplace. This article deals with the identification of necessary ergonomic adjustments in indoor working environments where the air temperature may exceed the prescribed values during the summer months. The results illustrate the requirements for a comprehensive concept for the implementation of technical, organisational and personal protective measures to create optimal working conditions under changing climatic conditions.

Keywords:

climate
change,
work,
heat,
occupational
health,
ergonomics

1 Uvod

Svetovna meteorološka organizacija opozarja, da se Evropa segreva hitreje kot druge celine, saj je bila leta 2023 za približno 2,3 °C toplejša kot v sredini 19. stoletja, medtem ko je svetovno povprečje povečanja temperature 1,2 °C (*WMO Confirms 2023 as Warmest Year on Record 'by a Huge Margin' | UN News*, 2024). Številne raziskave izpostavljajo, da ima povišanje povprečne temperature okolja pomemben vpliv na delovna mesta. Ekstremne temperature lahko povzročijo resne zdravstvene težave, povezane s toplotnim stresom, dolgotrajnejše višje temperature lahko povečajo tudi tveganje za poškodbe zaradi utrujenosti, pomanjkanja koncentracije, slabega odločanja in drugih dejavnikov (*Heat at work – Guidance for workplaces | Safety and health at work EU-OSHA*, 2023). Poklicni toplotni stres je rezultat kombinacije okoljskih in delovnih pogojev. Temperature nad 24-26 °C so povezane z zmanjšano produktivnostjo, pri temperaturah 33-34 °C pa delavec z zmerno intenzivnostjo dela izgubi 50% delovne zmogljivosti. Izjemno visoke temperature lahko povzročijo vročinski udar in celo smrt. Do leta 2030 se pričakuje, da bo zaradi previsokih temperatur izgubljenih več kot 2% skupnih delovnih ur letno, kar je enakovredno izgubi 80 milijonov delovnih mest (Lee, J., idr., 2023). K toplotni obremenitvi, ki lahko potencialno ogrozi delavce, lahko prispevajo različni dejavniki iz delovnega okolja. Med te dejavnike sodi kombinacija metabolične aktivnosti, ki je odvisna od opravljanega dela, in nošenja (zaščitnih) oblačil, kar lahko povzroči povečanje telesne jedrne temperature. Ta dvig temperature lahko sproži termoregulacijo telesa, kar lahko privede do dehidracije. Dehidracija nato vpliva na subjektivno dožemanje vročine in posledično na zavestne odzive osebe na toplotno obremenitev (Morrissey idr., 2021).

Namen prispevka je predstaviti pregled osnovnih toplotno-fizioloških mehanizmov toplotnega ravnovesja med človekom in okolico. Izpostavljamo ključna tveganja za zdravje, varnost in učinkovitost delavcev zaradi poletne presežene temperature v stavbah. Izpostavljamo predloge ergonomskih ukrepov, ki bodo v spreminjajočih se podnebnih pogojih omogočali razvoj optimalnih delovnih pogojev.

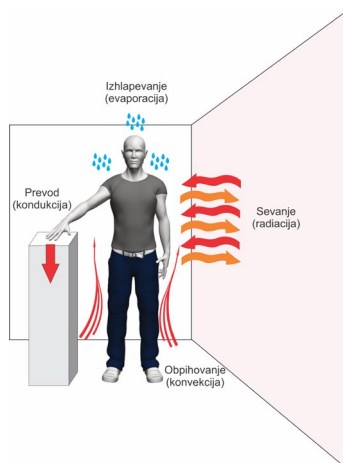
2 Materiali in metode

Za identifikacijo relevantne strokovne in znanstvene literature o vplivu podnebnih sprememb na ergonomijo delovnega okolja v vročih razmerah, smo izvedli sistematično selekcijo v domačih in tujih bazah podatkov Google Scholar, Scopus in Web of Science. Rezultate smo analizirali in primerjali med seboj, pri čemer smo bili pozorni na metodologijo in zaključke študij.

3 Rezultati

3.1 Toplotne obremenitve in fizikalni parametri okolja

Človek vzdržuje stalno temperaturo s pomočjo mehanizma kemične in fizikalne termoregulacije. Celična presnova je uravnavana na stalno telesno temperaturo, ki znaša v jedru telesa približno 37 °C. Pri obravnavi toplotnih obremenitev v okolju, človeka obravnavamo kot termodinamični sistem, vse izven njega, pa kot okolico. Med obema sistemoma, zaradi različnih temperaturnih nivojev, prehaja toplota. (Balantič, Z. idr., 2016). Telo za doseganje toplotnega ugodja, izmenjuje toploto z okolico predvsem s sevanjem (radiacija), obpihovanjem (konvekcija), prevajanjem (kondukcija) in izhlapevanjem znoja (evaporacija) (slika1).



Slika 1: Toplotni procesi za zagotavljanje ugodja

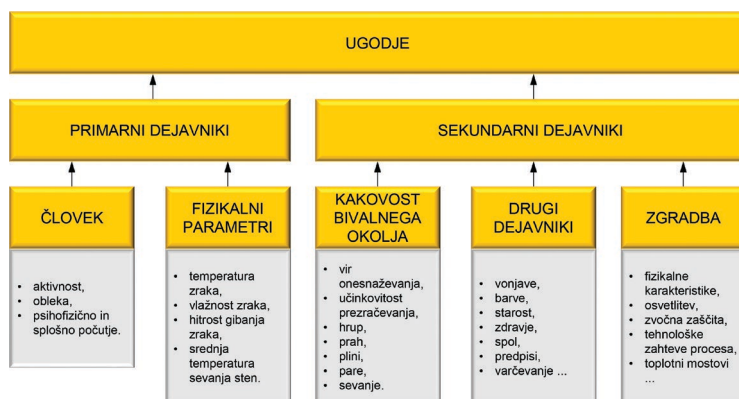
Vir: (Balantič, Z. idr., 2016)

Enačba toplotnega ravnotežja oziroma enačba za toplotno ugodje je dobljena eksperimentalno glede na občutek toplotne nevtralnosti (Balantič, Z. idr., 2016) in opisuje količino toplote, ki jo telo pridobi ali izgubi (shranjevanje). Opišemo jo lahko na naslednji način (*Thermal risks - OSHwiki | European Agency for Safety and Health at Work*, 2017):

$$\text{shranjevanje} = (\text{proizvodnja toplote}) - (\text{izhlapevanje} \pm \text{sevanje} \pm \text{prevajanje} \pm \text{konvekcija})$$

Shranjevanje toplote v telesu se poveča ali zmanjša, ko se toplota pridobiva ali izgublja z mehanizmi fizikalne izmenjave, ki potekajo med okoljem in telesom (izhlapevanje, sevanje, prevodnost in konvekcija). Te fizične izgube in pridobitve toplote ublažijo fiziološki mehanizmi, kot so potenje, drgetanje, vazodilatacija in vazokonstrikcija kožnih krvnih žil. Telo toploto proizvaja tudi s presnovo, ki se povečuje z večjo stopnjo aktivnosti. Hitrost presnove v mirovanju (približno 40-50 W/m²) je količina energije, ki je potrebna za osnovno delovanje telesa, kot so dihanje, možganski procesi in krvni obtok, ki celicam zagotavlja kisik (O₂) in hranila. Toplota, ki jo proizvajajo ti bistveni presnovni procesi, se s prevodnostjo širi v okoliške celice in se s tekočinami, kot je kri, porazdeli po telesu. Takoj, ko človek postane telesno dejaven, se metabolizem poveča. Hitrost metabolizma se razlikuje glede na vrsto in stopnjo telesne dejavnosti, od nizke 70-130 W/m² (sedenje za mizo in pisanje) do zelo visoke >260 W/m² (hoja po stopnicah). Ko se voda pretvori v vodno paro, prehaja na površino kože, kjer pride do kondenzacije. Voda za izhlapevanje porablja toploto telesa (kože) in tako temperatura kože pade. Seveda je proces izhlapevanja znoja odvisen od relativne vlažnosti okoljskega zraka. Višja kot je relativna vlažnost zraka, manjše je lahko izparevanje in manjša je količina toplote, ki jo telo izgubi. Izmenjava toplote s sevanjem je odvisna od razlike v površinski temperaturi med dvema predmetoma in nanjo ne vpliva temperatura zraka ali gibanje zraka. Človek lahko s sevanjem izgublja toploto s predmeti v prostoru, ki imajo nižjo površinsko temperaturo od površine njegove gole kože ali oblačil in pridobi toploto s predmeti, ki imajo višjo površinsko temperaturo. Količina toplote, ki se izgubi ali pridobi s konvekcijo, je odvisna od razlike med temperaturo kože in zraka v neposrednem stiku s kožo. Toplotna prestopnost med telesom in okolico se poveča z višjo hitrostjo gibanja okoliškega zraka. Naravna konvekcija je torej odvisna od temperaturne razlike med kožo in okoliškim zrakom. Konvekcija pa je lahko ustvarjena prisilno z vsiljenim gibanjem zraka ob telesu (ventilacija).

Ko se skladiščenje toplote v telesu poveča ali zmanjša, poskuša telo s fiziološkimi mehanizmi vzpostavljati ravnovesje tako, da vpliva na oddano in prejeta toploto. Če se telesna temperatura v jedru poveča (hipertermija), telo poskuša povečati izgubo toplote s potenjem in vazodilatacijo kožnih krvnih žil. Glavni način izgube toplote je potenje. Ko se telesna temperatura poveča, se poveča količina znoja, ki ga izločajo žleze znojnice, kar poveča hlajenje s površine kože zaradi izhlapevanja. Količina izgube toplote zaradi izhlapevanja je odvisna od relativne vlažnosti in temperature okoliškega zraka. Višja kot je relativna vlažnost, manj znoja lahko izhlapi in manj učinkovito postane znojenje kot hladilni mehanizem. Višja kot je temperatura kože, večjo količino toplote lahko izgubimo z izhlapevanjem. Na prenos toplote z izhlapevanjem, konvekcijo, prevodnostjo in sevanjem vpliva temperatura kože. Če se temperatura jedra poveča, se krvne žile kože odprejo (vazodilatacija), kar poveča pretok krvi, temperaturo kože in izgubo toplote iz kože. Ko temperatura jedra pade, se krvne žile kože zaprejo (vazokonstrikcija), kar zmanjša pretok krvi in temperaturo kože ter tako ohranja toploto z zmanjšanjem izgube toplote (*Thermal risks - OSHwiki* | *European Agency for Safety and Health at Work*, 2017). O toplotnem ugodju govorimo, ko je doseženo toplotno ravnotežje telesa z okolico pri različnih fizikalnih vplivih okolice (Balantič, Z., 2000). Na ugodje vplivajo različni dejavniki (slika 2).



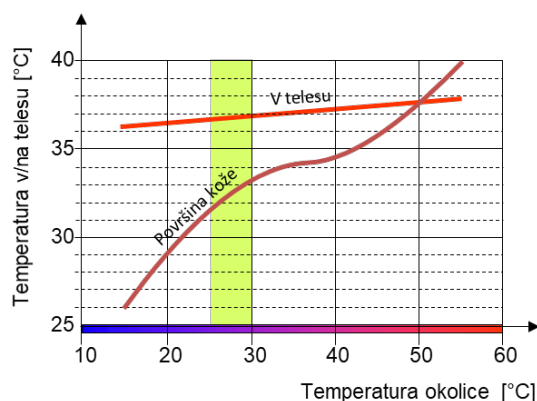
Slika 2: Dejavniki ugodja

Vir: (Balantič, Z. idr., 2016, str. 156)

Ključne dejavnike predstavljajo primarni dejavniki, saj je izmenjava toplote med telesom in okoljem odvisna od štirih klimatskih veličin (temperatura zraka, relativna vlažnost zraka, gibanje zraka, temperatura sevanja) ter dveh neklimatskih veličin (fizična aktivnost (metabolizem) in toplotni upor obleke) (Balantič, Z. idr., 2016).

3.2 Vplivi izpostavljenosti vročini na delovnem mestu

Človek normalno stanje vzdržuje pri telesnih temperaturah okoli 37 °C . Temperatura okolice, v katerem se človek brez zaščitnega oblačila počuti ugodno, je med 25 °C in 30 °C. Če človeški organizem s termoregulacijo zaradi vplivov iz okolice ne more vzdrževati telesne temperature na ustreznem nivoju, pride do neravnovesja. S povečevanjem temperature okolice se povečujeta tako temperatura telesa kot tudi temperatura na površini telesa (slika 3). Ker je toplotni tok vedno usmerjen s področja z višjo temperaturo proti področju z nižjo temperaturo, se telo do temperature okolice 50 °C zaradi toplotnega toka iz telesa proti okolici, ohlaja z izhlapevanjem in izparevanjem vlage s površine telesa. Če temperatura okolice še naprej narašča, se smer toplotnega toka obrne in telo se začne postopno pregrevati (Balantič, Z. idr., 2016).



Slika 3: Odziv temperature telesa pri različnih temperaturah okolice

Vir: (Balantič, Z. idr., 2016, str. 172)

Pregled znanstvenih poročil o zdravstvenem stanju delavcev, ki so izpostavljeni visokim temperaturam na delovnem mestu, kaže, da je veliko delavcev občutljivih na izpostavljenost vročini, kar vpliva na zdravje delavcev (Lee idr., 2022). Če se telo

začne pregreivati, lahko pride do različnih bolezenskih stanj (Balantič, Z. idr., 2016; *Heat at work – Guidance for workplaces | Safety and health at work EU-OSHA*, b. d.; Lee idr., 2022): dehidracija (utrujenost, zmanjšana gibljivost); toplotni krči (mišični krči, bolečine ali krči v trebuhu, rokah ali nogah); vročinski izpuščaj (skupki majhnih mehurčkov/drobnih rdečih lis na koži); toplotni edem (oteklina na gležnjih); vročinska sinkopa (kratka izguba zavesti, nejasen vid, omotičnost); rabdomioliza (razgradnja mišic, mišični krči/bolečine, nenormalno temno obarvan urin); toplotna izčrpanost (glavobol, utrujenost, motnje vida, razdražljivost, intenzivna žeja, slabost ali bruhanje, omotičnost, mišični krči, močno potenje, povišana telesna temperatura, hiter srčni utrip - palpitacije, zmanjšano izločanje urina, bleada, hladna in vlažna koža); toplotni udar (zmedenost, nejasen govor, nerazumno vedenje, nerazločen govor, popolna ali delna izguba zavesti, epileptični napadi, močno potenje ali vroča, suha koža, zelo visoka telesna temperatura, hiter srčni utrip in celo smrt, če oseba ne prejme nujne zdravstvene oskrbe).

Z naraščanjem pogostosti vročinskih valov se bodo posledice termalnega stresa povečale v vseh podnebnih območjih (Bauer, S., idr., 2022). Kateri posamezniki bodo trpeli zaradi segrevanja telesa in kateri okoljski pogoji ga lahko povzročijo, je zelo težko predvideti, saj so odzivi posameznikov različni. Na te individualne odzive vplivajo telesne značilnosti človeka, kot so starost, masa telesa, spol in stopnja telesne pripravljenosti (Lotens, W.A., 1981). Pomembno vlogo pri odzivu telesa na toplotne obremenitve iz okolja ima tudi toplotni upor oblačil (I_{cl}). Toplotni upor oblačil, ki ga izražamo v enotah clo, je odvisen od vrste in števila kosov oblačil, ki prekrivajo človeško telo. Vrednost clo (ang. thermal insulation of clothing) se določa po standardu BS EN ISO 9920. En clo ustreza $0,155 \text{ m}^2 \text{ K/W}$, kar pomeni, da oblačilo s toplotnim uporom 1 clo skozi površino 1 m^2 prepušča $6,5 \text{ W}$ toplote pri temperaturni razliki 1 K med notranjo in zunanjo površino oblačila. Koeficient pokritosti telesa (f_{cl}), ki je odvisen od toplotnega upora oblačilnega sistema (I_{cl}), izraža enačba: $f_{cl} = 1,05 + 0,1 \times I_{cl}$. Toplotni upor celotnega oblačilnega sistema se določi s seštevanjem upornosti posameznih kosov oblačil, vključno s spodnjim perilom, vrhnjimi oblačili in obutvijo, ločeno za moške in ženske (Balantič, Z. idr., 2016).

3.3 Ocena toplotnega stresa na delovnem mestu

Klimatske veličine (temperatura zraka, vlažnost zraka, hitrost gibanja zraka in sevanje toplote) se lahko spreminjajo neodvisno druga od druge. Ker njihove različne kombinacije človeku lahko dajejo enak toplotni učinek, je dobro poznati sumarne klimatske indekse, s katerimi lahko izrazimo sumarne učinke posameznih dejavnikov mikroklima. V ta namen so bili razviti različni sumarni toplotni indeksi, ki jih uporabimo glede na fizično aktivnost človeka (Balantič, Z. idr., 2016):

- indeks pričakovane presoje toplotnega občutja (PMV),
- normalna efektivna temperatura (NET),
- korigirana efektivna temperatura (KET),
- indeks toplotne obremenitve (HSI) in
- indeks WBGT.

Za natančno in individualizirano spremljanje odziva delavca na toplotni stres je koristno tudi merjenje fizioloških odzivov, saj se človek na toplotni stres avtomatsko odzove s povečanim srčnim utripom in močnejšim znojenjem, kar poveča temperaturo kože in telesa. To je še posebej pomembno pri delavcih, ki nosijo neprepustna oblačila, saj standardne metode okoljskega spremljanja, kot je merjenje WBGT, ne zagotavljajo natančnih pokazateljev toplotnega stresa v takih okoliščinah. Srčni utrip je enostavno meriti z uro. Nekateri delodajalci spremljajo tudi spremembe teže delavcev med izmeno kot indikator izgube vode zaradi znojenja (*Heat - Personal Risk Factors* |, b. d.).

4 Razprava

Stabilno toplotno ravnovesje je bistvenega pomena za človekovo zdravje. To ravnovesje je zaradi dela v vročih delovnih okoljih, ki so posledica vročinskih valov, lahko resno ogroženo. Telesna aktivnost in osebna zaščitna oblačila lahko dodatno prispevajo k povečanju telesne temperature in preprečujejo učinkovito odvajanje toplote. To obremenjuje kardiovaskularni sistem, povzroča izgubo tekočine in elektrolitov, pri čemer so srce, ledvice in možgani še posebej občutljivi. Povišane temperature v okolju lahko vplivajo na delavce v skoraj vseh sektorjih. Trenutno so najbolj izpostavljeni tveganju zaradi toplotnega stresa tisti, ki delajo na prostem. To

vključuje panoge, kjer je prisotno intenzivno fizično delo ob neposredni izpostavljenosti soncu in vročini, kot so kmetijstvo, gozdarstvo, vzdrževanje cest, ribištvo, gradbeništvo, rudarstvo, logistika, ravnanje z odpadki in komunalne storitve. Ob naravnih nesrečah ali gozdnih požarih so prizadeti lahko tudi delavci interventnih služb (gasilci, policisti in vojaško osebje, osebje nujne medicinske pomoči in reševalci). Tveganju so izpostavljeni tudi delavci v zaprtih prostorih, zlasti tisti, ki delajo v slabo hlajenih zgradbah, kabinah strojev brez hlajenja in v industrijskih okoljih z visoko proizvodnjo toplote. Ogroženi so lahko tudi delavci, pri katerih obvezna uporaba osebne zaščitne opreme lahko nenamerno prispeva k vročinskemu stresu. To so delavci v zdravstvu, restavracijah, kuhinjah, pralnicah, čistilnih servisih... (EU OSHA, 2023).

Urejanje delovnih pogojev v vročih okoljih se opira na različne predpise in smernice, ki temeljijo na toplotnih standardih. Mednarodna organizacija dela (ILO) in Svetovna zdravstvena organizacija (WHO) nudita globalne smernice, ki vključujejo priporočila o maksimalnih dovoljenih temperaturah in zahtevah za odmore ter hidracijo. V Evropski uniji (EU) je ključna Direktiva Sveta 89/391/EGS o varnosti in zdravju delavcev pri delu, ki zahteva od delodajalcev, da upravljajo s toplotnimi tveganji (*Okvirna direktiva o varnosti in zdravju pri delu | Safety and health at work EU-OSHA, 1989*). Posebna pozornost je namenjena standardom, kot je ISO 7243, ki določa "Wet Bulb Globe Temperature" (WBGT) indeks za oceno toplotne obremenitve v delovnih okoljih. Ta standard omogoča delodajalcem, da ocenijo toplotni stres okolja in ustrezno prilagodijo delovne pogoje (*ISO 7243, 2017*). Prav tako je pomemben posodobljen standard za ergonomijo toplotnega okolja ISO 7933, ki daje smernice za analitično določitev in interpretacijo podatkov toplotne obremenitve ter oceno možnih zdravstvenih tveganj (*ISO 7933, 2023*). Poleg zakonodaje EU, mnoge evropske države razvijajo lastne nacionalne predpise, ki se nanašajo na delo v vročih okoljih. Ti vključujejo podrobnejše smernice o temperaturnih omejitvah, odmorih, hidraciji in smernice o zagotavljanju primerne osebne zaščitne opreme. V Republiki Sloveniji sta ključna predpisa, ki urejata področje varnosti in zdravja pri delu, *Zakon o delovnih razmerjih (ZDR-1)* in *Zakon o varnosti in zdravju pri delu (ZVZD-1)*. ZDR-1 v svojem 45. členu nalaga delodajalcu dolžnost, da zagotavlja varne in zdrave delovne pogoje v skladu s posebnimi predpisi (*Zakon o delovnih razmerjih (ZDR-1), 2013*). ZVZD-1 pa med svojimi temeljnimi načeli določa obveznost delodajalca do zagotavljanja varnosti in zdravja delavcev pri delu (*Zakon o varnosti in zdravju pri delu (ZVZD-1), 2011*). Njima

podrejen je Pravilnik o zahtevah za zagotavljanje varnosti in zdravja delavcev na delovnih mestih, ki podrobneje določa zahteve, ki jih mora delodajalec upoštevati pri načrtovanju, opremljanju in vzdrževanju delovnih mest. V 6. poglavju (25.-30. člen) tega pravilnika je opredeljeno, da mora delodajalec zagotoviti temperaturo zraka, primerno fiziološkim potrebam delavcev. Najvišja dovoljena temperatura je omejena na 28 °C, razen v posebnih delovnih prostorih, kjer je lahko višja. V takih primerih mora biti temperatura v pomožnih prostorih, hodnikih in stopniščih nižja od 20 °C. V poletnih mesecih, ko zunanje temperature presežejo 28 °C, delodajalci za ublažitev učinkov visokih temperatur lahko sprejmejo ukrepe, kot so prilagoditev delovnega časa in pogostejši odmori. Najnižja sprejemljiva temperatura za delo v pisarni je 20 °C, optimalna pa 22 °C. Delodajalci morajo redno preverjati delovne razmere za zagotavljanje ustreznega toplotnega ugodja.

Ukrepi za zaščito pred poletnim pregrevanjem delovnih mest, vključujejo tehnične, organizacijske in osebne varovalne ukrepe, ki so tesno povezani z ergonomijo delovnega okolja. Tehnični ukrepi, kot so senčila in klimatske naprave, neposredno izboljšujejo fizikalno ergonomijo in toplotno ugodje, s čimer zmanjšujejo fizični stres in izboljšujejo kognitivne sposobnosti delavcev. Organizacijski ukrepi, kot so prilagajanje delovnih nalog, zagotavljanje pijače in prilagodljivost delovnega časa pa pripomorejo k ustvarjanju učinkovitejšega delovnega okolja, ki zmanjšuje mentalno in fizično obremenitev. S kognitivno ergonomijo so povezani osebna varovalna oprema in ukrepi, ki zahtevajo delavčevo individualno odgovornost, kot so zadostna hidracija, prehranjevanje in nošenje primernih oblačil. Povečana koncentracija vlage v oblačilih, poveča toplotno prestopnost med telesom in oblačilom ter poveča toplotno prevodnost oblačila. Na ta način se lahko zmanjša učinkovitost termoregulacije telesa, zato je pomembno izbirati oblačila iz lahkih in zračnih materialov, ki odsevajo sončno svetlobo, omogočajo ohlapno prileganje, odvajajo vlago in zagotavljajo zaščito pred soncem. Toplotno ugodje lahko dodatno izboljšamo s prilagodljivimi elementi, kot so zadrge in mrežaste odprtine. Vsi ti ukrepi skupaj ustvarjajo varno, ugodno in tudi udobno delovno okolje, kar zahteva usklajevanje med delodajalci in delavci ter upoštevanje ergonomskih načel.

Pregled raziskav o vplivu podnebnih sprememb na delovno zmogljivost človeka je pokazal, da bi le-te morale biti bolj obsežne in, da bi morale upoštevati različne demografske skupine. Vključevati pa bi morale tudi fizične, kognitivne in psihične zmogljivosti človeka. Številne raziskave so gradbene in tehnične rešitve, kot so

zunanje senčenje in energetsko učinkovito hlajenje, izpostavile kot ključne za preprečevanje pregrevanja in priporočajo, da bi morali predpisi, ki določajo "zdravju prijazne sobne temperature" določati "zdravju prijazno klimo" (Bauer, S., idr., 2022). Za obvladovanje toplotnih obremenitev na delovnem mestu je ključna aklimatizacija, ki vključuje tako fiziološke kot organizacijske ukrepe.

5 Zaključek

Spremenjene podnebne razmere prinašajo nove in zahtevne izzive za delovna mesta. Do sedaj pridobljena spoznanja kažejo na kompleksnost teh izzivov in izpostavljajo potrebo po nadaljnjih, poglobljenih raziskavah. Različne študije so že razkrile, da ekstremna vročina lahko privede do resnih zdravstvenih težav zaradi vročinskega stresa in zmanjšanja produktivnosti. Delavci, zlasti tisti, ki delajo na prostem, so izpostavljeni večjemu tveganju za poškodbe zaradi utrujenosti in zmanjšane koncentracije. Delodajalci morajo oceniti tveganja za zdravje in varnost delavcev, povezana s temperaturo, ne glede na to, ali delo poteka v zaprtih prostorih ali na prostem. Čeprav so na voljo že nekatere smernice za obvladovanje vplivov podnebnih sprememb na delovna mesta, se pogosto srečujemo z izzivi njihove praktične implementacije. Integracija teh smernic v vsakodnevne delovne procese in prilagajanje specifičnim potrebam različnih industrijskih sektorjev zahteva dodatne raziskave in razvoj ciljno usmerjenih rešitev. Pomembno je združiti znanstvene ugotovitve z aplikativnimi rešitvami, ki bodo omogočale učinkovito prilagajanje delovnih mest spreminjajočemu se podnebnju.

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VZPOSTAVLJANJE NACIONALNIH VOZLIŠČ NA PODROČJU RAKA

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Raziskave, inovacije na področju raka, organizacija zdravstvenega varstva se v Evropski uniji (EU) soočajo s številnimi izzivi. Oddaljenost pomembnih deležnikov, razdrobljenost iniciativ sta primer izzivov, ki zahtevajo usklajene rešitve, kar naslavljata Evropski načrt za boj proti raku in misija rak. Namen projekta ECHoS, ki predstavlja pomoč pri implementaciji misije rak je podpora izvajanju dejavnosti na področju raka v državah članicah EU in pridruženih članicah z vzpostavljanjem in razvojem vozlišč na področju raka. Delovala bodo na nacionalni, regionalni in lokalni ravneh. Cilji projekta so spodbujanje ustanavljanja nacionalnih vozlišč, vzpostavljanje mreže in podpora napredku misije rak na področju EU, ustvarjanje sinergij z drugimi evropskimi pobudami ter ustvarjanje temeljev za evropsko mrežo nacionalnih vozlišč na področju raka z razvojem okvira modela neprekinjenega poslovanja in delovanja. ECHoS postavlja temelje za oblikovanje evropske mreže nacionalnih vozlišč, vključno s slovenskim vozliščem, močnega in povezanega omrežja, ki bo zagotavljalo usklajenost in napredek na področju raka v EU.

Ključne besede:

nacionalna
vozlišča,
mreža,
ECHoS,
rak,
izzivi

ESTABLISHMENT OF NATIONAL CANCER MISSION HUBS

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Cancer research, innovation and the organization of health care in the European Union (EU) face many challenges. The remoteness of important stakeholders, fragmentation of initiatives are examples of challenges that require coordinated solutions, as addressed by Europe's Beating Cancer Plan, and Mission Cancer. The purpose of ECHoS project is to support the implementation of activities in EU Member States and associated countries by establishing and developing cancer mission hubs. They will operate at national, regional, local levels. The goals of ECHoS are to encourage the establishment of hubs, establish a network, support the progress of Mission Cancer in EU, to create synergies with other EU initiatives, create the foundations for EU network of cancer hubs by developing a framework for continuous operation. ECHoS lays the foundation for the EU network of hubs, including Slovenian hub, a strong, connected network that will ensure progress in the field of cancer in EU.

Keywords:

cancer
hubs,
network,
ECHoS,
cancer,
challenges

1 Uvod

Rak predstavlja tako v Evropi, katere prebivalstvo se stara, kot v Sloveniji velik javnozdravstveni problem. V naši državi zbolijo za rakom po podatkih Registra raka Onkološkega inštituta letno preko 15 000 ljudi, okrog 6500 jih umre. Pri moških predstavlja rak prvi vzrok smrti, pri ženskah pa drugi. Zaradi uspešnega odkrivanja in zdravljenja raka živi danes v Sloveniji že okoli 110 000 ljudi, katerim je bila vsaj enkrat v življenju postavljena diagnoza rak. Določeni raki so izjemno redki, drugi se pojavljajo pogosteje (Škrbec, 2021). V Sloveniji je najpogostejši rak dojke, sledijo mu rak prostate, debelega črevesa in danke, pljučni rak in kožni rak, ki skupaj predstavljajo okrog 60% vseh vrst raka. Opisanih je namreč približno 200 vrst rakavih boleznih. Bolezen se lahko pojavi v kateremkoli delu telesa in v vseh starostih. Najpogosteje se rak pojavlja pri ljudeh, ki so starejši od 50 let. Medtem, ko je bilo pred tremi desetletji petletno preživetje le 30%, danes okoli 60% vseh bolnikov z rakom živi še pet let po postavitvi diagnoze (Škrbec, 2021). Kljub napredku v zadnjih letih predstavlja rak veliko breme za družbo in pomemben vzrok obolevnosti v Evropski uniji (EU). Glede na staranje evropske populacije in socio-ekonomski položaj je pričakovati, da se bo v primeru neukrepanja incidenca rakavih obolenj v prihodnje še povečevala. Epidemiološka predvidevanja, da bo rak kot vzrok umrljivosti kmalu postal najpomembnejši problem človeštva na področju zdravja so se v nekaterih državah EU že uresničila (Jelenc in Albreht, 2020).

Obvladovanje raka je v EU pomemben izziv. Pri njegovem reševanju je potreben usklajen pristop evropskih držav, vključno z Evropsko komisijo. Ker je obvladovanje raka izjemno zahtevno področje ima velik pomen ustrezno načrtovanje učinkovitega preprečevanja, odkrivanja in zdravljenja raka, skladno s potrebami prebivalstva. Z namenom obvladovanja raka so po priporočilu Evropske komisije države članice pripravile nacionalne programe za obvladovanje raka (angl. *National Cancer Control Programmes*) ter strategije, politike in druge dokumente, tako nacionalne, kot regionalne (Commission of the European Communities, 2009, Albreht, Jelenc in Gorgojo, 2013). V Sloveniji področje obvladovanja raka ureja Državni program za obvladovanje raka (Ministrstvo za zdravje Republike Slovenije, 2022).

Krovni dokument na področju obvladovanja raka v EU je Evropski načrt za boj proti raku (angl. *Europe's Beating Cancer Plan*), ki je bil predstavljen februarja 2021 (European Commission, 2021). Gre za prednostno nalogo predsednice Evropske komisije von der Leynove na področju zdravstva ter nov pristop EU k preprečevanju, zdravljenju in oskrbi na področju raka. Izhodišče Evropskega načrta za boj proti raku so nove tehnologije, raziskave, inovacije. Izvedbi načrta, ki bo podprt z ukrepi, ki vključujejo različna področja (izobraževanje, zaposlovanje, socialna politika in enakost, kmetijstvo, okolje, podnebje, trženje, energija, promet, obdavčenje, kohezijska politika) so namenili štiri milijarde evrov (European Commission, 2021, Jelenc, idr., 2021). V sklopu Evropskega načrta za boj proti raku je obravnavana celotna pot bolezni, od preprečevanja raka do kakovosti življenja bolnikov z rakom ter preživelih. Evropski načrt za boj proti raku ima štiri stebre (angl. *pillars*), oz. štiri ključna tematska področja: preventivo, zgodnje odkrivanje raka, diagnostiko z zdravljenjem in kakovost življenja bolnikov z rakom ter tistih, ki so ga preboleli, oz. preživelih. Načrt ima tudi presečne (angl. *cross cutting*) teme; ki so raziskave, inovacije, zmanjševanje neenakosti ter digitalna in personalizirana medicina. Evropski načrt za boj proti raku vključuje tudi deset vodilnih pobud (angl. *flagship initiatives*) in dvaintrideset ukrepov na vsaki ključni stopnji bolezni (European Commission, 2021).

Drugo pomembno ključno iniciativo Evropske komisije na področju obvladovanja raka predstavlja dokument misija rak. Gre za edino misijo na področju zdravstva. Pojem "misija" je leta 2018 uvedla neodvisna strokovnjakinja in inovatorica prof. Mariana Mazzucato iz Londona. V publikaciji z naslovom »Mission-Oriented Research & Innovation in the European Union« je pripravila osnutek strateških priporočil za raziskave in inovacije v EU v prihodnosti na pobudo Evropske komisije. Področje je organizirala v tako imenovane "misije", ki so predstavljale nov pristop v smeri široko opredeljenih ciljev ter pobud (Mazzucato, 2018). Misije imajo jasno opredeljene naloge in cilje, ki so merljivi in časovno opredeljeni ter spodbujajo medsektorsko povezovanje različnih vrst raziskav in inovacij. Področje raziskav in inovacij je organizirano v pet tematskih misij (prilagoditev podnebnim spremembam, vključno s preobrazbo družbe; klimatsko nevtralna in pametna mesta; zdravi oceani, morja, obalne in celinske vode; zdravje tal in hrane ter misija rak). Vsaka misija ima vodjo, svoje predsedstvo, ki ga sestavlja do 15 vrhunskih strokovnjakov iz različnih področij ter odbore in skupščino, kar prispeva k

uspešnosti posamezne misije s posredovanjem strokovnega znanja in idej (Hribar in Jelenc, 2020).

Z namenom implementacije obeh ključnih krovnih dokumentov - Evropskega načrta za boj proti raku in misije rak, Evropska komisija sofinancira več projektov, v katerih sodelujejo partnerske organizacije iz številnih evropskih držav. Eden izmed gradnikov implementacije misije rak je projekt ECHoS (kratica za Vzpostavitev vozlišč na področju raka: omrežja in sinergije; angl. *Establishing of Cancer Mission Hubs: Networks and Synergies*), ki bo pripomogel k vzpostavitvi nacionalnih vozlišč na področju raka in povezovanju le teh v evropsko mrežo.

2 Nacionalna vozlišča na področju raka in Evropska mreža vozlišč

Nacionalna vozlišča (angl. *hubs*) na področju raka naj bi povečala kapacitete evropskih držav pri integraciji raziskav in politik na področju raka v EU na nacionalni, regionalni in lokalni ravni. Vzpostavljena vozlišča naj bi povezala raziskave in inovacije z razvojem politik, in sicer s podpiranjem medpolitičnega dialoga z različnimi relevantnimi deležniki. Prebivalce EU bodo vozlišča postavila v svoje središče pozornosti, kar bo pomenilo pomembno pridobitev za državljane držav članic EU. Vzpostavljena naj bi bila tudi tako imenovana Evropska mreža nacionalnih vozlišč na področju raka (angl. *European Network of Cancer Mission Hubs*), ki bi bila organizirana kot platforma in namenjena izmenjavi dobrih praks ter skupnih aktivnosti regionalnih in nacionalnih akterjev na področju raka v EU.

3 Projekt ECHoS

Projekt ECHoS, ki torej predstavlja temelj implementacije misije rak (European Commission, 2021) v EU ima kot glavni namen podporo izvajanju dejavnosti na področju raka v vseh evropskih državah članicah in pridruženih državah z vzpostavitvijo vozlišč na področju raka ter njihovemu razvoju (ECHoS, 2023). Vozlišča naj bi delovala na nacionalni ravni, regionalni in lokalni ravni. Štirje specifični cilji projekta ECHoS so spodbujati ustanovitev nacionalnih vozlišč na področju raka, vzpostaviti mrežo podpore napredku misije rak na področju EU, ustvariti sinergije z drugimi evropskimi pobudami in ustvariti temelje za evropsko mrežo nacionalnih vozlišč na področju raka z razvojem okvira modela neprekinjenega delovanja.

Agencija za klinične raziskave in biomedicinske inovacije iz Portugalske je glavni koordinator projekta ECHoS, ki se je uradno pričel aprila 2023 in v katerem sodeluje kar 57 partnerjev iz 28 držav članic EU, tri pridružene članice in ena mednarodna organizacija. V projektu sodelujejo Avstrija, Belgija, Hrvaška, Ciper, Češka, Estonija, Finska, Francija, Nemčija, Grčija, Madžarska, Irska, Izrael, Italija, Latvija, Litva, Luksemburg, Malta, Nizozemska, Norveška, Poljska, Portugalska, Romunija, Slovaška, Slovenija, Španija, Švedska in Turčija.

Slovenijo v projektu zastopa Nacionalni inštitut za javno zdravje (NIJZ). Projekt bo trajal 36 mesecev.

Projektno delo je razdeljeno v šest tematskih delovnih sklopov/paketov (angl. *work packages-WP*). Prvi delovni sklop (angl. *WP 1*) je namenjen vodenju, oz. koordinaciji projekta (angl. *Project Governance and Implementation*), drugi delovni sklop (angl. *WP2*) pa načrtovanju, ustvarjanju in izmenjavi znanja nacionalnih vozlišč s področja raka (angl. *National Cancer Mission HUBs design, creation, and knowledge exchange*). Tretji delovni sklop (angl. *WP3*) je namenjen identifikaciji, vključevanju in sodelovanju deležnikov (angl. *Multi-stakeholder identification, engagement, and cooperation*). Četrti delovni sklop (angl. *WP4*) bo iskal sinergije in postavil mostove do misij in drugih evropskih pobud (angl. *Synergies: bridges to Missions and other European initiatives*). Peti delovni sklop (angl. *WP5*) je poimenovan Nastajajoča EU mreža nacionalnih vozlišč s področja raka – študija načrtovanja (angl. *Future EU network of National Cancer Mission HUBs-Design Study*). Zadnji, šesti delovni sklop (angl. *WP6*) je namenjen komunikaciji, diseminaciji, vključevanju in sodelovanju prebivalcev (angl. *Communication, Dissemination, Citizens' Engagement & Participation*).

Prvi delovni sklop je kot omenjeno namenjen koordinaciji projekta, vodi pa ga Agencija za klinične raziskave in biomedicinske inovacije iz Portugalske. Drugi delovni sklop, ki ga vodi Inštitut za raka iz Italije, je namenjen opredelitvi temeljev, splošne zasnove in operativnih strukturnih elementov nacionalnih vozlišč na področju raka. Predvidene so nove konceptualne pobude, katerih cilj je ustvariti mostove na različnih področjih raka. Smernice, dobre prakse, krepitev zmogljivosti v programih izmenjave znanja in dogodki za ozaveščanje bodo služili za spodbujanje ustanavljanja nacionalnih vozlišč na področju raka. Delo tretjega delovnega sklopa usklajuje Center za inovacije v medicini iz Romunije. Med nalogami tega delovnega sklopa so vzpostavitev modelov podpore izvajanju misije rak, identifikacija

deležnikov in priprava interaktivnega orodja za interakcije deležnikov na različnih ravneh ter vključevanje deležnikov in vzpodbujanje sodelovanja. Delo četrtega delovnega sklopa koordinira Svet za znanost in tehnologijo iz Malte, sklop je usmerjen v ustvarjanje sodelovanja z evropskimi projekti in organizacijami na področju zdravstva in raziskav. Okrepil bo sinergije med projektom ECHoS in drugimi evropskimi organi, pobudami in akterji, z namenom zagotovitve učinkovitega političnega dialoga na vseh ravneh in omogočanja učinkovitih povezav med različnimi pobudami. Peti delovni sklop koordinira inštitut Sciensano iz Belgije, namenjen pa je razvoju trajnostnega modela neprekinjenega delovanja predvidene mreže vozlišč na področju raka. Med nalogami tega sklopa so določitev ciljev mreže EU nacionalnih vozlišč na področju raka, postavitve okvirja neprekinjenega delovanja – upravljanje, finance in poslovni modeli ter priprava strateškega načrta za trajnostno evropsko mrežo vozlišč na področju raka. Šesti delovni sklop koordinira Center za celostno obvladovanje raka Karolinska iz Švedske, namenjen pa je približevanju misije raka tistim, ki jo najbolj potrebujejo – državljanom. Delo šestega delovnega sklopa bo osredotočeno na komunikacijske dejavnosti na različnih ravneh in tudi na neorganizirane deležnike: državljane, bolnike in njihove družine, marginalizirane skupine in družbo na splošno (ECHoS, 2023).

Nacionalni inštitut za javno zdravje je aktivno vključen v delo vseh delovnih sklopov projekta ECHoS, razen v peti sklop, ki je namenjen načrtovanju bodoče evropske mreže nacionalnih vozlišč s področja raka. Ker bo slovensko nacionalno vozlišče na področju raka bo zelo verjetno predstavljal Onkološki inštitut že potekajo usklajevanja in med Nacionalnim inštitutom za javno zdravje in Onkološkim inštitutom. Nekatere evropske države so svoja vozlišča na področju raka že ustanovile, med drugimi ima nacionalno vozlišče tudi Portugalska, ki projekt ECHoS koordinira in bo svoje izkušnje in dobre prakse na področju ustanavljanja in delovanja vozlišča delila tudi z drugimi državami (Delnord, 2023).

4 Zaključek

Evropska komisija posveča problematiki raka v zadnjih letih veliko pozornosti, saj se zaveda njegovih posledic. Prebivalstvo EU se namreč stara in rak, katerega incidenca s starostjo narašča predstavlja v EU, vključno s Slovenijo velik javnozdravstveni problem, njegovo obvladovanje pa velik izziv. Usklajen pristop evropskih držav in Evropske komisije pri reševanju problematike je postal nujna.

Evropska komisija je pripravila dva ključna dokumenta, Evropski načrt za boj proti raku in iniciativa Misija rak, ki ju bo implementirala preko projektov, za katere je namenila signifikantna finančna sredstva. Projekt ECHoS je vezan na implementacijo misije rak. Raziskave, inovacije na področju raka ter organizacija zdravstvenega varstva v EU se namreč soočajo s številnimi izzivi, kot je to oddaljenost ključnih deležnikov in razdrobljenost iniciativ. To po mnenju Evropske komisije zahteva skupen pristop in usklajene rešitve. Namen projekta ECHoS je podpora izvajanju dejavnosti na področju raka v državah članicah EU in pridruženih članicah z vzpostavljanjem in razvojem vozlišč, oz. hub-ov na področju raka, ki bodo delovala na nacionalni, regionalni ali lokalni ravneh. Med cilji projekta so spodbujanje ustanavljanja nacionalnih vozlišč na področju raka, vzpostavljanje mreže vozlišč in podpora napredku misije rak na področju EU, ustvarjanje sinergij z drugimi evropskimi pobudami ter ustvarjanje temeljev za evropsko mrežo nacionalnih vozlišč na področju raka z razvojem okvira modela neprekinjenega poslovanja in delovanja. Preko projekta ECHoS bodo postavljeni temelji za oblikovanje bodoče evropske mreže vozlišč na področju raka, v katero bo povezano tudi slovensko vozlišče. Države, ki so svoja vozlišča že vzpostavila bodo v sklopu projekta svoje izkušnje in dobre prakse delila z državami, kot je to Slovenija, ki bodo svoja vozlišča načrtovala in vzpostavila v sklopu dela na projektu ECHoS. Mreža evropskih vozlišč na področju raka bo zagotavljala usklajenost in napredek na področju raka v EU.

Izjava

Projekt ECHoS je prejel sredstva iz programa Evropske unije preko Evropske izvajalske agencije za zdravje in digitalno tehnologijo (angl. European Health and Digital Executive Agency-HADEA) v okviru programa HORIZON Europe.

Projekt finansira Evropska unija. Izraženi pogledi in mnenja so avtorjevi in ne odražajo nujno stališč Evropske unije ali HADEA-e. Niti Evropska unija niti organ, ki ga financira ne prevzemata odgovornosti zanje.

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BOLNIŠNIČNE OBRAVNAVE ZARADI BOLEZNI MIŠIČNO-SKELETNEGA SISTEMA IN VEZIVNEGA TKIVA V LETU 2022 V SLOVENIJI

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Bolezni mišično-skeletnega sistema in vezivnega tkiva obsegajo preko sto petdeset različnih obolenj. V Sloveniji predstavljajo javnozdravstveni problem, saj so pomemben vzrok odsotnosti z dela, neudejstvovanja v družbi, zgodnjega upokojevanja in bolnišničnih obravnav oz. hospitalizacij. V retrospektivni-opazovalni raziskavi smo analizirali bolnišnične obravnave zaradi bolezni mišično-skeletnega sistema in vezivnega tkiva v Sloveniji za leto 2022. V analizi so bili uporabljeni najnovejši podatki redne zdravstvene statistike, ki se zbirajo na Nacionalnem inštitutu za javno zdravje. Rezultati raziskave so pokazali, da so bili leta 2022 najpogostejši vzroki za bolnišnične obravnave zaradi bolezni mišično-skeletnega sistema in vezivnega tkiva artroza kolka, artroza kolena in spondilopatije. Zabeleženih je bilo 20.454 bolnišničnih obravnav zaradi tovrstnih bolezni, 9031 pri moških in 11.423 pri ženskah, kar je predstavljalo 8,4% vseh bolnišničnih obravnav v tem letu. Pričakovati je, da se bo število bolnišničnih obravnav zaradi teh bolezni povečevalo, kar nujno zahteva sledenje ustreznim strateškim dokumentom.

Ključne besede:

bolnišnične obravnave, mišično-skeletne bolezni, kakovost življenja, Slovenija, vezivno tkivo

HOSPITAL ADMISSIONS DUE TO MUSCULOSKELETAL AND CONNECTIVE TISSUE DISEASES IN 2022 IN SLOVENIA

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Musculoskeletal and connective tissue diseases comprise over one hundred and fifty diseases. In Slovenia, they are a public health problem, an important cause of absence from work, lack of involvement in society, early retirement and hospital admissions, or hospitalizations. In a retrospective-observational study, we analyzed hospital admissions due to these diseases in Slovenia in 2022. The latest data from regular health statistics collected at the National Institute of Public Health were used. The results of the survey showed that the most common causes of hospitalization for musculoskeletal and connective tissue diseases were arthrosis of the hip, arthrosis of the knee and spondylopathy. There were 20,454 hospital admissions due to such diseases, 9,031 in men and 11,423 in women, which represented 8.4% of all hospital admissions in 2022. It is expected that the number of hospitalizations due to these diseases will increase, which urgently requires following the relevant strategic documents.

Keywords:

hospital admissions, musculoskeletal diseases, quality of life, Slovenia, connective tissue

1 Uvod

Bolezni mišično-skeletnega sistema in vezivnega tkiva so velika skupina preko sto petdesetih bolezní, za katere je značilno, da se lahko pojavijo v kateremkoli življenjskem obdobju, najpogosteje od adolescence do starosti. Dejavniki tveganj, ki so podobni pri večini kroničnih nenalezljivih bolezní vplivajo na razvoj bolezní mišično-skeletnega sistema in vezivnega tkiva. Spol, starost, genetski dejavniki, predhodne poškodbe ter drugi dejavniki, povezani z načinom življenja posameznika, kot je to povišana telesna teža, nepravilne prehranske navade, kajenje in pomanjkanje gibanja so le nekateri od dejavnikov, ki vplivajo na razvoj bolezní mišično-skeletnega sistema in vezivnega tkiva (WHO, 2022; Lewis idr., 2019).

Zaradi naraščanja deleža starejšega prebivalstva, pa tudi drugih obolenj, npr. debelosti je pričakovati, da se bo vpliv bolezní mišično-skeletnega sistema in vezivnega tkiva na družbo in posameznika povečeval (Lewis idr., 2019). Bolezni mišično-skeletnega sistema in vezivnega tkiva že danes predstavljajo javnozdravstveni problem in predstavljajo breme za zdravstvene sisteme in celotno družbo. Bolečine v hrbtu in vratu, osteoartritis, poškodbe, s krhkostjo povezani zlomi, sistemske vnetne bolezni, kot npr. revmatoidni artritis spadajo med najpogostejše kostno-mišične bolezni, od katerih mnoge zahtevajo bolnišnično zdravljenje. Tovrstne bolezni pogosto spremlja bolečina, mobilnost in funkcionalne sposobnosti so zmanjšane, prav tako sposobnost za delo in družbeno udejstvovanje (WHO, 2022).

Pred skoraj dvema desetletjema so že bile bolezni mišično-skeletnega sistema in vezivnega tkiva v Sloveniji glede na stroške za zdravila in bolnišnično zdravljenje za le nekaj bolezní iz te skupine na visokem četrtem mestu (Zaletel Kragelj, 2007). Zaradi vse večje prevalence bolezní mišično-skeletnega sistema in vezivnega tkiva postaja to področje vedno pomembnejše. Težave, ki jih imajo bolniki s temi boleznimi zahtevajo hospitalizacije, vodijo v prezgodnje upokojevanje in predvsem slabo kakovost življenja (WHO, 2022). Še posebej pereča je situacija pri starejših, saj so pri njih tovrstne težave pogostejše, populacija pa se nam stara (Briggs, 2016).

Namen naše raziskave je bil prikazati stanje na področju bolnišničnih obravnav zaradi bolezní mišično-skeletnega sistema in vezivnega tkiva v Sloveniji, v letu 2022.

2 Metodologija

Načrtovali smo retrospektivno opazovalno raziskavo. Bolezni mišično-skeletnega sistema in vezivnega tkiva v Sloveniji predstavljamo na osnovi bolnišničnih obravnav. Analizo podatkov smo opravili s programom Microsoft Excel, podatke smo predstavili tabelarično.

Izračunali smo stopnje bolnišničnih obravnav, ki predstavljajo število bolnišničnih obravnav na 1000 prebivalcev. Za izračun stopenj bolnišničnih obravnav smo upoštevali število vseh prebivalcev v Sloveniji leta 2022.

V analize smo vključili podatke redne zdravstvene statistike, ki jih zbiramo na Nacionalnemu inštitutu za javno zdravje, skladno z Zakonom o zbirkah podatkov s področja zdravstvenega varstva (Vlada RS, 2000) in so bralcu prosto dostopni na spletni strani podatkovnega portala (NIJZ, 2022). Podatke najdemo pod alinejo Hospitalizacije zaradi bolezni, do katere dostopamo preko alineje Zdravstveno varstvo. Podatki vključujejo vse diagnoze bolezni mišično skeletnega sistema in vezivnega tkiva iz Mednarodne klasifikacije bolezni in sorodnih zdravstvenih problemov za statistične namene, deseta revizija (IVZ, 2005). Podatki o bolnišničnih obravnavah zaradi diagnoz bolezni mišično skeletnega sistema in vezivnega tkiva so pridobljeni iz Evidence bolezni, poškodb in zastrupitev, ki zahtevajo zdravljenje v bolnišnici. Primeri so bili izbrani na podlagi glavne diagnoze, to je glavno stanje oziroma bolezen, diagnosticirana ob koncu bolnišnične obravnave kot glavni vzrok, zaradi katerega je oseba potrebovala zdravljenje v bolnišnici.

V prikaz podatkov so vključeni prvi in ponovni primeri bolnišničnih obravnav glede na glavno diagnozo.

3 Rezultati

3.1 Število in stopnja bolnišničnih obravnav v letu 2022

Rezultati naše retrospektivne opazovalne raziskave so pokazali, da je bilo v letu 2022 v Sloveniji 20.454 bolnišničnih obravnav zaradi bolezni mišično skeletnega sistema in vezivnega tkiva (9031 pri moških in 11423 pri ženskah), kar je predstavljalo 8,4%

vseh bolnišničnih obravnav v tem letu. Stopnja bolnišničnih obravnav je bila višja pri ženskah, kar je prikazano v Tabeli 1.

Tabela 1: Število in stopnja bolnišničnih obravnav, Slovenija, 2022

	Skupaj	Moški	Ženske
Število	20454	9031	11423
Stopnja	9,7	8,5	10,9

Vir: podatkovne zbirke NIJZ

3.2 Vzroki bolnišničnih obravnav v letu 2022

Med najpogostejšimi vzroki za bolnišnične obravnave zaradi bolezni mišično-skeletnega sistema in vezivnega tkiva so bile v letu 2022 artroza kolka (koksartroza) (M16), artroza kolena (gonartroza) (M17) in druge spondilopatije (M48), in sicer pri obeh spolih, kar je prikazano v Tabeli 2. Na četrtem in petem mestu sta bili pri moških druge okvare medvretenčne ploščice (diskusa) (M51) in notranja motnja kolena (M23), pri ženskah pa sta bili pridobljena deformacija prstov rok in stopal (M20) in bolečina v hrbtu (dorzalgija) (M54).

Tabela 2: Število bolnišničnih obravnav zaradi diagnoz bolezni mišično-skeletnega sistema in vezivnega tkiva po spolu, Slovenija, 2022

Diagnoze	Skupaj	Moški	Ženske
Gnojni artritis (M00)	192	121	71
Reaktivne artropatije (M02)	13	7	6
Seropozitivni revmatoidni artritis (M05)	72	20	52
Druge vrste revmatoidni artritis (M06)	16	3	13
Juvenilni artritis (M08)	59	23	36
Protin (giht) (M10)	87	74	13
Druge, s kristali povzročene artropatije (M11)	19	4	15
Druge specifične artropatije (M12)	6	3	3
Drugi artritis (M13)	162	88	74
Poliartroza (M15)	5	2	3
Artroza kolka [koksartroza] (M16)	3870	1811	2059
Artroza kolena [gonartroza] (M17)	3806	1485	2321
Artroza prvega karpometakarpalnega sklepa (M18)	204	33	171

Diagnoze	Skupaj	Moški	Ženske
Druge vrste artroza (M19)	627	301	326
Pridobljena deformacija prstov rok in stopal (M20)	953	146	807
Druge vrste pridobljenih deformacij udov (M21)	229	102	127
Okvare pogačice (patele) (M22)	115	35	80
Notranja motnja kolena (M23)	928	480	448
Druge specifične motnje sklepa (M24)	183	89	94
Druge motnje sklepa, ki niso uvrščene drugje (M25)	372	170	202
Nodozni poliarteritis (vozličasto vnetje žil) in sorodne motnje (M30)	44	26	18
Druge vrste nekrotizirajoče žilne bolezni (vaskulopatije) (M31)	245	115	130
Sistemski lupus eritematozus (M32)	33	7	26
Dermatopolimiozitis (M33)	28	12	16
Sistemska skleroza (M34)	21	5	16
Druge vrste sistemska vezivnotkivna bolezen (M35)	129	52	77
Kifoza in lordoza (M40)	10	2	8
Skolioza (M41)	103	19	84
Osteohondroza hrbtenice (M42)	5	1	4
Druge deformirajoče bolezni hrbta (dorzoopatije) (M43)	288	83	205
Ankilozirajoči spondilitis (M45)	12	10	2
Druge vnetne spondilopatije (M46)	100	63	37
Spondiloza (M47)	37	11	26
Druge spondilopatije (M48)	1904	846	1058
Okvare medvretenčne ploščice (diskusa) cervikalne hrbtenice (M50)	170	60	110
Druge okvare medvretenčne ploščice (diskusa) (M51)	1156	604	552
Druge bolezni hrbta (dorzoopatije), ki niso uvrščene drugje (M53)	80	33	47
Bolečina v hrbtu (dorzalgija) (M54)	1019	417	602
Miozitis (M60)	23	12	11
Mišična kalcifikacija in osifikacija (M61)	7	5	2
Druge mišične motnje (M62)	41	21	20

Diagnoze	Skupaj	Moški	Ženske
Sinovitis in tenosinovitis (M65)	210	80	130
Samodejno pretrganje (spontana ruptura) sinovije in kite (M66)	49	23	26
Druge sinovijske in kitne motnje (M67)	101	48	53
Motnje mehkega tkiva zaradi rabe, pretirane rabe in pritiska (M70)	72	52	20
Druge bolezni sluznih vrečk (burzopatije) (M71)	26	15	11
Motnje veziva (fibroblastične motnje) (M72)	369	301	68
Okvare (lezije) rame (M75)	498	238	260
Entezopatije spodnjega uda, razen stopala (M76)	87	32	55
Druge entezopatije (M77)	78	28	50
Druge motnje mehkega tkiva, ki niso uvrščene drugje (M79)	176	102	74
Osteoporozo s patološkim zlomom (M80)	81	16	65
Osteoporozo brez patološkega zloma (M81)	42	21	21
Osteomalacija pri odraslih (M83)	1	-	1
Motnje zveznosti (kontinuitete) kosti (M84)	151	75	76
Druge motnje gostote in zgradbe kosti (M85)	44	27	17
Osteomielitis (M86)	322	221	101
Osteonekroza (M87)	158	83	75
Pagetova bolezen kosti [deformantni osteitis] (M88)	2	1	1
Druge bolezni kosti (M89)	19	8	11
Juvenilna osteohondroza kolka in medenice (M91)	20	16	4
Druge vrste juvenilna osteohondroza (M92)	13	7	6
Druge osteohondropatije (M93)	47	21	26
Druge bolezni hrustanca (M94)	41	18	23
Druge pridobljene deformacije mišičnoskeletnega sistema in vezivnega tkiva (M95)	56	33	23
Mišičnoskeletne motnje po posegih, ki niso uvrščene drugje (M96)	418	164	254

Vir: podatkovne zbirke NIJZ

Primerjava stopenj bolnišničnih obravnav na 1000 oseb med spoloma jasno prikaže razliko v stopnji bolnišničnih obravnav zaradi 3 najpogostejših vzrokov, ki so pogostejši pri ženskah kot pri moških. Stopnja bolnišničnih obravnav zaradi diagnoz

bolezni mišično-skeletnega sistema in vezivnega tkiva na 1000 oseb za 5 najpogostejših vzrokov obravnav po spolu, za leto 2022 je prikazana v Tabeli 3.

Tabela 3: Stopnja bolnišničnih obravnav zaradi diagnoz bolezn mišično-skeletnega sistema in vezivnega tkiva na 1000 oseb za pet najpogostejših vzrokov obravnav po spolu, 2022

Moški		Ženske		Skupaj	
M16	1,71	M17	2,21	M16	1,84
M17	1,40	M16	1,96	M17	1,80
M48	0,80	M48	1,01	M48	0,90
M51	0,57	M20	0,77	M51	0,55
M23	0,45	M54	0,57	M20	0,48

Vir: podatkovne zbirke NIJZ

4 Razprava in zaključek

Ker se prevalenca bolezn mišično-skeletnega sistema in vezivnega tkiva povečuje in postaja ta skupina bolezn vedno pomembnejša, tudi v luči stroškov, ki jo spremljajo, (Sedlak, 2021) smo s pričujočo analizo bolnišničnih obravnav zaradi te velike skupine bolezn želeli opozoriti na problematiko tovrstnih hospitalizacij. Osredotočili smo se na leto 2022, ki je sledilo letoma, ki ju je močno zaznamovala pandemija covid-19. Danes namreč vemo, da je imel pojav pandemije covid-19, katere povzročitelj je bil koronavirus SARS-CoV-2 in ki se je pojavila leta 2019 negativen vpliv na obolenja mišično-skeletnega sistema in vezivnega tkiva (Hasan idr., 2021; Simonović idr., 2023). Rezultati naše retrospektivne opazovalne raziskave kažejo, da je bilo v letu 2022 v Sloveniji 20.454 bolnišničnih obravnav zaradi bolezn mišično-skeletnega sistema in vezivnega tkiva, 11.423 pri ženskah in 9.031 pri moških. Opisano predstavlja 8,4% vseh bolnišničnih obravnav v letu 2022. Stopnja za moške in ženske skupaj je znašala 9,7. Za primerjavo je bila med leti 2016 in 2019 povprečna letna stopnja bolnišničnih obravnav 10,8 na 1.000 prebivalcev, v kovidnem letu 2020 pa je bil opažen močan upad, in sicer na 8,3 (Simonović idr., 2023).

Skupina znanstvenikov je v obsežni študiji, ki je zajela obdobje od leta 1999 do leta 2019 v Angliji in Wales-u ugotovila skoraj 100% povečanje števila bolnišničnih obravnav zaradi bolezn mišično-skeletnega sistema in vezivnega tkiva v proučevanem obdobju. Več kot polovica bolnišničnih obravnav je bila pripisljiva ženskam. Vzrok za bolnišnične obravnave so bile v večini primerov poliartropatije,

osteoartritis in druga obolenja sklepov. Njihova raziskava ni vključevala obdobja po letu 2019 (Ali idr., 2022).

Nekateri tuji avtorji, ki so proučevali bolnišnične obravnave v zadnjih letih pripisujejo zmanjšanje števila hospitalizacij v obdobju, ki vključuje pojav pandemije covid-19 ukrepom, ki so bili sprejeti v času pandemije z namenom omejitve širjenja virusa, pa tudi izogibanju obiska zdravnika s strani bolnikov, ki so se na ta način skušali izogniti okužbam, tudi v Sloveniji, kar je navedeno v strokovni literaturi (Birkmayer idr., 2020; Selke-Krulichova, 2022).

V znanstveni literaturi nismo zasledili raziskav, ki bi bile osredotočene na bolnišnične obravnave zaradi bolezni mišično-skeletnega sistema in vezivnega tkiva in ki bi vključevale podatke za leto 2022. Skupina kanadskih sicer opisuje prevalenco bolezni mišično-skeletnega sistema in vezivnega tkiva v letu 2022, vendar so se osredotočili na populacijo študentov (Nouri Parto, 2023). Večinoma so tuji avtorji v svojih raziskavah osredotočeni na vpliv covid-19 na število bolnišničnih obravnav; opisujejo znižano število bolnišničnih obravnav pacientov brez simptomov covid-19 v obdobju pandemije (Rennert-May idr., 2021).

V Sloveniji je bilo v letu 2022 skoraj 10% hospitalizacij zaradi bolezni mišično-skeletnega sistema in vezivnega tkiva, nad čemer se velja zamisliti. Najpogostejši vzroki za bolnišnične obravnave so bili artroza kolka (koksartroza), artroza kolena (gonartroza) in spondilopatije, tako pri moških, kot pri ženskah. Z vidika povečevanja prevalence bolezni mišično-skeletnega sistema in vezivnega tkiva in v luči staranja populacije smo želeli osvetliti stroškovni vidik hospitalizacij zaradi teh bolezni z analizo najnovejših podatkov, ki se zbirajo na NIJZ. Slovenija bi morala slediti nekaterim drugim državam, ki so pripravile za obvladovanje področja bolezni mišično-skeletnega sistema in vezivnega tkiva strateške dokumente z opisom ključnih aktivnosti in prioritet. Glede na rezultate naše analize, glede na javnozdravstveni problem bolezni mišično-skeletnega sistema in vezivnega tkiva ter z vidika staranja populacije je to že sedaj nujno potrebno.

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ANALYZING THE CORRELATION BETWEEN LOGISTIC COMPANIES' REVENUES AND THE DYNAMICS OF THE S&P 500 INDEX IN THE LIGHT OF ACCELERATED DIGITIZATION

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The objective of this study is to examine the complex relationship between the revenues of logistics companies in the US market and the performance of the S&P 500 Index between 2009 and 2022. Through a comprehensive analysis, the study aimed to identify correlations and key patterns that could shed light on the impact of logistics companies on the performance of the S&P 500 Index. Key findings show a correlation coefficient of -0.18, suggesting a moderate negative correlation between logistics company earnings and movements in the S&P 500 Index. Notable trends emerged in key years, particularly 2020 and 2021, highlighting the resilience and responsiveness of logistics earnings to broader economic and market changes.

Keywords:

digitization, logistics, S&P Index, business, global market

1 Introduction

Traditional market as we know it from the past has undergone substantial transformation in the past two decades. Technological innovations, and not least the Internet, have changed the traditional ground rules (Dorčák et. al. 2015). The transport industry is a key sector for national economic and social development. Modern transport has become an important economic activity for human civilization. The transport industry is one of the main components of globalization, contributing significantly to the economy and playing a key role in daily activities around the world (Boqiang et. al, 2013).

To achieve effective business performance, it is essential to ensure a balance between the needs, requirements and expectations of the users of a particular service. It is necessary to carry out continuous measurements and to try to determine the planned set of values to be achieved. Logistics plays a very important role in all this, providing answers to questions of efficiency and optimization, considering the indicators that most influence rationalization (Stević et. al, 2017). On the one hand, the transport subsystem of logistics represents the largest percentage of logistics costs, and, on the other hand, it allows the purpose and objectives of logistics to be achieved because it affects the economic system of each country. To rationalize the logistics costs incurred in carrying out the various transport activities, good management is needed to identify appropriate strategies. Micro, small, and medium enterprises are suitable and interesting when considering the adoption of business process management strategies. In this context, the assessment of human resources is important because it influences the definition of business processes and their structuring, which according to Dobrosavljevic and Urošević (2019).

The Global Industry Classification System (GICS) has 11 stock market sectors in its taxonomy. It further breaks down these 11 sectors into 24 industry groups, 68 industries, and 157 sub-industries. Companies which have transport in their core of business are part of the US index the S&P 500 Index. The index is categorized into 11 sectors, representing distinct classifications for the companies it monitors. These sectors encompass a wide range of industries, including healthcare, technology, energy, real estate, and more. The term "S&P" originates from Standard & Poor's, with the index tracking the performance of 500 large-cap U.S. companies. The industrial sector is very diverse and includes several sub-sectors such as aerospace

and defense, mechanical engineering, construction, transport and industrial conglomerates. The transportation segment includes companies involved in various modes of transportation such as airlines, logistics, railways, and shipping. Moreover, Warren Buffett advises investors to consistently invest in a low-cost S&P 500 index fund, emphasizing the importance of maintaining this strategy during both favorable and challenging market conditions. He further suggests that this approach is sound even for those who may not possess financial expertise, underscoring the simplicity and effectiveness of a long-term investment strategy in the S&P 500. Berkshire Hathaway Warren's company was considered in research by Pollák and others (2021) as a reference point in the analysis of search results and reputation scores. Although it did not outperform its parent company in general search results, its overall online presence and impact on reputation scores based on search results was considered. As a conglomerate with no individual brands, Berkshire Hathaway's reputation was reflected indirectly through its various investments and holdings, which provided a unique perspective in the study. In the context of this study, hypotheses go beyond mere conjecture, they are methodologically designed to explore, confirm, or refine underlying assumptions. The dynamic nature of financial markets requires a high approach, and our hypotheses are designed to reveal patterns, and trends in industrial sector.

(H0): There is no significant correlation between the annual revenue growth of logistics companies in the S&P 500 and the yearly changes in the S&P 500 index.

(H1): There is a significant correlation between the annual revenue growth of logistics companies in the S&P 500 and the yearly changes in the S&P 500 index.

2 Current state of knowledge of the analyzed issue

The original studies on financial contagion were based on Pearson's correlation coefficient, and researchers compared the Pearson's coefficients during the crisis and in normal times between financial markets. If the correlation coefficient is larger during a crisis, it means that there is a financial contagion effect. To explore methods for testing the behavior of financial contagion based on the joint movement of different market asset prices (Zhu et. al. 2018). Ang and Chen (2002) applied the asymmetric multivariate GARCH-M model to analyze the financial contagion. Bae et al. (2003) used the Multivariate Logistic regression to analyze extreme events

between different areas to examine the financial contagion. But all co-movement analysis only examined the existence of contagion, does not give the extent and trends of contagion. Haldane (2013) explored the relationships between network complexity, diversity, and financial fragility from the perspective of network ecology and epidemiology and presented the reasons for the fragility of the structure of the financial system. Another way to investigate possible effects of the pandemic on businesses is to analyze stock prices, in contrast to other data sources, they allow for the estimation of the consequences of an event without long observation periods (Ramelli & Wagner, 2020). According to the theory of efficient markets, stock prices represent the expected present discounted value of dividends changes in stock prices are the result of changing expectations about future returns and risks (Fama, 1970; West, 1988). The study from Paetsch and others (2017) critically analyses differences and synthesizes of different devices and types of digital traffic on the overall performance of mobile networks. At the same time, the study examines the correlation between mobile network dynamics and broader financial market trends. The research, which proposes a new framework for mobile data, aims to address the growing disconnect between network capacity, usage patterns and the underlying value of data. In addition, researchers claimed that freight distribution and transportation activities are as one of the primary sources of greenhouse gas emission (GHG) and high consumption of energy (Kim and Han, 2023). International Energy Agency claims that global carbon emission from transportation modes is around 24% of the total emission.

3 Materials and Methods

The main objective of this research was to examine the relationship between the revenues of logistics companies in the US market and the trends observed in the S&P 500 Index over the last 14 years (2009-2022). To achieve this objective, data was obtained from the US Securities and Exchange Commission, specifically using information available in 10-K annual reports.

The first step in the analysis was to calculate year-on-year growth rates. This method allowed a quick calculation of year-over-year growth rates for each year and for each individual company. The research then proceeded to calculate the average growth rate for each year, aggregated across all companies considered. This methodology was used to gain a comprehensive understanding of the annual revenue dynamics of

logistics companies in the US market and to see how these trends correlated with the broader movements observed in the S&P 500 Index over the 14-year period.

$$\text{YoY Growth Rate} = \frac{(\text{Current Year Value} - \text{Previous Year Value})}{\text{Previous Year Value}} \times 100$$

A correlation analysis was then carried out comparing the percentage sales growth of each company in the S&P 500 Index with the percentage change in the S&P 500 Index over several years. The aim of this analytical approach was to determine the extent to which the earnings performance of individual companies is consistent with the overall trends in the broader market. Correlation, as used in this study, is a statistical technique used to quantify the strength and direction of a linear relationship between two variables. The main correlation coefficient used in this context is the Pearson correlation coefficient, which is a widely accepted metric for such analyses.

In our case, the average revenue growth of logistic companies might be the dependent variable, and the yearly growth rate of the S&P 500 index is the independent variable.

Table 1: Investigated subjects

Name of the company	Industry
United Parcel Service	transportation
Union Pacific Railroad	transportation
CSX Transportation	transportation
Federal Express	transportation
Norfolk	transportation
Old Dominion Freight Line	transportation
Delta Air Lines	airlines/transportation
J.B. Hunt Transport Services	transportation
Southwest Airlines Co	airlines/transportation
Expeditors International of Washington	transportation
C.H. Robinson Worldwide	transportation

Source: own processing based on The Global Industry Classification System (GICS)

4 Results and discussion

The data was subjected to analysis, the following table presents the results of the regression statistical analysis. Subsequently, the results are discussed in the context of the topic.

Table 2: Results of statistical testing

Regression Statistics	
Multiple R	-0,188074619
R Square	0,035372062
Adjusted R Square	-0,052321386
Standard Error	13,16915066
Observations	14

Source: own processing

Given the weak negative correlation, it can be interpreted that as the annual growth rate of the S&P 500 Index rises, the average revenue growth of the 11 listed logistics companies tends to fall slightly on average and vice versa. However, the correlation is not strong, and the relationship does not have high predictive power. The weak negative correlation may indicate that the earnings growth of logistics companies does not accurately reflect the overall market trends represented by the S&P 500 index. Overall, the correlation coefficient of -0.18807 indicates a weak negative relationship between the average earnings growth of logistics companies in the S&P 500 Index and the annual growth rate of the S&P 500 Index.

The effects of the 2008 financial crisis continued to be felt in 2011 and had a lasting impact on businesses. Companies faced major challenges during this period because of the global economic slowdown. The resulting reduction in demand for transport, particularly in the manufacturing sector, had a significant impact on shipping volumes. The volatility of fuel prices during this period was an additional challenge that had a noticeable impact on the operating costs of these companies. In addition, the prevailing economic uncertainty and fluctuating patterns of international trade have introduced an additional layer of complexity that has potentially affected logistics companies' revenue streams. As a result, there has been an industry-wide

initiative as companies have begun to implement comprehensive transformation plans. These strategic efforts have required significant expenditure to upgrade infrastructure and adapt to evolving market trends. In the years that followed, a significant shift towards technology investment and a proactive attitude towards adapting to new trends in the industry emerged as important drivers of sales dynamics. This was a period of transformation, characterized by strategic investments in technology by companies. The emergence of the COVID-19 pandemic in recent years has led to a paradigm shift in consumer behavior. The significant increase in e-commerce activity has acted as a major catalyst, positively impacting parcel volumes for logistics companies. Increased demand for home delivery, coupled with significant changes in consumer preferences.

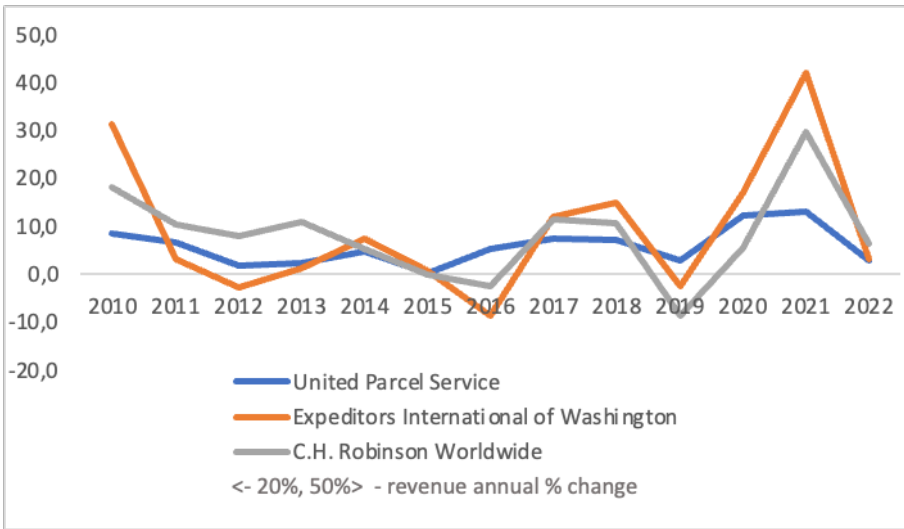


Figure 1: Revenue percentage growth

Source: own processing, specifically using information available in 10-K annual reports

The aerospace industry experienced a period of recovery in 2010, indicating that the effects of the global financial crisis have been overcome. The two controlled companies, like their partners, benefited from the improving economic climate. In particular, the recovery was underpinned by increased consumer confidence and a recovery in business travel. This joint drive contributed to a stabilization of sales, which were characterized by the companies' renewed travel activity. However, the subsequent emergence of the COVID-19 pandemic in the following years brought

about a significant change in the operating environment for both Delta and Southwest. This period was characterized by a sharp decline in demand for air travel, accompanied by an increase in flight cancellations and major operational problems. The imposition of government restrictions, widespread lockouts and pervasive global uncertainty had a profound impact on passenger behavior and led to visible changes in travel decisions. The resulting environment, characterized by an unprecedented confluence of external factors, has significantly eroded the once stable revenue performance of these airlines.

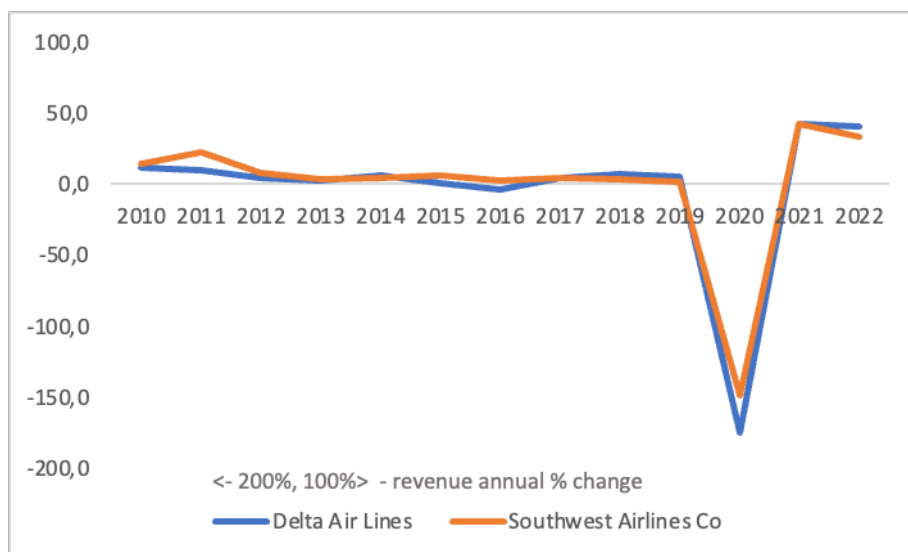


Figure 2: Revenue percentage growth

Source: own processing, specifically using information available in 10-K annual reports

5 Conclusion

In summary, the objective of this research was to clarify the complex relationship between the annual earnings growth of logistics companies within the S&P 500 Index and the corresponding annual changes in the S&P 500 Index. The focus was on assessing the existence and significance of the correlation between these variables. The obtained correlation coefficient of $-0,18$ indicates a weak negative correlation. Although this correlation is statistically significant, its magnitude suggests that the annual earnings growth of logistics companies in the S&P 500

Index is only moderately related to the annual changes in the S&P 500 Index. 2011, characterized by a global economic slowdown, and the following years 2020-2021, characterized by the unprecedented impact of the COVID-19 pandemic on the global economy, were identified as the critical years for this analysis. This was a critical time for the annual revenue growth dynamics of logistics companies and the broader market, represented by the S&P500 Index. With respect to the hypotheses formulated, the research results lead us to reject the null hypothesis (H0), which implies the absence of a significant correlation, and to accept the alternative hypothesis (H1), which implies a statistically significant correlation. Although the correlation is statistically detectable, the weak nature of the correlation highlights the importance of considering other factors and nuances that contribute to the complex dynamics of the logistics sector within the broader financial environment. The correlation between annual earnings growth and the S&P 500 Index was the primary focus of the research. Other relevant factors such as industry-specific dynamics, geopolitical events and regulatory changes were not part of the analysis and may therefore limit the scope of the findings.

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UPRAVLJANJE MEDGENERACIJSKEGA SODELOVANJA IZ NASLOVA PREDSDOKOV IN IZZIVOV

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Staranje prebivalstva pomembno vpliva na dinamiko delovne sile in zahteva učinkovito prilaganje spremembam. Osredotočili smo se na upravljanje medgeneracijskega sodelovanja in reševanje vrzeli, ki ob tem nastajajo. Starejše generacije imajo več delovnih in življenjskih izkušenj, na drugi strani pa mlajša generacija prinaša sveže ideje. Sodelovanje različnih generacij pomeni združevanje različnih perspektiv pri reševanju kompleksnih problemov, ki zahtevajo širok spekter znanj in izkušenj. Prilaganje spremembam za mlajšo generacijo ne predstavlja nekih večjih težav, na drugi strani pa se pogosto srečujemo s tem, da se starejši zaposleni težje prilagajajo novim okoliščinam. V delovnem okolju, kjer se dogajajo hitre tehnološke spremembe so starejši zaposleni pogosto zapostavljeni, saj se pojavljajo določeni predsodki, ki predstavljajo dodaten izziv pri upravljanju medgeneracijskega sodelovanja. Pri učinkovitem prilagajanju spremembam se starejši soočajo s specifičnimi izzivi pri uporabi digitalnih tehnologij. Reševanje teh izzivov zahteva prilagojene programe usposabljanja, ki temeljijo na individualnih potrebah zaposlenih. Ustvarjanje okolja, kjer se spodbuja sodelovanje med različnimi generacijami, se odraža z organizacijsko klimo, ki ima pozitiven vpliv celotno delovno okolje.

Ključne besede:

medgeneracijsko
sodelovanje,
delovno
okolje,
predsodki,
izzivi,
organizacijska
klima

MANAGING INTERGENERATIONAL COOPERATION BY ADDRESSING PREJUDICES AND CHALLENGES

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The aging of the population has a significant impact on the dynamics of the workforce and requires effective adaptation to change. We focused on managing intergenerational cooperation and solving the gaps that arise. Older generations have more work and life experience, on the other hand, the younger generation brings fresh ideas. The cooperation of different generations means combining different perspectives in solving complex problems that require a wide range of knowledge and experience. Adapting to changes for the younger generation does not pose any major problems, but on the other hand, we often encounter the fact that older employees find it more difficult to adapt to new circumstances. In a work environment where rapid technological changes are taking place, older employees are often neglected, as certain prejudices appear, which represent an additional challenge in the management of intergenerational cooperation. When it comes to effectively adapting to change, the elderly face specific challenges when using digital technologies. Addressing these challenges requires customized training programs based on the individual needs of employees. Creating an environment where cooperation between different generations is encouraged is reflected in the organizational climate, which has a positive impact on the entire work environment.

Keywords:

Intergenerational
cooperation,
working
environment,
prejudices,
challenges,
organizational
climate

1 Uvod

Raznolikost delovne sile bi na prvi mah lahko označili kot orodje, s katerim organizacije lahko dosejajo konkurenčno prednost. Vendar pa je odnos med različnimi generacijami kompleksen izziv v katerem se prednosti pokažejo le z učinkovitim upravljanjem medgeneracijskega sodelovanja. Odnos do dela, vrednote in pričakovanja zaposlenih se spreminjajo, zato se srečujemo s pojavom predsodkov, ki so pogosta ovira pri premagovanju vrzeli na tem področju.

Stereotipi, ki se osredotočajo na starost so pogosta spodbuda za nastanek napetosti med generacijami, kar pa v končni fazi lahko privede do nesoglasij in konfliktov, ki negativno vplivajo na delovno okolje (Graf in Nikzad-Terhune, 2023). Če želimo izkoristiti prednosti, ki jih prinaša vsaka generacija, mora organizacija k temu pristopiti z ustrežno strategijo, ki bo omogočila učinkovito sodelovanje, ki ne bo podleglo vplivu stereotipov.

Medgeneracijsko sodelovanje postaja vedno večji izziv s katerim se organizacije srečujejo. Zaposleni predstavljajo gonilno silo podjetja, zato je pomembno, da sodelovanje med njimi temelji na prenosu in izmenjavi znanja. Vodstvo ima pomembno vlogo pri vzpostavitvi pozitivne organizacijske klime, ki spodbuja sodelovanje in ustvarja delovno okolje, ki je atraktivno tako za mlajše, kot tudi starejše zaposlene (Rožman, Tominc in Crnogaj, 2022).

Vsebina članka se nanaša na premostitev vrzeli pri medgeneracijskem sodelovanju, ki nastajajo kot posledica stereotipov. Na podlagi relevantne literature smo podali predloge, ki lahko pripomorejo pri upravljanju sodelovanja med generacijami. Izzivi, ki ob tem nastanejo so lahko priložnost za izboljšavo organizacijske klime in uvedbo pozitivnih sprememb, ki bodo podlaga za izkoristek potenciala različnih generacij.

2 Pregled literature

2.1 Opredelitev generacij in razlik v odnosu do dela

Generacijo lahko opredelimo kot skupino posameznikov, ki so rojeni v nekem časovnem okolju, ter pripadajo isti starostni skupini. Pripadniki določene generacije si običajno delijo podobna prepričanja, izkušnje in kulturne vzorce, ki so se

oblikovali na podlagi zgodovinskih dogodkov ter družbenih sprememb (Klimczuk, 2015). Razvrščanje posameznih generacij v časovni okvir je v literaturi opredeljeno na različne načine. Brečko (2008) je na podlagi raziskave generacije opredelila in razvrstila v pet skupin:

- Generacija veteranov (1920-1945),
- Baby boomer (1946-1965),
- Generacija X (1966-1985),
- Generacija Y Milenijci (1986-2000),
- Generacija Z (2000 in dalje).

V nadaljevanju bomo opredelili razlike v odnosu do dela med Baby Boomer generacijo, generacijo X, generacijo Y ter generacijo Z. Odnos do dela generacije veteranov, ki so po Brečko (2008) rojeni med leti 1920 in 1945, v tem članku ne bomo raziskovali.

Odnos do dela pripadnikov generacije Baby Boomer, je značilen po tem, da pogosto ni ravnotežja med zasebnim in poklicnim življenjem. Eden od razlogov je tudi v tem, da si želijo dolgoročne varnosti in stabilnosti skozi celo življenje. So zelo predani delavci, ki stremijo k učinkovitosti in kakovosti pri opravljanju delovnih nalog (Bejtkovsky, 2016).

Bejtkovsky (2016) ugotavlja, da je za to generacijo pohvala nadrejenih pomembna, a si poleg pohvale želijo tudi denarnih povišic, nagrad in napredovanja. Baby Boomerji se dobro znajdejo pri delu v timu, njihova učinkovitost pa najbolj jasno pride do izraza v podjetjih kjer je hierarhija jasno določena.

Generacija X stremi k finančni neodvisnosti s ciljem usklajevanja zasebnega in poklicnega življenja. Samostojnost pri delu je lahko razlog, da delo opravijo na svoj način in ne sledijo striktnim navodilom vodij. Za razliko od njihovih predhodnikov nimajo visoke stopnje zvestobe delodajalcu, zato brez težav zamenjajo delovno mesto (Gupta in Singh, 2020).

Generacijo Y z drugim izrazom imenujemo tudi "Milenijci". V delovnem okolju zelo samozavestni zato pogosto stremijo k neodvisnosti. Spoštujejo konstruktivno kritiko, na drugi strani pa so za svoje delo radi nagrajeni, bodisi s pohvalo ali pa z drugimi ugodnostmi (Usmani, Asif, Mahmood, Khan in Burhan, 2019).

Ravnotežje med zasebnim in poklicnim življenjem ima velik vpliv na njihov odnos dela. Pozitivna organizacijska klima vpliva na njihovo zadovoljstvo pri delu, ki se kaže tudi pri delovni uspešnosti, a je njihova zavzetost nižja, glede na zavzetost prehodnih generacij (Usmani et al., 2019).

Generacija Z se najbolj razlikuje od vseh ostalih generacij, ki smo jih navedli. Njihova motivacija je usmerjena predvsem k ohranitvi njihovega življenjskega stila in prostega časa. Karierni cilji se ne osredotočajo le na eno samo, temveč stremijo k več karieram istočasno. S strani vodje ali mentorja si želijo konstantnih povratnih o svojem delu (Gaidhani, Arora in Sharma, 2019).

Velik vpliv na njihovo življenje ima tehnologija, kar se odraža tudi v načinu komunikacije s sodelavci in strankami, kar pomeni, da ta poteka predvsem preko digitalnih komunikacijskih kanalov. Delovno mesto naj bi jim omogočalo fleksibilen delovni čas in delo od doma (Gaidhani et al., 2019).

2.2 Stereotipi in izzivi

Vzpostavitev delovnega okolja, ki bo prilagojen značilnostim, ki jih imajo različne generacije, predstavlja izziv s katerim se organizacije vsakodnevno srečujejo. Različni pogledi na svet in delovni pristopi pogosto predstavljajo ovire, ki zavirajo sodelovanje in prenos znanja med zaposlenimi, ki spadajo v različne generacije (Brečko, 2021).

S staranjem prebivalstva se pojavljajo izzivi s katerimi se soočamo tako v vsakdanjem življenju, kot tudi v delovnem okolju. Spremembe na tem področju ustvarjajo vrzeli in povečujejo napetost med mlajšo in starejšo generacijo. Mlajše generacije kot vzrok za to, da jim primanjkuje željenih delovnih mest in posledično tudi izkušenj vidijo v tem, da starejše generacije ostajajo dlje časa delovno aktivne (Chung, Lee in Kim, 2023).

Kategorizacija posameznikov na podlagi stereotipov o starostnem obdobju vodi v prepričanje, da za celotno skupino veljajo določene lastnosti. Starejši zaposleni so pogosto označeni kot neprilagodljivi kar pomeni, da se niso pripravljene prilagajati spremembam in so posledično manj učinkoviti, sploh na področju digitalnih tehnologij (Fan, 2023).

Vsaka generacija ima svoje značilnosti zato je jasno, da mora biti vodstveni pristop prilagojen, če želimo dobiti željene učinke s strani zaposlenih. Mann (2023) ugotavlja, da so izzivi pri vodenju generacije Z: krajši razpon pozornosti, izrazita želja po avtonomiji ter naklonjenost k digitalni komunikaciji.

Baby Boomer generacijo spremlja stereotip, da se ne želijo prilagajati spremembam ter, da je ravno zato sodelovanje z njimi težavno. Stereotipi povezani z generacijo X so lenoba, nezadovoljstvo in cinizem. Generacija Y je pogosto opredeljena kot lena, saj jim več pomeni prosti čas, kakor pa čas, ki ga preživijo v delovnem okolju (Waldman, 2021). Stereotipi, ki se nanašajo na milenijce so (Arras-Djabi, Cottard in Shimada, 2023): slaba delovna etika; omejene sposobnosti ljudi ali komunikacija zaradi tehnologije; niso zainteresirani za zaslužek ali vlaganje svojega časa; več znanja o tehnologiji; občutek upravičenosti; samosvoj itd. Za generacijo Z velja (Uche, 2023), da: imajo kratek razpon pozornosti; večopravilniki (»multitaskerji«); zasvojeni s tehnologijo in ne zmorejo komuniciranja iz oči v oči; pričakujejo preveč od blagovnih znamk in podjetij, s katerimi sodelujejo; želijo biti hitro nagrajani.

Flores in drugi (2022) menijo, da je najpogostejši izziv komunikacija med različnimi generacijami. Različne izkušnje, mnenja ali hobiji, so razlogi, da generacije med seboj težko komunicirajo. Ob tem se pojavljajo občutki nelagodja ali nepripadnost delovnem okolju, saj se zaposleni lahko počuti izključenega, če obstaja pomanjkanje interakcije s sodelavci.

2.3 Učinkovito upravljanje medgeneracijskega sodelovanja

Tehnološki napredek in razvoj digitalnih tehnologij ima velik vpliv na delovne procese v organizaciji. Konkurenčnost človeških virov je v veliki meri odvisna od koncepta medgeneracijskega učenja, ki vključuje prenos in soustvarjanje znanja, ki je potrebno za doseganju organizacijskih ciljev. Raznolikost moramo prepoznati kot

priložnost ter strategijo upravljanja le te uskladiti s potrebami organizacije kot celote (Boštjančič, Prelog in Ismagilova, 2019).

Vodstvo ima veliko vlogo pri ustvarjanju okolja, kjer bo vpliv stereotipov manjši, oziroma ga sploh ne bo. Fan (2023) ugotavlja, da mora vodja spodbujati sodelovanje in spoštovanje med zaposlenimi, ter graditi organizacijsko kulturo, ki bo usmerjena k medsebojnemu zaupanju in sodelovanju. Pristop k zmanjšanju vpliva medgeneracijskih razlik z vidika stereotipov, mora biti prilagojen organizacijski kulturi in potrebam zaposlenih, z upoštevanjem organizacijskih ciljev.

Priložnost za spodbujanje sodelovanja ponuja mentorstvo, ki pa ni nujno, da se izvaja v tradicionalni obliki, kjer starejši zaposleni mentorira sodelavca, ki je mlajši od njega. Ta oblika mentorstva je priporočljiva pri uporabi digitalnih orodij, kjer so zahtevane specifične kompetence, ki primanjkujejo starejšim zaposlenim. Na ta način se poleg prenosa znanja, krepi tudi medsebojno spoštovanje in razumevanje razlik (Gadomska-Lila, 2020).

Digitalna pismenost pa nima pozitivnih učinkov le na razvoj zaposlenih in doseganje boljše delovne uspešnosti. Reis, Mercer in Boger (2021) menijo, da sodelovanje med različnimi generacijami lahko spodbudimo z uporabo tehnologije, ki omogoča podporo pri komunikaciji. To področje odpira širok spekter možnosti za nadaljnje raziskovanje, ki bo v pomoč pri sodelovanju starejših in mlajših generacij.

Rožman in drugi (2022) so ugotovili, da podjetja, ki imajo izdelano strategijo upravljanja medgeneracijskega sodelovanja, dosegajo konkurenčno prednost na trgu. Med drugim se kot pozitivna posledica kaže tudi večja zavzetost zaposlenih, predvsem v situacijah, ki ustvarjajo dodatne obremenitve in posledično tudi višji nivo stresa.

V prihodnosti bo poudarek na sodelovanju med generacijami vedno bolj izrazit, saj se podjetja zavedajo kako pomembno je ohranjati delovno silo. Zadovoljstvo, zavzetost in motivacija močno vplivajo na delovni učinek posameznika. Pintarič, Marič in Balantič (2023) so mnenja, da morajo organizacije spodbujati in vzdrževati pozitivno vzdušje, saj bodo zaposleni posledično bolj zadovoljni in motivirani tudi za delovne naloge, ki zahtevajo sodelovanje med različnimi generacijami.

3 Diskusija

Demografske spremembe in razvoj tehnologije sta bistveno poudarila medgeneracijske vrzeli v delovnem okolju. Raznolikost pa je pogosto opazovana z negativne strani, kar pa onemogoča, da prepoznamo priložnosti, ki se ob tem pojavljajo. Strinjamo se z Rožman in drugimi (2022), da ima vodstvo ključno vlogo pri vzpostavitvi okolja v katerem bodo zaposleni med seboj sodelovali, ne glede na starost in generacijo kateri pripadajo.

Poudariti je potrebno, da ima vsaka generacija svoje perspektive in značilnosti, ki se odražajo v delovnem okolju. Na podlagi raznolikosti pa se pogosto pojavljajo stereotipi, ki pa le onemogočajo napredek pri medsebojnem sodelovanju in povezovanju. Menimo, da je ravno ta raznolikost ključna prednost pri upravljanju človeških virov.

Z združevanjem v večgeneracijske time lahko dosežemo, da si zaposleni med seboj prenašajo znanja, ki jim bodo v pomoč pri nadaljnjem napredku. Generacija Z se s svojimi značilnostmi bistveno razlikuje od preostalih, kar pa je pogosto izraženo v negativnem kontekstu. Mann (2023) pravi, da je pripadnike potrebno sprejeti ter jim biti mentor, saj predstavljajo dinamično generacijo, ki odraščča s tehnologijo, kar se odraža tudi v digitalni pismenosti in kompetencah s tega področja.

Eden od ključnih izzivov, ki smo jih zaznali je vzpostavitev komunikacije, ki bo imela pozitivne učinke na sodelovanje. Ta komunikacija mora biti spoštljiva, vključujoča in upoštevati ter presežati razlike med posameznimi generacijami. Pintarič in drugi (2023) so izpostavili, da ima organizacija pri tem ključno vlogo, saj spodbujanje pozitivnega vzdušja vpliva na produktivnost zaposlenih.

Ker pa organizacija uspešno deluje le kot celota, je bistvenega pomena, da na poti k spremembam sodelujejo vsi deležniki. Tako vodstvo, kot tudi zaposleni morajo biti pripravljeni prilagajati se spremembam in biti odprti za nova znanja, ne glede na to ali bodo ta posredovana s strani mlajših ali pa s strani starejših generacij.

4 Zaključek

Medgeneracijsko sodelovanje med zaposlenimi predstavlja velik izziv, ki ima lahko, ob neučinkovitem upravljanju, negativne posledice na odnose med zaposlenimi in posledično tudi na celotno delovanje organizacije. Pintarič in drugi (2023) izpostavljajo, da bo komunikacija med deležniki predstavljala največji izziv pri upravljanju medgeneracijskega sodelovanja.

Kinger in Kumar (2023) ugotavljata, da je spodbujanje sodelovanje in komunikacije med različnimi generacijami, predstavlja pomembno nalogo kadrovskih strokovnjakov. Pri tem je potrebno upoštevati tudi razlike, ki se med njimi pojavljajo saj so stališča, vrednote in pričakovanja glede dela različni.

Prihodnost na trgu dela bo zaznamovana s prevlado generacij X, Y in Z, kar pomeni, da bo pod njihovim vplivom tudi organizacijska dinamika. Sodelovanja med različnimi generacijami ne smejo omejevati stereotipi, ki bi lahko negativno vplivali na odnose med zaposlenimi. Prepletanje različnih generacij znotraj organizacije pomeni, da lahko z raznovrstnim spektrom znanj, izkušenj in perspektiv zagotovimo inovativne rešitve.

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DIGITALNA PODPORA SPREMSTVU PACIENTOV S POUDARKOM NA ETIKI SKRBI IN KAKOVOSTI STORITEV

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Na zagotavljanje celovite kakovosti za odgovorno in humano oskrbo pacientov vpliva vse več dejavnikov, vključno z novimi tehnologijami. Med ključnimi storitvami zdravstvene oskrbe pa je spremstvo pacientov. To zahteva premišljeno načrtovanje in skrbno delovanje, da je v vseh pogledih zagotovljeno spoštljivo, empatično in etično ravnanje. Uvajanje novih tehnologij, digitalne podpore in z njo povezane umetene inteligence tudi na področju zdravstvene oskrbe prinaša vrsto novosti, tako koristi kot tveganj. Naslovni prispevek se v celoti osredotoča na uveljavljenih podlagah etike skrbi, ki ne zajema zgolj klasične logistike, naročanja in izvajanja storitve spremstva, temveč pomembno prispeva k celostni, odgovorni in kakovostni oskrbi pacientov, vključno z etično odgovornostjo pri uporabi novih tehnologij na tem področju.

Ključne besede:

spremstvo
pacientov,
etika skrbi,
digitalizacija,
zdravstvo,
storitve

DIGITAL SUPPORT FOR PATIENT ACCOMPANIMENT WITH EMPHASIS ON ETHICS OF CARE AND SERVICE QUALITY

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The provision of comprehensive quality through responsible and humane patient care is influenced by more and more factors, including new technologies. Among the key factors is accompanying the patient. This requires thoughtful planning and careful delivery of services that ensure respectful, empathetic and ethically responsible treatment of patients in all respects. The introduction of new technologies, digital support and related artificial intelligence also brings a series of innovations to this area, both in terms of benefits and risks. The contribution is entirely focused on the established foundations of care ethics, which not only cover classic logistics, ordering and implementation of accompanying services, but also contribute significantly to the holistic, responsible and high-quality treatment of the patient, including ethical responsibility in the use of new technologies in this field.

Keywords:
accompanying
patients,
ethics of care,
digitization,
healthcare,
service

1 Uvod

V zdravstvu se vedno bolj uvajajo digitalni sistemi in nove tehnologije, od katerih se pričakuje, da bodo povečale učinkovitost, zmanjšali stroške in olajšali spremljanje zdravstvenega varstva, povečali varnost ter zadovoljstvo in opolnomočenje pacientov (Fagerström et al., 2017; Nguyen et al., 2017). Javno mnenje je digitalizaciji zdravstvenega varstva večinoma naklonjeno, saj jo vidi kot nujnost ter družbeno in gospodarsko korist za skupno dobro (Weiss, 2019). Uvajanje digitalnih orodij v bolnišničnem okolju spreminja organizacijo dela in odnose zdravstvenega osebja tudi do pacientov (Fagerström et al., 2017). Pri tem nikakor ni zanemarljivo, da nove tehnologije kljub vse večji zmogljivosti ne morejo nadomestiti tistih značajskih lastnosti ljudi, moralnih vrlin ali kompetenc, ki so tako v medosebnih odnosih zdravstvenega osebja kot v odnosu do pacientov nenadomestljiv dejavnik človečnosti oziroma humanosti. Galbany-Estragues & Comas-d'Argemir (2017) ugotavljata, da mlajše medicinske sestre porabijo manj časa za poslušanje, pogovor s pacienti in njihovimi družinskimi člani kot starejše, ki so z večletnim izkustvom etike skrbi ali uporabne etike skrbniškega dela bolj večše komunikacije s pacienti, pacienta znajo nagovoriti, ga potolažiti in prepričati. Vosman in Niemeijer (2017) sta ugotovila, da je delo v skladu z etiko skrbi (Tronto, 1993, 2010) v sodobni bolnišnici vse težje, vendar je kljub tako kompleksni organizaciji etika skrbi še vedno prisotna v različnih oblikah. Ob tem so presenetljiva dognanja tistih raziskovalcev, ki ugotavljajo, da sta delo, ki ga opravlja osebje zdravstvene nege, in etika skrbi, na kateri temeljijo njihova dejanja, v bolnišničnem okolju manj cenjena (Wilson, 2004; Galbany-Estragues & Comas-d'Argemir, 2017). Skrbniška dela so pogosto podcenjena in zaničevana, izvajalci pa nevidni, saj večino skrbniškega dela, tako plačanega kot neplačanega, opravljajo ženske. Genderizacija oziroma torija spolov z etiko skrbi, ki je prvovrstna tema feministične etike, naj bi bila med razlogi, da so skrbniška dela podcenjena in neprepoznana (Elson, 1991). Z razliko mnogih drugih dobrin in storitev, ki jih lahko nadomestimo denimo z ugodjem nakupovanja, skrbniškega dela in etike skrbi v medčloveških odnosih, še posebej v odnosu do pacientov in drugih šibkejših oseb ali skupin (zaenkrat) še ne morejo nadomestiti stroji ali tehnologija (Tronto, 2013). Čeprav industrija z vedno novimi inovacijami išče načine za zmanjšanje stroškov s tehnologijo, stroški oskrbe ostajajo visoki, tako glede osebja kot časa. Tako kot ljudi, ki izvajajo skrbstvena dejanja, pogosto ni mogoče nadomestiti s tehnologijo, tudi časa, ki je potreben za opravljanje skrbstvenih dejanj, tehnologija ne more drastično skrajšati.

V prispevku bomo predstavili proces spremstva pacientov in prednosti, ki jih je prinesla digitalna podpora naročanja spremstva pacientov. Ugotovitev, ki s problematiziranjem teorije spolov (t.i. genderizacije) terjajo posebno pozornost tudi v smislu preprečevanja diskriminacije na podlagi spola, na tem mestu podrobneje ne obravnavamo, saj gre za kompleksno področje, ki terja poseben pristop in obseg raziskovalnega dela. Zato se bomo tega področja oziroma izziva le dotaknili v okviru kratke predstavitve etike skrbi. Gre za uporabno etiko, ki se kot oddeljeno področje ali subdisciplina moralne teorije ne nanaša le na določene poklice ali področja, pa tudi ne na posamezni vidik spola, temveč jo razumemo kot ključno podlago za ustvarjanje dobrih in skrbečih odnosov v praksi katerega koli področja, vključno z izzivi novih tehnologij, velikih podatkovnih sistemov in umetne inteligence.

2 Etika skrbi

2.1 Kaj je skrb?

Pojem »skrb« izvira iz latinskega izraza »cura, providentia« in pomeni skrb v smislu razumne previdnosti. To je tista previdnost, s katero se razumen človek odziva na pretečo nevarnost (tveganje), da se pravočasno izogne neželenim posledicam. Slovenski etimološki slovar (Snoj, 2024) opredeljuje skrb kot: skrben, skrbnik, skrbnništvo, skrbéti, oskrbéli, oskrbba, oskrbnik, oskrbovati itd.¹

Skrb je jedro človečnosti. Vsakdo daje in prejema skrb v določeni obliki skozi svoje življenje, saj smo ljudje ob rojstvu kot dojenčki popolnoma odvisni od svojih negovalcev, ki zagotovijo varno pot v otroštvo. Skrb lahko pomeni skrb za sebe (fizično, mentalno, čustveno), za druge ljudi (družine, lokalne skupnosti, svetovne družbe) in za nefizični svet (živali, okolje, ekosistemi). Skrb je več kot dajanje; je prejemanje skrbnih dejanj od drugih; je sodelovanje pri skrbnih dejanjih z drugimi (Tronto, 2013). Švab (2003) meni, da v sodobnem zahodnem svetu prevladuje prepričanje, ki opredeljuje skrb kot potrebo odvisnih oseb kot so: invalidi, otroci, bolni starejši ipd., medtem ko večina ljudi skrbi ne potrebuje. Skrb je tako razumljena kot enosmeren odnos med tistim, ki skrb daje, in tistim, ki jo prejema.

¹ <https://fran.si/193/marko-snoj-slovenski-etimoloski-slovar/4291850/skb?View=1&Query=oskrba>

Etika skrbi vidi skrb kot moralno bogato in generativno pojmovanje, ki bi moralo biti v središču etičnega razmišljanja in odločanja (pogosto je prezrto s strani drugih etičnih teorij). Pri tem etika skrbi poudarja vrednost medosebnih odnosov, univerzalnost človekove odvisnosti od drugih, pomen čustev in telesa ter kontekstno občutljivo naravo etičnega premišljevanja, ki se ne drži zgolj abstraktnih moralnih pravil (Kwan, 2023).

Širšo in popolno definicijo skrbi sta opredelili politični teoretičarki Joan Tronto in Berenice Fisher (1990, 40), ki menita, da je skrb: »Dejavnost človeške vrste, ki vključuje vse, kar počnemo, da bi ohranili, nadaljevali in popravili svoj »svet«, da bi v njem lahko najbolje živeli. Ta svet vključuje naša telesa, nas in naše okolje, vse, kar bi splekli v kompleksno mrežo, ki vzdržuje življenje«. Ta definicija, ki poudarja procesno razsežnost skrbi in implicira, da je proces skrbi lahko usmerjen ne le k ljudem, temveč tudi drugim živim bitjem in stvarem, je močno vplivala na nadaljnji razvoj moralne in politične teorije skrbi in je služila kot izhodišče za številne aplikacije etičnega vidika skrbi.

Nel Noddings v: Centa, Pokorny (2017) razlikuje med naravno in etično skrbjo. Naravna skrb je povezana z vzgibom želje. Etična skrb pa je povezana z vzgibom, da nekaj moramo narediti, ker je to moralno primerno. Naravna skrb od nas ne zahteva posebnega etičnega truda, vendar pa nas vodi k temu, da se naučimo etične skrbi.

Avtorici Tronto & Fischer (1990, 40) sta opredelili štiri faze skrbi: a) skrbeti za - posvečanje pozornosti nečemu s poudarkom na kontinuiteti, vzdrževanju in popravilu; b) poskrbeti za - prevzemanje odgovornosti za dejavnosti, ki se odzivajo na opažena dejstva v skrbi; c) dajati skrb - konkretne naloge in neposredno skrbstveno delo, d) prejemati skrb - odzivi tistih, na katere je skrb usmerjena.

2.2 Etika skrbi

Koncept etike skrbi ima svoje korenine v feministični etiki. Od svoje prve formulacije v zgodnjih osemdesetih letih prejšnjega stoletja, se je etika skrbi razvila v rastoče področje etičnega raziskovanja, ki se je razširilo po vsem svetu kot uspešna alternativa glavnim tokovom moralne in politične filozofije (Urban, 2022).

Pojem »etika skrbi« je skovala ameriška razvojna psihologinja Carol Gilligan (2003) v svoji svetovno znani knjigi »In a Different Voice«. Carol Gilligan in Nel Noddings sta tradicionalne moralne pristope pripisala moški pristranskosti in uveljavila »glas skrbi« kot legitimno alternativo »pravični perspektivi« liberalne teorije človekovih pravic (The Internet Encyclopedia of Philosophy, 2024). Poleg omenjene Carol Gilligan in Nela Noddingsa so pomembno prispevale k razvoju področja etike skrbi še: Annette Baier, Virginia Held, Eva Feder Kittay, Sara Ruddick in Joan Tronto. V Sloveniji je etiko skrbi raziskovala Jana Šmitek (2004, 209), ki ugotavlja, da je v zdravstveni negi prvenstveno uporabna etična teorija etike skrbi, ker se neposredno povezuje z osnovno vlogo zdravstvene nege pri bolniku – s profesionalno skrbjo. Ob tem meni, da bi bilo dobro etiko skrbi kot teoretično vsebino vključiti v izobraževalne programe vseh zdravstvenih delavcev.

Avtorica Gilligan označuje etiko skrbi kot značilen slog moralnega presojanja in način konstruiranja moralnih problemov, ki se osredotoča na odgovornost za medčloveške odnose, gradi moralno presojo na konkretnem poznavanju določene situacije in konteksta, poudarja prednost povezanosti in izhaja iz spoznanja, da v odgovornem ravnanju do sebe in drugih ni nobenega protislovja. Gilligan meni, da je »ideal skrbi dejavnost odnosa, videnja in odzivanja na potrebe, skrbi za svet z ohranjanjem mreže povezav, da nihče ne ostane sam« (2003, 62).

Etika skrbi se je razvila kot moralna teorija, ki ni pomembna le za t. i. zasebna področja družine in prijateljstva, temveč tudi za medicinsko prakso, pravo, politično življenje, organizacijo družbe, vojno in mednarodne odnose. Etika skrbi se včasih obravnava kot potencialna moralna teorija, ki bi lahko nadomestila tako prevladujoče moralne teorije, kot so kantovska etika, utilitarizem ali aristotelovska etika vrlin. Včasih se na to gleda kot na obliko etike vrlin (ang. *virtue ethics*). Skoraj vedno se razvija kot poudarjanje zapostavljenih moralnih vidikov, ki so vsaj tako pomembni kot vidiki, ki so osrednji za moralo pravičnosti in pravic ali koristnosti in zadovoljevanja preferenc (Held, 2006, 9).

Za etiko skrbi imajo velik pomen vrednote in vrline, ki dajejo posamezniku pomemben značaj, iz katerega njegovo delovanje tudi izhaja. Osnovne vrednote, ki vodijo etiko skrbi, so tiste, ki jih običajno povezujemo z ženskami – intuicija, čustvenost in sodelovanje, medsebojno, lokalno in posebno (Vosman & Niemeijer, 2017; Wilson, 2004). Tronto (1993) dodaja še štiri vrednote oz. etične vrline:

pozornost, odgovornost, kompetentnost in odzivnost. Te vrednote v neoliberalni družbi na splošno niso preveč cenjene, saj je bolj cenjena objektivnost, produktivnost in tekmovalnost. To velja tako za vodilne v zdravstvu kot za razvijalce zdravstvenih informacijskih sistemov, ki prav tako cenijo produktivnost in posplošljivost tako pri organizaciji dela kot tehničnih orodjih (Salminen - Karlsson, Golay, 2022). Po mnenju Emslieja in Watta (2017) tovrstno vodenje zdravstvenega varstva temelji na tehnični racionalnosti. Zdravstveni informacijski sistemi in druga digitalna orodja pa so del te preobrazbe zdravstvenega varstva, saj omogočajo regulacijo in usmerjanje oskrbe (Salminen - Karlsson, Golay, 2022).

2.3 Umetna inteligenca v luči etike skrbi

Skrb zahteva veliko časa, lahko je psihično izčrpavajoča in pogosto zahteva interakcijo ena-na-ena. Tehnologija umetne inteligence že obravnava nekatere od teh izzivov. Tako so že znani primeri kjer so humanoidni roboti prisotni za pomoč zdravstvenemu osebju, pri pridobivanju zalog materiala in pripomočkov. Robot potuje do območja skladišča, odčita in zbere potrebni material ter se vrne na bolnišnični oddelek (Clipper et al., 2018). Ti roboti omogočajo zdravstvenemu osebju, da lahko nameni več časa za nego in oskrbo pacienta. Nekateri roboti so sposobni na varen način fizično premeščati paciente in nuditi pomoč pri posedanju pacientov, kar zmanjša fizične obremenitve zdravstvenega osebja. (De Swarte, Boufous in Escalle, 2018). Humanoidni roboti lahko naredijo več kot le dviganje, prinašanje in zbiranje, pomaga lahko tudi pri diagnosticiranju hranjenju, kopanju in menjavi povojev (Barnard, 2017). Etzioni & Etzioni (2017, 184) menita, da so »humanoidni roboti očitno veliko boljši od zdravstvenega osebja, ko gre za spomin in pridobivanje informacij. Tako so učinkovitejši pri pomnjenju katera zdravila je bolnik jemal ter kakšne so njihove interakcije in stranski učinki«. Ljudje po drugi strani pa »bolje berejo med vrsticami, poslušajo ne samo, kaj ljudje govorijo, ampak tudi način, kako to povedo, njihov ton glasu in dotik« (str. 185). Umetna inteligenca je lahko še posebej dobra pri kognitivni empatiji. Vendar pa se je treba zaradi nezmožnosti umetne inteligence za čustveno ali izkustveno empatijo izogniti precejšnjim tveganjem v zvezi z manipulacijo in neetičnim vedenjem povezanim s psihopatološkimi bolniki (Montemayor et al., 2021).

Tronto (1993) meni, da humanoidnim robotom primanjkuje kritičnih zmogljivosti, potrebnih za skrb. Če izhajamo iz dejstva, da je oskrba bistvenega pomena za zdravstveno nego, sledi, da umetna inteligenca ne bo sposobna etično skrbeti za naloge, ki so bistvene za etiko zdravstvene nege in oskrbe. Razdalja, ki jo ustvari tehnologija, lahko blokira empatijo, ki bi se pojavila ob pogledu na obraz nasprotnika. To pomeni, da razvijalcem in tistim, ki uporabljajo umetno inteligenco, primanjkuje sposobnosti prepoznavanja ali razumevanja skrbi in duševnih stanj subjektov, na katere vpliva umetna inteligenca (Montemayor et al., 2021). Umetna inteligenca ne more zagotoviti zavestne empatične pozornosti, ker empatija temelji na naših bioloških zavestnih in nezavednih miselnih izkušnjah in naših zmožnostih pozornosti, da izberemo najbolj pomembne in potrebne informacije za pacienta v določeni situaciji oskrbe. To je zakoreninjeno v bioloških izkušnjah, kot je odzvanjanje na čustva drugega. Vse, kar bo lahko naredila umetna inteligenca, je, da predstavi situacijo hipotetičnega pacienta in jo uporabi za konkreten nabor podatkov o določenem pacientu v skladu z nekim algoritmom ali pravilom sklepanja. Zato umetna inteligenca ne more zagotoviti empatične pozornosti in pristne skrbi za ljudi. V najboljšem primeru lahko zagotovi čustveno nepristransko oskrbo s predstavitvami in pravili o primerih (Ibid).

3 Spremistvo pacientov

Spremistvo pacientov je v bolnišnični dejavnosti vpeto v področje oskrbe kot podporna dejavnost zdravstvene nege. V skladu s Kadrovskimi standardi in normativi v zdravstveni in babiški negi, so bolničarji-negovalci v bolnišnični dejavnosti lahko razporejeni na delovna mesta kot spremljevalci za spremitvo pacientov, v urgentni in operativni dejavnosti ter intenzivni terapiji na področju priprave materiala in čiščenja prostorov, pripomočkov ter opreme z visokim tveganjem. Bolničar-negovalec je vključen tudi v delovni proces preskrbe z bolnišničnim perilom, skrbi za priročna skladišča materiala in pripomočkov ter opravlja kurirska dela. Bolničarji-negovalci so tako praviloma vključeni v delo oskrbe in ne sodelujejo v neposredni zdravstveni negi pacientov (Kadrovski standardi in normativi v zdravstveni in babiški negi, 2021, 21). Poleg profila bolničar-negovalec (v nadalje: spremljevalec) opravljajo spremitvo pacientov tudi oskrbovalke v bolnišnici po opravljenem internem izobraževanju.

V Univerzitetnem kliničnem centru Ljubljana je dejavnost spremstva pacientov najdlje prisotna na trižnem oddelku Urgentnega kirurškega bloka, kjer je bila uvedena predvsem za potrebe spremstva novo sprejetih pacientov. V okviru centralizacije in vzpostavitve Oskrbovalnih služb, se je leta 1994 formirala Služba za spremstvo bolnikov, z namenom razbremenitve osebja zdravstvene nege opravil, ki spadajo v segment oskrbe. Naročanje spremstva je do leta 2017 potekalo preko telefona in z ročnim vodenjem evidence naročil. Povprečno je bilo dnevno cca 800 telefonskih naročil spremstva. Velik obseg podatkov ob odsotnosti računalniške podpore ni omogočal sodobne poslovne analitike. Tako so bili nujni podatki obdelani ročno, kar je bilo časovno zamudno in stroškovno nesprejemljivo. Hkrati pa so bili podatki na papirnih naročilnicah pomanjkljivi in pogosto nečitljivi. Po uspešno izvedenem javnem naročilu za programsko opremo Dispatch 3000, ki omogoča digitalno naročanje storitev spremstva, je bil vzpostavljen sistem naročanja najprej na oddelkih interne klinike, nato še na preostalih klinikah in kliničnih oddelkih.

3.1 Proces spremstva pacientov

Spremstvo pacientov izvajajo spremljevalci, Službe za spremstvo bolnikov, v sodelovanju z zdravstvenim osebjem iz oddelkov oz. enot UKCL.

3.1.1 Naročilo prevoza oz. spremstva pacienta

Naročanje spremstva pacienta na bolnišničnem oddelku je v pristojnosti nadzorne (odgovorne) medicinske sestre oddelka, ki določi in naroči spremstvo pacienta na dogovorjeno lokacijo. Odločitev je vezana na strokovno oceno zdravstvenega stanja pacienta, na podlagi katere medicinska sestra določi vrsto spremstva in način prevoza. V primeru dvomov se o vrsti spremstva posvetuje z odgovornim zdravnikom na oddelku.

Odgovorna medicinska sestra oddelka izvede naročilo v programu Dispatch 3000 oz. izjemoma preko telefona. Naročilnica mora biti natančno in v celoti izpolnjena. Zabeležene morajo biti tudi vse morebitne posebnosti (izolacija na oddelku, kisik, infuzija...).

Medicinska sestra - dispečer v Službi za spremstvo bolnikov sprejema naročila oddelkov v programu Dispatch 3000. Naročila vsebujejo naslednje podatke: naziv oddelka, ki naroča, podatek kam je potrebno pacienta peljati, kdaj naročnik potrebuje spremstvo pacienta, način spremstva (peš, sede, leže), koliko spremljevalcev potrebujejo, čas oddanega naročila. Dispečer sprejeta naročila posreduje spremljevalcem elektronsko na dlančnike oz. mobilne telefone. Ob tem določi tudi prioriteto izvedbe naročil, kar je za spremljevalce vodilo po katerem vrstnem redu naj izvedejo naročila.

3.1.2 Prevzem / predaja / vrnitev pacienta

Odgovorna medicinska sestra na oddelku poskrbi za predajo pacienta, da lahko spremljevalec na oddelku prevzame pacienta. Ob predaji se na naročilnico zabeleži ura predaje in podpis. Po transportu pacienta na napoteno mesto, spremljevalec preda pacienta in spremno dokumentacijo zdravstvenemu osebju.

Pri vrnitvi pacienta na oddelek ali enoto, spremljevalec zdravstvenemu osebju preda pacienta ter dokumentacijo in jih seznanji z morebitnimi posebnostmi, ki jih je zaznal v času spremstva. Odgovorna medicinska sestra na oddelku prevzame pacienta in na naročilnici zabeleži čas njegove vrnitve. Naročilnico za prevoz oz. spremstvo pacienta v UKCL, spremljevalec odda dispečerju Službe za spremstvo bolnikov, ki jo ustrezno arhivira.

V procesu spremstva se med pacientom in spremljevalcem pogosto splete neformalni pogovor, ki prispeva k zmanjšanju stresa, in negotovosti pri pacientu ob čakanju na preiskave, ki včasih niso najbolj prijetne. Tako lahko vrline spremljevalca kot so prijaznost, pozornost, sočutje in zmožnost predstavljanja, kako se pacient počuti v tej posebni situaciji, pomemben prispevek k zagotavljanju celovite kakovosti oskrbe.

3.1.3 Prednosti digitaliziranega naročanja spremstva

Z vzpostavitvijo programa za digitalno naročanje spremstva se je pokazalo veliko prednosti, naj jih omenimo le nekaj: Zmanjšanje papirnega poslovanja (predhodno dnevno ročno vodenje več evidenc); Omogočena je poslovna analitika za potrebe izračuna interne realizacije; Takoj dosegljivi podatki npr. kdaj je bilo spremstvo

naročeno, koliko časa je trajalo, kdo je opravil spremstvo..., Omogočeno je spremljanje realizacije izvedenih naročil spremstva na posameznega spremljevalca (izračun obremenitev na posameznika); Programska oprema omogoča kreiranje mesečnega razporeda; S pomočjo programske opreme obvladujemo spremljanje osnovne opreme (spremljevalec ob vsakem spremstvu odčita QR kodo vozička s katerim opravlja spremstvo); Vodenje evidence čiščenja sedečih in ležečih vozičkov; Močno se je zmanjšalo število odklonov, saj s transparentnimi podatki hitro rešimo zaplete.

3.1.4 Priložnosti

V prihodnje si želimo realizirati, da se e - naročilnica ne bo tiskala in bodo vsi vključeni v proces spremstva posamezne korake potrjevanja opravljali preko dlančnika ali mobilnega telefona.

4 Sklepne misli

Predstavljeni model oziroma način digitaliziranega naročanja spremstva pacientov je nedvomno primer dobre prakse, ko je uporaba novih tehnologij že od načrtovanja potreb preko izdelave in vgradnje modela skrbno načrtovana in nadzorovana tudi v etičnem pogledu. To je lep primer etike skrbi, ki lahko služi kot podlaga za izdelavo normativnih pravil, načel in konkretnih določb o etičnem ravnanju pri načrtovanju, vgradnji in uporabi novih tehnologij na zdravstvenem in vseh drugih področjih. Na drugi strani primerjava zgornjih ugotovitev, ki na primeru »genderizma« ocenjujejo nevarnost, da lahko neetični nameni pri izdelavi in zlorabe pri uporabi novih tehnologij toliko bolj povečajo nevarnost diskriminacije in drugih odklonskih ravnanj, bodisi v medosebnih odnosih medicinskega osebja bodisi v odnosu do pacientov, avtorice z ugotovitvami tega skromnega prispevka ob vseh koristih, ki jih prinašajo veliki podatkovni modeli, podprti z umetno inteligenco, hkrati opozarjamo na uveljavljeni koncept računalniške stroke: »smeti noter, smeti ven« (ang. *garbage in, garbage out*). Če v zvezi s tem sklenemo pri poslanstvu etike skrbi ali uporabne etike v zdravstveni negi, si moramo ljudje kljub vsem koristim, ki jih, tako kot v opisanem primeru, prinašajo nove tehnologije, z vso skrbnostjo in razumno previdnostjo prizadevati, da z bliskovitim razvojem umetne inteligence ne izgubimo še tisto malo človečnosti, ki je naše poslednje zatočišče pred nevarnostjo neetičnih namenov in

zlorab novih tehnologij na zdravstvenem in vseh drugih področjih našega zasebnega in družbenega življenja.

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PRISTOP K TRAJNOSTNIM ORGANIZACIJSKIM SPREMEMBAM

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Razumevanje ciljev, obsega in omejitev sprememb procesov je ključnega pomena pri prilagajanju poslovnih sistemov spremembam v okolju. V prispevku je predstavljen pristop k organizacijskim spremembam za ustvarjanje trajnostnih procesov. V prvem delu prispevka je predstavljena mednarodna raziskava, ki je bila izvedena v štirih državah. Na podlagi rezultatov raziskave je prikazana uporabnost in koristnost organizacijskih ukrepov z vidika njihovega pozitivnega vpliva na kazalnike strukturne in operativne učinkovitosti poslovnih procesov. V drugem delu prispevka je delovanje pristopa testirano na primeru minimizacije odpadkov v procesu razvoja v industriji premazov. Študija primera ponazori uspešnost pristopa v 88 % zmanjšanju odpadkov in do 48 % zmanjšanju časa in stroškov.

Ključne besede:

organizacijske spremembe, pristop, kazalniki učinkovitosti, ukrepi, minimizacija odpadkov

APPROACH TO SUSTAINABLE ORGANIZATIONAL CHANGES

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Understanding the goals, scope, and limitations of process changes is crucial when adapting business systems to environmental changes. The paper presents an approach to organizational changes to create sustainable processes. In the first part of the paper, an international survey, which was carried out in four countries, is presented. Based on the research results, the applicability and usefulness of organizational measures are shown from the point of view of their positive impact on structural and operational efficiency indicators of business processes. In the second part of the paper, the performance of the approach is tested on the example of waste minimization in the development process in the coatings industry. A case study illustrates the approach's success in reducing waste by 88% and time and cost by up to 48%.

Keywords:
organizational
changes,
approach,
efficiency
indicators,
measures,
waste
minimization

1 Uvod

Prilagajanje organizacijskih sistemov hitrim spremembam v okolju je nujno. Organizacijske spremembe zahtevajo čas in resurse, ki bi jih sicer uporabili za izvajanje temeljne dejavnosti. Pojavlja se vprašanje kako uvajati organizacijske spremembe in kdaj so učinki organizacijskih sprememb na konkurenčnost organizacijskih sistemov tolikšni, da se vložki izplačajo (Žužek idr., 2021). Odgovor lahko poiščemo v različnih pristopih uvajanja sprememb (Pettersen, 2009; van der Aalst, 2016). V članku se osredotočamo na procesne pristope (Dumas idr., 2013; van der Aalst in La Rosa., 2016), kjer analiziramo in izboljšujemo poslovne procese, čemur sledi implementacija sprememb in digitalna transformacija poslovnega sistema (Rosário in Dias, 2022). V spirali spreminjajočih se poslovnih zahtev (Žužek idr., 2021) je potrebno razumeti cilje sprememb in dejanske spremembe v poslovnih procesih, ki jih dosežemo z ukrepi, metodami in tehnikami, znotraj različnih pristopov izboljševanja poslovnih procesov (Krhač Andrašec, 2022). Namen pričujoče raziskave je predstaviti inovativni pristop uvajanja trajnostnih organizacijskih sprememb. Inovativnost pristopa je v povezanosti projektne pristopa in predvidevanju učinkov organizacijskih sprememb na učinkovitost poslovnih procesov. Organizacijska sprememba je enkratna, časovno omejena naloga z večjim številom deležnikov, omejenimi resursi in je povezana s tveganjem. Pripravimo jo in obvladujemo na projektni način. Izvedba projekta ima opredeljen začetek, faze, aktivnosti in mejnike ter zaključek s potrditvijo, da so zastavljeni cilji doseženi (Project Management Institute, 2021). Projekt ima tudi organizacijski del (Kern in Urb, 2022), na katerega se osredotočamo v nadaljevanju.

1.1 Opredelitev zahtev in omejitev (inicializacija projekta)

Faza priprave projekta je pogoj, da se projekt organizacijske spremembe začne. Prvi proces je inicializacija, kjer se identificira problemsko stanje. Določanje obsega je pristojnost odločevalcev, ki zaznajo odstopanje učinkovitosti in uspešnosti sistema, in sicer s spremljanjem operativnih kazalnikov več dimenzij konkurenčne prednosti vrazžjega kvadranta (van Looy in Shafagatova, 2016):

- Čas (npr. pretočni čas, čas čakanja (Chimhamhiwa idr., 2009)),
- Stroški (npr. strošek procesa, strošek kakovosti (Vernadat idr., 2013)),
- Kakovost (npr. kakovost izhodnih rezultatov (Glavan, 2012)),

- Fleksibilnost (npr. fleksibilnost procesa (Herzog in Polajnar, 2006), raznolikost izdelkov ali storitev (Gunasekaran in Kobu, 2007)).

Na podlagi tega se definira namen organizacijske spremembe, ki praviloma naslovi eno ali več dimenzij in kvantificira pričakovane vrednosti. Ob tem se določijo robni pogoji, saj se kvantificira in uteži ostale dimenzije.

1.2 Opredelitev vsebin organizacijske spremembe (koncipiranje projekta)

Priprava projekta poteka v okviru dveh procesov projektnega managementa. Prvi vsebinski proces je koncipiranje, kjer tim na podlagi analize stanja odloča o pristopu organizacijske spremembe in kateri ukrepi, metode ali tehnike bodo uporabljeni (Krhač Andrašec, 2022). Če želimo izračunati stroške in koristi, moramo vedeti, kateri procesi bodo podvrženi organizacijskim spremembam. Pri izbiri procesov si pomagamo z oceno strukturne učinkovitosti (Urh idr., 2019), ki jo izračunamo iz modelov procesov in poslovnih objektov v njih ter strukturnih kazalnikov učinkovitosti (Cardoso, 2008; Figl, 2017). Primerjava ocen strukturne učinkovitosti med procesi pove, kateri izmed njih imajo največji potencial za izboljšanje in jih prioritetno izberemo.

Za vsak ključen proces se izberejo različni ukrepi, metode ali tehnike (Urh idr., 2011; Krhač Andrašec, 2022):

- Ukrepi (npr. združevanje aktivnosti, povečanje paralelnega izvajanja aktivnosti, opolnomočenje izvajalcev (Franz idr., 2011)),
- Metode (npr. Process Modelling (Schweikhart in Dembe, 2009), Benchmarking (Botha idr., 2012), Brainstorming (Stoiljković idr., 2011)),
- Tehnike (npr. FMEA (Schuller idr., 2017), EPC (Amjad idr., 2018), Cause and Effect Diagram (Boutros in Cardella, 2016)).

Za vsak izbran proces se nato določijo operativni kazalniki učinkovitosti s katerimi se bodo merili učinki organizacijskih sprememb (Valiris in Glykas, 2004), saj njihovo doseganje predstavlja doseganje ciljev projekta. Za vsak operativni kazalnik se določi naziv, enota mere in ciljni gradient (npr. zmanjšanje). Izmeri se tudi vrednost pred

začetkom projekta in se določi pričakovana vrednost po zaključku projekta. Za vsak izbrani proces se po potrebi prilagodi utež med operativnimi kazalniki posameznih dimenzij in med operativnimi kazalniki posamezne dimenzije. V okviru koncipiranja se izračuna tudi ekonomika projekta. Pričakovani učinki organizacijske spremembe so razlika med vrednostmi izbranih operativnih kazalnikov trenutnega stanja in pričakovanega stanja. Lahko so neposredni (stroškovni) in posredni (čas, kakovost, fleksibilnost) ter kombinacija vseh naštetih učinkov. Za njihov izračun je potrebno sešteti vse učinke za vsako ponovitev procesa in na podlagi tega izračunati učinke za izbrano časovno obdobje. Opisano aktivnost ponovimo za vse procese, ki so predmet organizacijske spremembe.

1.3 Opredelitev načina uvedbe organizacijske spremembe (planiranje projekta)

Obseg in vsebina projekta izhaja iz namena in ciljev, robni pogoji pa predstavljajo okvir plana izvajanja. Izvedbeni del projekta uvajanja organizacijske spremembe običajno razdelimo na naslednje faze (Dumas idr., 2013): priprava na izboljšavo, posnetek obstoječega stanja, analiza stanja, izboljšava ključnih procesov z izbranimi ukrepi, implementacija rešitve, prilaganje sistema ter spremljanje in nadzor procesov. Aktivnosti znotraj faz so odvisne od izbranih ukrepov, metod ali tehnik in morajo biti v planu natančno definirane.

Primernost in uspešnost predstavljenega pristopa smo v raziskavi preverjali:

- S prikazom koristi metod in tehnik izboljševanja procesov skozi njihov vpliv na kazalnike učinkovitosti (poglavje 3.1),
- S študijo primera minimizacije odpadkov v procesu razvoja (poglavje 3.2).

2 Metodologija

Celotna raziskava je bila izvedena v treh fazah:

- Pregled teoretičnih osnov (poglavje 1),
- Preverjanje primernosti pristopa z dokazom o koristi metod in tehnik (poglavja 2.1 in 2.2),
- Preverjanje uspešnosti pristopa s študijo primera minimizacije odpadkov v procesu razvoja (poglavje 2.3).

2.1 Določitev reprezentativnega vzorca

Reprezentativni vzorec je bil določen na podlagi statistike Eurostata za zadnji dostopni leti (Eurostat A-E, 2021). Zaradi obsega dostopnih podatkov smo se osredotočili na štiri države Evropske unije (Slovenijo, Hrvaško, Nemčijo in Švedsko) (Krhač Andrašec, 2022). Na podlagi pregleda velikosti podjetij je kot vodilni kriterij oblikovanja vzorca upoštevana bruto dodano vrednost. Ob upoštevanju srednje velikih in velikih podjetij v vzorec tako zajamemo vsaj 56,8 % bruto dodane vrednosti v vseh izbranih državah. Na podlagi pregleda podjetij po poslovnih področjih je pri vseh kriterijih ugotovljeno izstopanje šestih poslovnih področij, ne glede na splošne primerjave ali primerjava po državah: Predelovalne dejavnosti; Trgovina, vzdrževanje in popravila motornih vozil; Gradbeništvo; Strokovne, znanstvene in tehnične dejavnosti; Informacijske in komunikacijske dejavnosti; Promet in skladiščenje. Za določitev reprezentativnosti vzorca smo preverili natančnejše podatke o primernosti izbranih podjetij. Izračunali smo delež podjetij zajetih v raziskavo, če se osredotočimo na šest izstopajočih poslovnih področij. Rezultati so potrdili, da vzorec tako zajema vsaj 71.8% velikih in 74.7% srednje velikih podjetij v vseh izbranih državah. Podrobni podatki za ostale dejavnosti v času priprave raziskave niso bili dostopni.

2.2 Anketni vprašalnik

Za izvedbo raziskave je bil izdelan anketni vprašalnik, ki je zajemal šest sekcij in je bil pripravljen v štirih jezikih. Bil je povsem anonimen in ni zahteval osebnih podatkov respondentov. Pripravljen je bil s pomočjo orodja 1ka (1ka, 2021). Pred začetkom raziskave je bil vsebinsko in tehnično validiran s strani devetih zaposlenih v podjetjih različne velikosti in namembnosti. Vsako podjetje je po e-pošti prejelo vabilo k sodelovanju v mednarodni raziskavi ter v vnaprej določenih terminih dva opomnika. Za vsako zavrnjeno e-pošto (npr. tehnične težave, neobstoječ e-naslov itn.) smo vabilo posredovali na drugi kontakt podjetja. Raziskava je izvedena v obdobju med aprilom in julijem v letu 2021, pri tem pa je bil vprašalnik za posamezno državo dostopen natanko 90 dni. Anketna vprašalnika za slovenska in nemška podjetja sta bila objavljena tudi na socialnih omrežjih Facebook in LinkedIn.

Po zaključku zbiranja podatkov so v analizo zajeti vsi ustrezno izpolnjeni anketni vprašalniki. Pripravljena je analiza stopnje odziva, ki je pokazala največjo stopnjo odziva v Sloveniji (14.7%) in najmanjšo na Švedskem (0.8%). Skupna stopnja odziva anketnih vprašalnikov je 7.6%. Rezultati analize stopnje odziva so skladni s pričakovanji, saj o nižjih stopnjah odziva poročajo tudi Sivo idr. (2006) in Baruch in Holtom (2008): od 3% pri podatkih, pridobljenih od posameznikov in od 10% pri podatkih, pridobljenih od podjetij. Novejše vrednotenje raziskav s stopnjami odziva od 5% je pokazalo, da so študije z nižjimi stopnjami odziva pogosto le zanemarljivo manj natančne kot raziskave z višjimi stopnjami odziva (Morton idr., 2012). Pripravljen je tudi izračun ustreznosti dosežene velikosti vzorca na podlagi prosto dostopnega kalkulatorja (Sample size calculator, 2021). Ugotovili smo, da je pri obravnavani populaciji priporočen vzorec 196 podjetij. Priporočen vzorec smo presegli ter s 95% stopnjo zaupanja lahko trdimo, da je doseženi vzorec ustrezen in reprezentativen za izbrano populacijo.

2.3 Študija primera minimizacije odpadkov v procesu razvoja novih izdelkov v industriji premazov

Težava v industriji premazov je vse večja kompleksnost razvoja novih izdelkov, ki morajo izpolnjevati številne zahteve. Premazi so sestavljeni iz različnih sestavin: smol, aditivov, pigmentov, polnil, katalizatorjev, topil itn. Pri klasičnem načinu razvijalci pripravijo in testirajo številne potencialne izdelke v laboratoriju. Le tehnološko ustrezni (ščitijo podlago, izpolnjujejo estetska merila itn.) so vključeni v proizvodnjo. Zaradi velikega števila možnih sestavin ustvarjanje novih premazov vključuje zapletene sisteme z visokim pretokom in računalniško simulacijo, da bi izpolnili zahteve izdelkov kot je običajno v npr. farmacevtski industriji (Bohorquez idr., 2015). Napredek v laboratorijski opreми pospešuje testiranje in omogoča več meritev v določenem obdobju, kar skrajša čas razvoja izdelka. Vendar je za zagotovitev varnosti in okoljskih vidikov ključno oceniti nevarnosti izdelka na podlagi podatkov o sestavinah med pripravo formulacije (Askham idr., 2013). Izkoristek sodobne informacijske tehnologije lahko znatno poenostavi procese (Bokolo idr., 2018).

Za korenito izboljšanje procesa razvoja premazov je potrebno proces preoblikovati z izbranimi ukrepi, metodami in tehnikami. V tem primeru je primerna uporaba digitalne transformacije (Camodeca in Almic, 2021) v kombinaciji z drugimi ukrepi

prenove procesov (npr. zmanjšanje števila aktivnosti, sprememba vrstnega reda izvajanja aktivnosti ipd.).

Primarni cilj je optimizirati število testov v laboratoriju. Za to potrebuje formulator dostop do strukturiranih baz podatkov o sestavinah, ki bi morale biti v oblaku in imeti posodobljene, natančne podatke. Potem lahko formulator pripravi formulacijo, ki bo uporabniku ustrezala s funkcionalnega, zdravstvenega in okoljskega vidika. Prednost opisane prenove je omogočanje priprave potrebne dokumentacijo (npr. oznake nevarnosti, varnostni in tehnični listi) na podlagi katere se lahko izognemo nepotrebnim laboratorijskim preiskavam, kar pa bo omogočilo minimizacijo odpadkov. Poleg tega je tako mogoče skrajšati pretočni čas razvoja in minimizirati njegove stroške. Pogoj za predlagano izboljšavo je analiza procesa za katero potrebujemo relevantne in ažurne podatke, procesne modele in »tehnični omogočevalci« (German Standardization Roadmap, 2018).

Najprej je bilo potrebno pripraviti AS-IS (klasičen način) in TO-BE (prenovljen način) model procesa razvoja premazov. Nato pa najti »tehnični omogočevalci«, ki omogoča spletno iskanje sestavin premazov v realnem času, virtualno formulacijo premazov ter pripravo digitalnih tehničnih in varnostnih listov. Na koncu so predlagana prenova procesa oziroma njene koristi testirane v izbranem podjetju.

3 Rezultati

V poglavju predstavljamo rezultate analize koristi metod in tehnik izboljševanja procesov skozi pozitiven vpliv na kazalnike učinkovitosti. Analiza je zajemala več testov: deskriptivno statistiko, test deleža in test populacijskega povprečja. Vsi testi so izvedeni večkrat, saj smo analizirali vpliv naborov metod in tehnik izboljševanja poslovnih procesov na strukturne in operativne kazalnike učinkovitosti. V drugem delu poglavja so prikazani rezultati študije primera minimizacije odpadkov v procesu razvoja.

3.1 Analiza koristi metod in tehnik izboljševanja procesov

Anketni vprašalnik je izpolnilo 213 respondentov iz različnih podjetij. V raziskavi so sodelovali predvsem:

- Srednje velika (55.9%) in velika podjetja (41.8%),
- Podjetja materialne (60.6%) in nematerialne proizvodnje (36.6%),
- Podjetja iz Slovenije (60.6%) in Hrvaške (28.6%).

Na začetku analize so pripravljene kontingenčne tabele iz katerih je razvidno število respondentov z izbrano stopnjo izboljšave kazalnika ter njihovim odstotkom glede na število respondentov, ki so ocenjevali enak pojem (Krhač Andrašec, 2022). Vsaj 75% respondentov je izbralo močno ali zelo močno izboljšavo procesov. Na podlagi tega in priporočenih pogojev testa (Binomial test, 2021) smo test deleža izvedli s pogojem 75%. S testom deleža smo preverjali trditev, da je populacijski delež podjetij, pri katerih je prišlo do pomembnega pozitivnega vpliva na izboljšanje posameznega kazalnika, višji od 75%.

Teste smo izvedli za nabor 7 metod in 6 tehnik. Rezultati so prikazani v tabelah 1 in 2, pri čemer so podane p-vrednosti. Za konec analize pozitivnega vpliva metod in tehnik na kazalnike učinkovitosti je uporabljen še test populacijskega povprečja. Z njim smo preverjali moč pozitivnega vpliva metod in tehnik na posamezen kazalnik (tabeli 1 in 2), saj nas je zanimalo, ali lahko pri prihodnjih njihovih uporabah pričakujemo vsaj zmerno izboljšavo poslovnega procesa. Za začetek sta postavljeni ničelna in alternativna hipoteza, pri čemer je ocena 2.5 hipotetične vrednosti postavljena na podlagi vsebine vprašalnika, kjer je le-ta predstavljala 50% izboljšavo.

Tabela 1: Vpliv metod in tehnik na strukturne kazalnike učinkovitosti

	Zmanjšanje št. aktivnosti	Zmanjšanje št. izvajalcev	Zmanjšanje št. dokumentov	Zmanjšanje št. odločitev	Povečanje deleža aktivnosti, podprtih s programsko opremo
Metode (123)¹	< 0.001	0.007	< 0.001	< 0.001	< 0.001
	< 0.001 (117)	0.003 (104)	< 0.001 (112)	< 0.001 (115)	< 0.001 (112)
Tehnike (41)	0.004	0.270	0.270	0.013	< 0.001
	0.077 (38)	0.006 (33)	< 0.001 (33)	0.015 (37)	< 0.001 (39)

¹ Število v oklepaju predstavlja velikost vzorca na katerem je izveden posamezen test.

Iz tabele 1 je razvidno, da so vse p-vrednosti izvedenih testov deleža za metode manjše od 0.05. Posledično lahko trdimo, da je populacijski delež podjetij, pri katerih je prišlo do pomembnega pozitivnega vpliva metod na vse strukturne kazalnike učinkovitosti, višji od 75%. Prav tako lahko trdimo, da je populacijski delež podjetij, pri katerih je prišlo do pomembnega pozitivnega vpliva tehnik na zmanjšanje števila aktivnosti, zmanjšanje števila odločitev in povečanje deleža aktivnosti, podprtih s programsko opremo, višji od 75%. Za pozitiven vpliv tehnik na zmanjšanje števila izvajalcev in dokumentov pa tega ne moremo trditi. Iz tabele je tudi razvidno, da je večina p-vrednosti izvedenih testov populacijskega povprečja manjših od 0.05. Trdimo torej lahko, da je povprečna ocena izboljšav strukturnih kazalnikov učinkovitosti glede na uporabo metod višja od 2.5. Enako lahko trdimo tudi, da je povprečna ocena izboljšav zadnjih štirih strukturnih kazalnikov učinkovitosti glede na uporabo tehnik višja od 2.5. Izjema je p-vrednost testa za povprečno oceno izboljšave (zmanjšanja) števila aktivnosti. V tem primeru je p-vrednost $0.077 > 0.05$, kar pomeni, da ne moremo potrditi, da je povprečna ocena izboljšave (zmanjšanja) števila aktivnosti na podlagi uporabe tehnik višja od 2.5.

Tabela 2: Vpliv metod in tehnik na operativne kazalnike učinkovitosti

	Skrajšanje časa procesov	Znižanje stroškov procesov	Izboljšanje kakovosti procesov	Izboljšanje fleksibilnosti procesov
Metode (123)	< 0.001	< 0.001	< 0.001	< 0.001
	< 0.001 (119)	< 0.001 (114)	< 0.001 (120)	< 0.001 (117)
Tehnike (41)	< 0.001	< 0.001	< 0.001	0.004
	< 0.001 (40)	0.001 (39)	< 0.001 (41)	0.007 (38)

¹ Število v oklepaju predstavlja velikost vzorca na katerem je izveden posamezen test.

Iz tabele 2 je razvidno, da so vse p-vrednosti izvedenih testov za metode in tehnike manjše od 0.05. Posledično lahko trdimo, da je populacijski delež podjetij, pri katerih je prišlo do pomembnega pozitivnega vpliva metod in tehnik na vse operativne kazalnike učinkovitosti, višji od 75%. Na podlagi pridobljenih rezultatov lahko trdimo tudi, da je povprečna ocena izboljšav operativnih kazalnikov učinkovitosti glede na uporabo metod in tehnik višja od 2.5.

Posledično lahko potrdimo, da:

- Uporaba metod in tehnik izboljševanja poslovnih procesov pozitivno vpliva na operativne kazalnike učinkovitosti (8 od 8 izvedenih testov),
- Uporaba metod in tehnik izboljševanja poslovnih procesov pozitivno vpliva na strukturne kazalnike učinkovitosti (8 od 10 izvedenih testov),
- Pri uporabi metod in tehnik izboljševanja poslovnih procesov lahko pričakujemo zmerno povprečno oceno izboljšave vseh operativnih kazalnikov,
- Pri uporabi metod izboljševanja poslovnih procesov lahko pričakujemo zmerno povprečno oceno izboljšave strukturnih kazalnikov,
- Pri uporabi tehnik izboljševanja poslovnih procesov lahko pričakujemo zmerno povprečno oceno izboljšave štirih strukturnih kazalnikov.

Na koncu smo preverili možnosti in moč istočasnega pozitivnega vpliva posameznih metod oz. tehnik na strukturne in operativne kazalnike učinkovitosti. Izsek rezultatov je prikazan v tabeli 3. V analizi je uporabljena deskriptivna statistika v obliki povprečnih ocen izboljšav kazalnikov učinkovitosti. Povprečne ocene pozitivnih vplivov pojmov iz enake skupine na posamezni kazalnik so medsebojno primerjane in rangirane, kar je označeno z barvami od bele (najmanjši pozitivni vpliv) do temno sive (največji pozitivni vpliv).

Tabela 3: Moč pozitivnega vpliva metod na operativne kazalnike učinkovitosti

	Skrajšanje časa procesov	Znižanje stroškov procesov	Izboljšanje kakovosti procesov	Izboljšanje fleksibilnosti procesov
Brainstorming (47)	3.37	3.07	3.43	3.26
Benchmarking (32)	3.53	2.87	3.53	3.39
P. Mapping/ P. Modelling (17)	3.59	3.12	3.65	2.88
5S (14)	3.36	3.42	3.43	3.23
VSM (7)	3.86	2.86	3.14	3.57
Process Simulation (5)	2.40	2.40	2.60	2.40
PDCA (1)	2.00	1.00	5.00	4.00
Povprečna ocena vpliva na kazalnik	3.42	3.00	3.45	3.22
Povprečna ocena vpliva na skupino kazalnikov	3.27			

¹ Število v oklepaju predstavlja velikost vzorca na katerem je izveden posamezen test.

Iz analize ni bilo možno zaključiti, katera metoda ali tehnika je boljša znotraj svoje skupine, saj se je število respondentov pri posameznih pojmih preveč razlikovalo. Vendar so rezultati pokazali, da metode in tehnike vplivajo na vsaj šibke (ali večje) izboljšave kazalnikov učinkovitosti. Pri pregledu posameznih rezultatov je potrjeno, da metode in tehnike v povprečju zmerno vplivajo na strukturne in operativne kazalnike učinkovitosti. Hkrati pa je iz rezultatov analize možno razbrati, da so metode nekoliko učinkovitejše pri izboljšavah poslovnih procesov z vidika strukturnih in operativnih kazalnikov učinkovitosti. Tako smo potrdili, da je z uporabo posameznih metod in tehnik izboljševanja poslovnih procesov možno istočasno pozitivno vplivati na strukturne in operativne kazalnike učinkovitosti.

3.2 Študija primera minimizacije odpadkov v procesu razvoja novih izdelkov v industriji premazov

Cilj v prikazanem primeru raziskave je bil zmanjšati količino odpadkov ter optimizirati pretočni čas in stroške procesa razvoja premazov. Različne razvojne procese lahko grobo ločimo na dve različici:

- Razvoj novega izdelka brez IKT podpore (klasičen proces),
- Razvoj novega izdelka z IKT podporo in lokalno bazo podatkov.

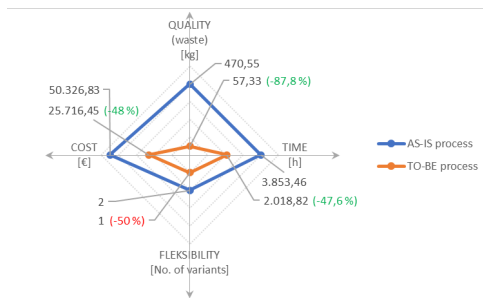
Procesne variante so enake glede nastajanja odpadkov, razlikujejo pa se v IKT podpori procesnih aktivnosti. Odpadki nastajajo v treh dejavnostih: laboratorijskem testiranju izdelkov ter zunanji in notranji validaciji.

Tekom raziskave so pridobljeni podatki o količinah odpadkov, ki nastanejo pri laboratorijskem testiranju posameznega premaznega vzorca. Povprečna količina odpadkov, ki nastane pri enem testu, je 1 kg. To je predvideno glede na povprečno količino sestavin v enem vzorcu: 0,25 - 2,5 kilograma. V eni laboratorijski preiskavi se testira 20-50 vzorcev, kar pomeni da je 35 vzorcev lahko povprečno število le teh za izračun zmanjšanja odpadkov. Pri izračunu smo upoštevali tudi število ponovitev posameznih aktivnosti za en uspešno izveden razvoj premaza. Izračunano je bilo, da je povprečna količina odpadkov pri laboratorijskem testiranju 467 kilogramov. V skupni količini odpadkov za en uspešen razvoj izdelka je potrebno upoštevati tudi odpadke notranje in zunanje validacije izdelka. V tem primeru je skupna količina odpadkov nekaj več kot 470 kilogramov.

Za preoblikovanje procesa smo uporabili metodo Process Modelling in implementirali »tehnični omogočevalec« ter izvedli ukrep zmanjšanja števila aktivnosti (odprava dveh aktivnosti) in ukrep spremembe vrstnega reda izvajanja aktivnosti (sprememba zaporedja šestih od preostalih 16 aktivnosti).

Predlagana izboljšava je pomembno vplivala na število laboratorijskih testov in čas, potreben za uspešno izvedbo prenovljenega procesa (časovna prednost). Zmanjšano število laboratorijskih testov vodi do učinkovite minimizacije količine odpadkov, ki nastanejo med njimi. Po prenovi procesa je povprečna količina sestavin enega testiranega vzorca enaka. Vendar se povprečno število vzorcev za izračun minimizacije odpadkov zmanjša na 10. To je zaključeno na podlagi zmanjšane števila vzorcev pri posameznem testu (5-15) zaradi spremenjenega zaporedja izvajanja aktivnosti (predhodno digitalno testiranje formulacij). Tako se povprečna količina odpadkov v prenovljenem razvojnem procesu zmanjša na nekaj več kot 57 kilogramov.

Ugotovljene so tudi druge prednosti prenovljenega procesa: okolju prijazna rešitev, krajši pretočni čas, nižja cena, inovativnost, širša ponudba, možnost izdelave optimalnih izdelkov, možnost sledenja napredku in večja verjetnost izdelave nišnih izdelkov v manjših serije. Tako predlagana izboljšava pomaga zmanjšati stopnjo onesnaženosti (okoljska prednost). Laboratorijski testi so dražji od računalniških simulacij zaradi cene opreme, človeškega dela, energije in materialov (stroškovna prednost). Ponavljajoče se delo v laboratoriju je zamudno. Manj ponovitev testiranja pa daje formulatorjem več časa za razvoj novih izdelkov (inovativna prednost). Predlagana izboljšava procesa razvoja premazov je omogočila znatne prihranke, kar je grafično prikazano na sliki 1.



Slika 1: Vražji kvadrant ključnih prihrankov prenovljenega procesa razvoja

Vir: lastna raziskava

4 Diskusija in zaključek

V raziskavi je na podlagi analiziranih izkušenj implementacij organizacijskih izboljšav:

- Potrjen pozitiven vpliv metod in tehnik izboljševanja procesov na kazalnike učinkovitosti. Rezultate podkrepijo tudi Griesberger idr. (2011), ki teoretično ovrednotijo vpliv metod in tehnik in ocenjujejo, da npr. tehnika Cause and Effect Diagram vpliva na posamezne elemente (npr. viri in vhod procesov).
- Potrjen je istočasen pozitiven vpliv metod in tehnik izboljševanja procesov na kazalnike učinkovitosti. Dokaz potrjuje ugotovitev (Griesberger idr., 2011), da ne obstaja tehnika, ki izboljša strukturne kazalnike in pri tem ne izboljša vsaj en operativni kazalnik.

Posledično je možno sklepati o vplivu izboljšav strukturnih kazalnikov učinkovitosti na operativne kazalnike učinkovitosti (Krhač Andrašec, 2022), o čemer govorita tudi Urh in Zajec (2016), ki dokazujeta, da ima zmanjšanje števila aktivnosti pozitiven vpliv na čas in fleksibilnost izvajanja procesov. Prav tako trdita, da ima optimizacija izvajalcev pozitiven vpliv na čas in stroške izvajanja procesov.

Z navedenimi dokazi je potrjena primernost pristopa uvajanja trajnostnih organizacijskih sprememb. Njegova uspešnost je potrjena s študijo primera, oz. realnim projektom prenove procesa razvoja novih izdelkov v industriji premazov, in sicer z uporabo digitalne transformacije (oz. vpeljavo »tehničnega omogočevalca«) in metode Process Modelling, kjer je doseženo 88% zmanjšanje odpadkov ter do 48% skrajšanje časa in zmanjšanje stroškov. Pri tem se je fleksibilnost zmanjšala za 50 % z zmanjšanjem števila variant procesa. Tak rezultat je pričakovan, saj je praktično nemogoče izboljšati vse štiri dimenzije konkurenčne prednosti z eno samo izboljšavo.

Ob ustrezni zrelosti podjetja (Novak in Janeš, 2007) je predstavljen pristop pomoč poslovodstvu pri odločanju o predlaganih organizacijskih spremembah. Le-ta omogoča tudi merjenje učinkov organizacijskih sprememb po zaključku projekta in dokončni implementaciji sprememb v podjetje. Za prihodnje raziskave na tem področju priporočamo verifikacijo pridobljenih rezultatov z drugimi kvantitativnimi metodami raziskovanja (npr. eksperimentom) na razširjenem vzorcu. Ocenjujemo tudi, da bi pristop v prihodnosti lahko dopolnili z vključitvijo umetne inteligence

(Paullada idr., 2021). V poslovnem repozitoriju je namreč veliko število modelov procesov in poslovnih objektov. Velika količina podatkov v več časovnih presekih (longitudinalna analiza) s pomočjo strojnega učenja nedvomno omogoča boljše predvidevanje učinkov organizacijskih sprememb.

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USE OF ADVANCED TECHNOLOGIES FOR PERSONALIZED TRAINING IN FITNESS

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In the paper we address utilization of advanced technologies for supporting physical exercises backed by sports theory. Despite the availability of digital technologies, wearable sensor devices and AI methods for monitoring heart rates and planning training sessions, there is currently no all-encompassing solution for customizing fitness routines based on individual health and capabilities. For this purpose, we propose to develop a comprehensive framework that utilizes information from personal trainers to personalize workout programs at fitness centres. This proposed framework aims to address this gap by analysing user data to tailor exercises according to specific requirements, including age, abilities, and injury history. The objective is to make exercise more accessible and safer, reducing reliance on often costly personal trainers. In this paper we present an initial proposal rather than a finished product. Future work involves creating a prototype, assessing its efficiency, and integrating measures for preventing injuries, ultimately improving quality of life through healthier lifestyles and accessible fitness training.

Keywords:

artificial intelligence, fitness, training program, neural networks, expert systems

1 Introduction

To effectively address the challenge of limited availability of comprehensive sports theory on the internet and the resulting difficulty in finding trustworthy sources for effective training routines, we must also consider the important issue of data utility. The extensive amount of data gathered through wearable technology and other fitness tracking devices loses much of its value without a strong foundation in sports theory. This lack of theoretical knowledge makes it challenging for individuals, including personal trainers who may not have formal qualifications in sports science, to interpret the data accurately. Therefore, even with advanced technologies at our disposal, we are unable to fully optimize training routines based on collected health metrics. The absence of accurate understanding in sports theory leads to a reliance on potentially ineffective or harmful training methods, underscoring the critical need for accessible and reliable sports theory resources.

The progress of physical fitness training in this context is increasingly influenced by technological innovations (M. Xu et al., 2022), specifically in the fields of artificial intelligence (AI) and wearable technology (Omarov et al., n.d.). These advancements, such as AI-based virtual fitness coaches that provide instant feedback and personalized workout plans, along with wearable devices that monitor health metrics, signify a significant shift towards more efficient fitness routines. However, achieving a genuine transformation in physical fitness training requires integrating these technological solutions with a thorough comprehension of sports theory. By investigating the potential of these technologies alongside a strong foundation in sports theory, we can fully harness their capabilities to revolutionize physical fitness training. This will result in not just an abundance of collected data but also truly valuable insights for improving training outcomes.

2 Literature review

A variety of approaches and systems have been proposed to enhance the quality of training and rehabilitation while minimizing injuries and optimizing performance.

One innovative approach is seen in the utilization of AI algorithms for special movements in sports. Studies have explored how floating-point numbers in AI algorithms can optimize fitness functions and simulate training scenarios (Li &

Zhao, 2014). This work demonstrates how AI can be meticulously applied to track and improve the quality of sports training, ensuring that athletes reach their peak performance levels.

In parallel, the MOPET system exemplifies a context-aware, user-adaptive wearable system for fitness training (Buttussi & Chittaro, 2008). This system stands out for its focus on real-time data coming from sensors and its use of an embodied agent to provide interactive guidance, which can significantly benefit untrained individuals by providing motivation and safety advice tailored to personal fitness levels and environmental context.

Moreover, the development of pervasive mobile assistance systems in health and fitness scenarios (Emrich et al., 2014) shows the potential of mobile apps in personal fitness training, by considering users' health constraints and personal interests. Such systems exemplify how personalization and context-awareness can be effectively incorporated into training regimes.

Similarly, the design of a cable-driven interactive rehabilitation device with 3D trajectory tracking and force feedback (H. Xu et al., 2022) reflects an advance in rehabilitation equipment. This device allows for a more interactive and engaging form of physical therapy, which could be particularly beneficial for upper limb rehabilitation.

Further research has been conducted on the application of AI in sports training through case study approaches (Wei et al., 2021). These studies explore the intersection of AI technology with sports training, revealing the potential of AI to provide analytical support in physical education.

In addition, the use of recurrent neural models in sports training has been examined (Dhanke et al., 2022). Such models have been developed to analyse the effect of physical training and to aid in the treatment and prevention of sports injuries, which is essential for the long-term health and performance of athletes.

Another noteworthy development is the artificial intelligence-based tracking model for functional sports training goals in competitive sports (Zhao et al., 2021). This model focuses on functional physical training, showcasing the gradual shift from

elite athletes to grassroots level and highlighting the importance of advanced training concepts in sports injury prevention and performance enhancement.

Lastly, the realization of wireless sensors and intelligent computer-aided teaching in physical education (Wu & Zhang, 2022) demonstrates the integration of high-tech sensors and AI to facilitate improvements in teaching methods and the overall quality of physical education.

Collectively, these studies underscore a transformative shift in physical education and sports training. Through the lens of AI and advanced technology, researchers and practitioners are crafting innovative solutions that promise to enhance the way we train, rehabilitate, and understand the human body in motion. These advancements in digital technology, especially in wearable devices and AI, are establishing new standards in fitness training methods. The progress is leading us towards a future where personalized approaches and efficiency take centre stage in fitness and athletic training methodologies.

3 Methodology

In recent years the use of digital technology in training is gaining a lot of attention. To address the problem of comprehensive support in physical training, we aim to develop a conceptual model based on existing theories and practice. For this purpose, we first conducted a literature review to determine what is known, what we don't know and what are the functionalities and guidelines for the new model development. We followed the PRISMA model for literature review (Page et al., 2021) and searched the key words "sports", "fitness training", "physical training", "artificial intelligence" in the bibliographical databases Web of Science and Scopus for the past 20 years.

Physical AND training = 262057

Fitness AND training = 28588

"fitness training" = 926

"physical training" = 7932

"physical training" AND "artificial intelligence" = 43

"fitness training" AND "artificial intelligence" = 9

...

3.1 Proposing a personalized fitness model using advanced technologies

The integration of Artificial Intelligence (AI) and its subset Machine Learning (ML) in fitness training is fundamentally changing the way personalized fitness programs are created. Azlina & Mokmin (2020) exemplify how platforms like IVFIT employ AI to effectively engage individuals in physical activities without constant supervision, thus demonstrating its potential for enhancing independent fitness routines. However, Dergaa et al. (2023) argue that AI-generated fitness plans may lack specificity for long-term health improvement, underscoring the necessity for more interactive AI solutions in the realm of fitness.

Simultaneously, ML technologies are adapting exercise plans according to individual fitness levels and objectives. The research conducted by Iyer & Debang (2024), Nguyen et al. (2022), and Scheinker (2021) illustrates how ML can address evolving fitness needs, thereby augmenting the efficacy of workout regimens.

Wearable technology also plays a crucial role in the world of fitness by providing vital health data such as heart rates and movement patterns. Ryu et al. (2023) and Steedman (2023) showcase the profound impact wearables have on monitoring exercise routines and tailoring them to individual needs, ensuring accurate and up-to-date fitness guidance.

Our envisioned fitness model proposes the integration of Artificial Intelligence (AI), including its subset Machine Learning (ML) and wearable technology, to establish a framework for personalized fitness objectives. The model's architecture, featuring a GPT API (application programming interface) for the personalization of exercises, a Recurrent Neural Network (RNN) for the intelligent selection of exercises, and an expert system for tailored injury prevention advice, suggests a highly adaptive and user-specific fitness experience.

In this proposed model, a user-centric frontend would interact with sensor devices to collect real-time fitness data, which would then be processed by the backend to adaptively modify fitness routines based on immediate feedback. Anticipated to incorporate strong privacy protections, the proposed model aims to address health data concerns while offering customized training programs.

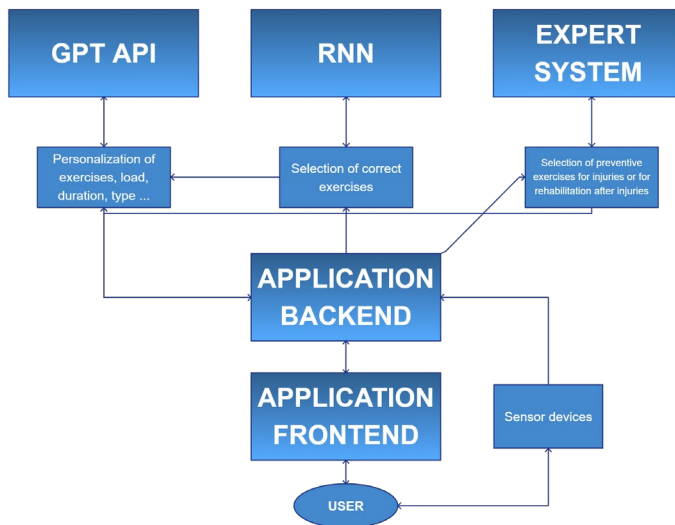


Figure 1: The proposed conceptual architecture of an AI-driven personalized fitness application

(Source: Own - diagram was made using pencil.evolus.vn)

While currently in the conceptual stage, this model has the potential to redefine personal fitness by extending its reach to professional athletic training and healthcare services. Its scalability and adaptability are indicative of its capacity for broader application, potentially leading to significant advancements in physical training and health optimization.

4 Utilizing GPT API for enhanced fitness experience

By incorporating the GPT API into our fitness model, we can explore new possibilities for customizing fitness plans. Building on Alao (2023) research, our model will feature an advanced AI assistant that dynamically adjusts diet and exercise recommendations in real time, providing a highly interactive and personalized training experience. The integration of Large Language Models (LLMs), as studied by Tesfagiorgis & Monteiro Silva (2023), will transform user interaction by simplifying access to complex fitness and nutritional information.

Additionally, we will prioritize ethical considerations in the implementation of AI, as emphasized by Chaudhary et al. (2023). This means safeguarding user privacy and data security within our fitness application. Our aim is not only to drive technological innovation, but also to ensure a trustworthy and user-centric fitness journey that aligns with individual needs and preferences. We aspire to seamlessly merge advanced AI capabilities with ethical practices, establishing a new benchmark for personalized, technology-driven fitness training.

5 Expert systems in injury management and exercise selection

Our system incorporates the insights of Valle et al. (2017) to establish a detailed method for classifying muscle injuries. By considering various aspects, this model facilitates precise diagnosis and treatment. The design of our system is further informed by Molloy et al. (2020) work on risk reduction strategies, specifically in relation to musculoskeletal injuries. Their emphasis on early injury identification and standardized exercise programming is crucial to our approach. Additionally, we have incorporated Padua et al. (2018) recommendations on injury prevention training, which include incorporating diverse exercise regimes. These comprehensive strategies aim to minimize injuries and optimize fitness training, thus influencing the selection of key features in our proposed system:

1. **Customizable Training Programs:** These programs are tailored to meet individual needs and encompass a variety of exercises for well-rounded fitness.
2. **Feedback and Adaptation:** A real-time feedback mechanism allows for program adjustments based on user input, enhancing safety and efficacy.
3. **Injury-Specific Advice:** Specialized exercises and recovery tips are provided for individuals recovering from injuries.
4. **Educational Content:** Information about common injuries and prevention strategies is included to empower users with knowledge.
5. **Long-term Tracking:** Progress tracking over time enables assessment of the impact of training on injury prevention as well as overall fitness.

This comprehensive approach ensures that our system addresses individual requirements while being supported by empirical evidence.

6 Performance coefficient as a new metric for exercise selection

Drawing upon the findings of Çakiroğlu (2021) research concerning the influence of athletic self-confidence and perfectionism on athletic achievement, our proposed performance coefficient measure will possess a distinctive framework. The measure will encompass three separate coefficients which specifically examine the lower body, core region, and upper limbs - each symbolizing significant muscle groups. This segmentation enables a thorough evaluation of an individual's athletic aptitude in these essential domains.

Exercises can be designed to address each specific muscle group during the execution phase. The quantification of an individual's performance in these exercises will enable the calculation of corresponding coefficients. To illustrate, leg strength and functionality can be assessed through exercises such as squats or lunges, core stability can be evaluated through exercises that target the trunk, and arm strength can be measured with bench press or push-ups. The outcomes derived from these exercise sessions will serve as the basis for determining the coefficients that reflect an individual's comprehensive physical capacity.

The incorporation of self-efficacy, as emphasized by Çakiroğlu (2021), will be of great importance. We can integrate a self-evaluation element wherein individuals evaluate their level of assurance in executing each physical activity. This self-evaluation will play a vital role in determining the coefficient, ensuring that the metric not only captures physical capability but also the individual's self-perception of their athletic proficiency.

Overall, the proposed approach for performance assessment is designed to deliver a nuanced view of an individual's fitness capabilities, capturing not just the physical performance through the calculation of specific upper body, lower body, and trunk coefficients, but also integrating the psychological aspect of self-efficacy to reflect an individual's confidence and self-perceived competence in their athletic pursuits.

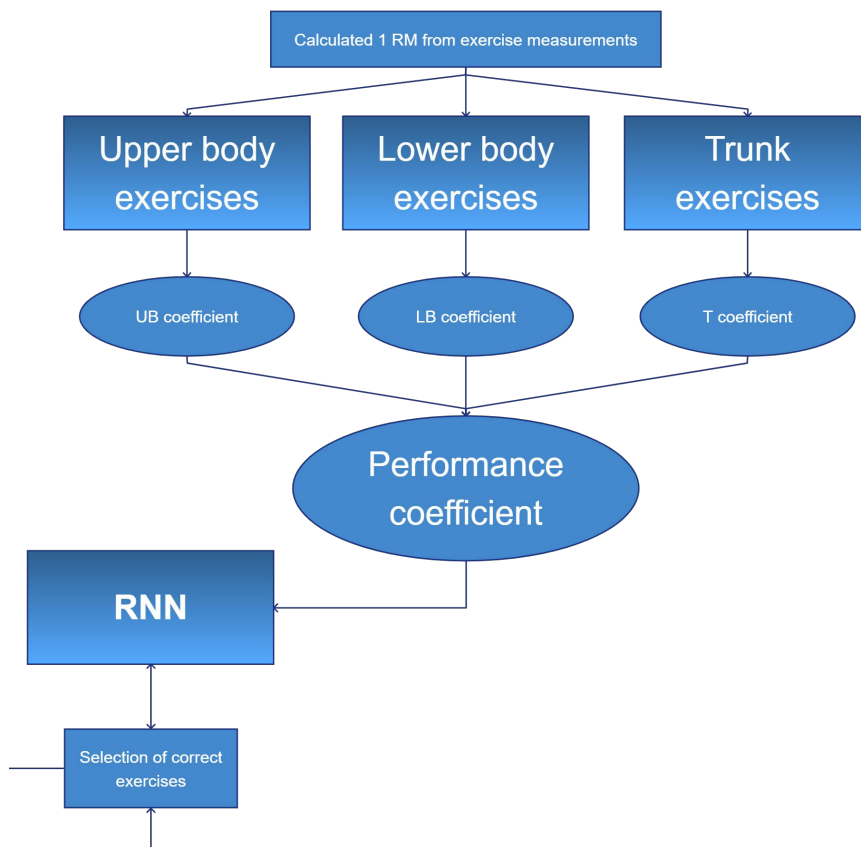


Figure 2: Performance coefficient calculation model and its connection to RNN framework
(Source: Own - diagram was made using pencil.evolutus.vn)

7 Addressing diverse needs such as age, muscular symmetry and training background

Designing efficient resistance training programs necessitates a thorough comprehension of individual requirements, particularly considering variables such as age, muscular balance, and training history. Personalization is essential, as specified by Kraemer & Fragala (2006), with each program specifically customized to suit individual objectives and closely monitored to ensure both effectiveness and safety. Implementing progressive resistance training, which is fundamental for physiological enhancements, entails altering the intensity and number of exercises

over time. This methodology is critical for consistent improvements in strength and physiological functions, acknowledging that progress rates may vary depending on the specific exercise protocol employed.

It is important to tailor exercises to suit different age groups. Younger individuals should concentrate on activities that build strength and endurance, while older adults should prioritize exercises that improve balance, flexibility, and joint health. To prevent injuries and enhance performance, it is crucial to work on achieving muscular symmetry by targeting both primary and opposing muscle groups. The complexity of the training program varies depending on an individual's experience level. Beginners can begin with foundational exercises, whereas experienced athletes may engage in more specialized training.

The principles of our system will be implemented by evaluating the individual requirements of each user and adjusting programs accordingly. The user's age, muscular equilibrium, and training background will be taken into consideration to create a tailored training plan that progresses over time, prioritizing safety and optimizing its efficiency.

8 Challenges and future directions in tech-driven fitness training

In the domain of technology-based fitness training, the focus lies on the fusion of cutting-edge technology with conventional training methods. Key obstacles and areas for development in this field involve making sure that tech-centric solutions are accessible and affordable to a wider demographic, sustaining user interest over an extended period, and consistently enhancing the technology to align with current scientific research and fitness trends.

An important domain for further investigation pertains to the advancement of more intricate artificial intelligence (AI)-powered customization tactics, capable of adjusting to individual requirements using up-to-date information. Furthermore, there is an increasing necessity to tackle the disparity in digital access, guaranteeing fair availability of these fitness technologies, particularly within disadvantaged communities.

Advancements in wearable technologies and their incorporation into fitness programs indicate a notable prospective avenue. These devices have the potential to offer more accurate information on individual performance, health measurements, and conceivably even psychological conditions, thereby enhancing the comprehensiveness and efficacy of training programs.

As technology continues to advance, ethical concerns surrounding data privacy and the psychological effects of continuous monitoring will grow in significance. Consequently, there will be a need to establish stringent safeguards for privacy and develop ethical principles governing the utilization of personal information in fitness training.

9 Conclusion

In conclusion, this paper has highlighted a crucial gap in the fitness industry: the underutilization of the extensive data generated by digital health technologies. Despite advancements in devices and artificial intelligence capable of monitoring health metrics, the development of personalized fitness programs that fully capitalize on this data remains incomplete. Our proposed framework seeks to integrate the expertise of personal trainers with sophisticated AI algorithms to tailor fitness programs that consider individual characteristics such as age, ability, and medical history. By doing so, we aim to increase the accessibility and safety of exercise regimens, reducing the need for costly personal training services.

The outlined concept lays the groundwork for a technology-driven system that does more than collect data; it applies intelligent analysis to create personalized fitness solutions. Our future work includes the development of a prototype that will be rigorously tested for its efficiency in generating bespoke exercise programs and its ability to incorporate injury prevention methodologies.

Our goal is to harness the transformative potential of AI and wearable technology to redefine personalized fitness. By doing so, we aspire not only to improve the quality of life for individuals through more accessible and healthier lifestyle choices but also to set a new standard for technology-enhanced fitness solutions. Through continued research and development, we envision a fitness industry that is both

informed by data and grounded in the principles of sports science, offering long-term health benefits to users worldwide.

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VLOGA DIGITALNE INTELIGENCE V USPEŠNOSTI RAZPOREJANJA ZASEBNEGA IN DELOVNEGA ČASA - PREGLED LITERATURE

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Tehnologija je praktično del našega vsakdana, tako doma, kot v službi. Uspešno vključevanje v delovno in družbeno okolje posameznika je odvisno tudi od veščin uporabe sodobnih digitalnih tehnologij. Po eni strani digitalne tehnologije omogočajo bolj učinkovito delo in izrabo časa, po drugi strani pa neprestana dosegljivost od koderkoli lahko vpliva na nezmožnost razporejanja zasebnega in delovnega časa. Za obvladovanje izzivov, ki jih prinaša življenje v vse bolj digitalnem svetu pa niso dovolj le digitalne kompetence, pač pa skupek družbenih, čustvenih in kognitivnih sposobnosti. V prispevku bomo pripravili sistematični pregled raziskav na področju vpliva digitalne tehnologije na razporejanje zasebnega in delovnega časa. V ta namen bomo pregledali bibliografske podatkovne baze Web of Science, Scopus in ProQuest dissertation in thesys po izbranih ključnih besedah. Cilj prispevka je opredeliti raziskovalno vrzel ter pripraviti nadaljnji načrt raziskave.

Ključne besede:

upravljanje s časom, usklajevanje zasebnega in delovnega življenja, digitalna tehnologija, digitalna kompetenca, digitalna inteligenca

THE ROLE OF DIGITAL INTELLIGENCE IN THE EFFECTIVENESS OF SCHEDULING PRIVATE AND WORK TIME - LITERATURE REVIEW

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Technology is practically a part of our everyday life, both at home and at work. Successful integration into an individual's work and social environment also depends on the skills of using modern digital technologies. On one hand, digital technologies enable more efficient work and time utilization, while on the other hand, constant accessibility from anywhere can affect the inability to manage private and work time. To cope with the challenges of living in an increasingly digital world, digital competencies alone are not enough; a combination of social, emotional, and cognitive abilities is required. In this contribution, we will provide a systematic review of research on the impact of digital technology on the scheduling of private and work time. For this purpose, we will examine the bibliographic databases of Web of Science, Scopus, and ProQuest dissertations and theses using selected keywords. The aim of the contribution is to identify research gaps and prepare a further research plan.

Keywords:

time
management,
work-life
balance,
digital
technology,
digital
competence,
digital
intelligence

1 Uvod

Digitalna doba, imenovana tudi digitalna revolucija (Kowalski, 2015) in četrta industrijska revolucija (Schwab, 2016), je čas obširne uporabe digitalnih tehnologij pri različnih človeških dejavnostih (Novak, 2019), kjer je zaskrbljujoč predvsem eksponentno hiter razvoj (Schwab, 2016 in Kowalski, 2015).

V Sloveniji prebivalci internet v 80% uporabljajo za pregled e-pošte, 75% za iskanje informacij, 70% za branje spletnih novic, 64% za neposredno sporočanje, 63% za spletna družbena omrežja, 57% za e-bančništvo, 56% za telefoniranje, 31% za dostop do lastne zdravstvene dokumentacije, 28% za objavljanje lastnega mnenja o družbenih ali političnih temah, z 18% prodajo obloga oz. nudenje storitev, z 11% učenje na daljavo, z 11% iskanje službe in 7% za sodelovanje v posvetovanjih ali glasovanjih o družbenih ali političnih temah (SURS, 2022). Literatura razkriva kompleksnost in multidimezionalnost pojma digitalne kompetence (Roll & Ifenthaler, 2021). Kot najpogosteje uporabljan okvir za opisovanje digitalnih kompetenc se uporablja DigComp (Zhao, Pinto Iorente, & Sánchez Gómez, 2021), katerega sestavlja pet področij. To so informacijska pismenost, komuniciranje in sodelovanje, varnost ter reševanje konfliktov (Carretero, Vuorikari, & Punie, 2017).

Digitalna doba zaposlene manj osredotoča na uravnoteženje zasebnega in delovnega življenja, ter vse bolj na uravnoteženje med tehnologijo in življenjem (Mahajan, 2022). Ker je vpliv tehnologije zelo močan in digitalne inteligence predstavljajo pomembno komponento za delovanje v digitalni dobi, nas zanima, kakšna je vloga digitalne inteligence na upravljanje zasebnega in delovnega časa in na upravljanje časa zasebnega in delovnega življenja.

2 Digitalna kompetenca in digitalna inteligenca

2.1 Digitalna kompetenca

Znanje je v 21. stoletju postalo ključnega pomena. Ljudje morajo pridobiti digitalne kompetence, da lahko vstopijo na trg dela. S tem so si digitalne kompetence pridobile naziv »veščine 21. stoletja«. Vendarle pa izraz veščine 21. stoletja zajemajo veliko več kot le digitalne kompetence, saj niso vezane samo na uporabo in podprtje informacijsko-komunikacijsketehnologije, temveč vključujejo tudi sodelovanje,

komunikacijo, digitalno pismenost, državljanstvo, reševanje problemov, kritično mišljenje, ustvarjalnost in produktivnost (Voogt & Roblin, 2012).

2.2 Digitalna inteligenca

Digitalna inteligenca se nanaša na sposobnost učinkovite rabe informacijske tehnologije, razumevanje digitalnega okolja in sposobnost kritičnega razmišljanja ter reševanja problemov v digitalnem kontekstu. Z razumevanjem digitalnega okolja ljudje lahko bolje komunicirajo in sodelujejo v sodobni informacijski družbi. Razvoj veččin 21. stoletja je ključno za uspešno vključevanje v digitalno dobo (Adams N. B., 2004).

3 Upravljanje s časom

Upravljanje s časom predstavlja načrtno razporejanje razpoložljivega časa v skladu z osebni cilji, življenjskim slogom ter upoštevanjem individualnih preferenc, želj in izzivov. Kriterij učinkovitega upravljanja s časom ne obsega le doseganje postavljenih ciljev, temveč poudarja tudi potrebo po doseganju teh ciljev v najkrajšem možnem času (Karaoglan, 2006 in Eldeleklioglu, 2008). Ključnega pomena je optimalno izkoriščanje razpoložljivega časa, kar zahteva premišljeno načrtovanje (Karaoglan, 2006).

Upravljanje s časom lahko pomaga ljudem, da si čas razdelijo tako, da dosežejo največjo produktivnost in učinkovitost. Za namene upravljanja s časom so kot dober način možna koriščenja raznih veččin. Poleg globokega dela obstajajo razne tehnike, kot je Eisenhowerjeva matrica, Tehnika Pomodoro, Parkinsonov zakon, Metoda »ABCDE«, SMART metoda, Metode časovnega blokiranja in Tehnika Paretove analize (My Hours, 2024).

4 Upravljanje časa ter zasebno in delovno življenje

4.1 Uskajevanje zasebnega in delovnega življenja

Koncept usklajevanja je iskanje ravnovesja med zasebnim in delovnim življenjem ter je sposobnost hkratnega doseganja ciljev in občutka zadovoljstva na vseh področjih življenja (Kirchmeyer, 2000). Pomeni tudi sprejemljivo stopnjo konflikta med delovnimi potrebami in nedelovnimi sferami (Greenblatt, 2002).

4.3 Bogatitev dela in družine

Sinergetski učinki med delom in družinskim življenjem potekajo v obeh smereh. Raziskave kažejo, da lahko spretnosti, učinki in viri iz delovnih izkušenj obogatijo življenje doma, hkrati pa spretnosti, vplivi in povečana učinkovitost doma obogatijo življenje na delovnem mestu (Carlson, Kacmar, Wayne, & Grzywacz, 2006).

4.4 Zadovoljstvo z usklajevanjem zasebnega in delovnega življenja

Zadovoljstvo z usklajenim zasebnim in delovnim življenjem implicitno zajema splošno ujemanje med posameznikovimi željenimi in dejanskimi izkušnjami, ki so vezane na zasebno in delovno življenje (Abendroth & den Dulk, 2011).

5 Digitalna kompetenca in inteligenca ter upravljanje zasebnega in delovnega življenja

Tehnologija nas je naredila tako obsežne, da hitro komuniciramo in pošiljamo sporočila v trenutku, kar ohranja mobilne telefone in druge interaktivne naprave nenehno pri roki. Odstotek odmika od tehnologije je manjši, zmanjšana je družinska komunikacija in vsak je po svoje zaposlen z virtualnim svetom. Socialni mediji so največji dejavnik tehnologije in rabe interneta, ki vzame veliko časa, saj je to navada trenutne generacije (Mahajan, 2022). Nedavna raziskava je pokazala, da digitalna kompetenca ne vpliva na uspešnost storitev, pozitivno pa vpliva na ravnotežje med zasebnim in delovnim življenjem ter stres (Garini, 2023).

5.1 Vloga digitalne inteligence pri upravljanju s časom zasebnega in delovnega življenja

Učinkovita raba digitalnih tehnologij bistveno izboljšuje koordinacijo in izmenjavo znanja med posamezniki, kar posledično prispeva k optimalnemu ravnotežju med delovnim in zasebnim življenjem ter povečuje delovno uspešnost. Nedavna raziskava razkriva, da uporaba digitalnih tehnologij, namenjenih izboljšanju komunikacije in odločanja, ne kaže bistvenega vpliva na ravnotežje med delovnim in zasebnim življenjem ter delovno uspešnost v kontekstu digitalnega dela. To poudarja pomembnost premišljene implementacije digitalnih orodij za doseganje optimalnih rezultatov v delovnem okolju (Duan, Deng, & Wibowo, 2023).

Iluzija o večopravilnosti kot »velesili« digitalne dobe je tesno povezana z motnjami, slabim upravljanjem časa in izgubo produktivnosti. Ena izmed študij je pokazala, da digitalni domorodci nenehno skačejo med različnimi oblikami digitalnih medijev približno enkrat vsako minuto, kar osiromaši njihovo čustveno naložbo v katero koli dejavnost (Conley, 2011). To je klasičen vzrok za slabo upravljanje časa (Ramasubbu, 2016). Priporočano je izogibanje večopravilnosti in motnjam, saj se izgublja fokus. Smiselno je tudi omejiti čas preživet na telefonu, izklopiti telefon ali obvestila med delom, določiti količino časa za preverjanje e-pošte in izbrati manj hrupno delovno mesto. Koristno je tudi izbiranje krajših odmorov, najti zase najbolj produktiven čas, se lotiti razdelitve nalog na manjše dele in realizirati delegiranje nalog drugim (My Hours, 2024).

5.2 Vloga digitalne inteligence pri upravljanju zasebnega in delovnega časa

V sodobnem hitrem poslovnem okolju, kjer je delo obsežno, a čas omejen, postaja ključnega pomena učinkovito upravljanje s časom. Raziskava iz leta 2012 dodatno poudarja, da strategije upravljanja s časom pomembno prispevajo k povečani produktivnosti, še posebej za posameznike, ki se soočajo s kompleksnimi izzivi in večjimi vlogami. Ena od učinkovitih strategij upravljanja s časom vključuje razvrščanje nalog po prioritetah in postavljanje realističnih rokov, kar omogoča osredotočenost na najnujnejše naloge. Kot izhaja iz študije, tak pristop ne le vodi do povečane produktivnosti, temveč tudi prispeva k večjemu zadovoljstvu pri delu. Poleg povečane produktivnosti pa je tudi zmanjšanje stresa tesno povezano z učinkovitim upravljanjem časa (Chase, in drugi, 2012). Študija iz leta 2014, je razkrila, da imajo tisti, ki imajo nadzor nad svojim časom, manjši občutek stresa in tesnobe (Häfner, Stock, & Oberst, 2014). Omenjeni raziskavi podpirata zaključek obsežne raziskave v zadnjih desetletjih - pravilno upravljanje s časom omogoča posameznikom premagovanje občutka preobremenjenosti in zmanjšanje vpliva stresa ter zahtev sodobnega življenja. Poudarjata tudi, da se velik del upravljanja s časom osredotoča na uravnoteženje obveznosti med delom in zunanjim življenjem, kar vključuje vsakodnevno posvečanje časa dejavnostim, ki prinašajo zadovoljstvo, zmanjšujejo stres ter obnavljajo energijo (My Hours, 2024).

Obstajajo možnosti rabe digitalne inteligence za namene lažjega upravljanja časa, kot so raba programske opreme za sledenje časa (My Hours, Timly, Scoro, Harvest, Quick Books Time, Replicon idr.) (Ramasubbu, 2016).

5.2.1 Prednosti rabe digitalne inteligence

Virtualni svetovi ponujajo mladim generacijam svobodo izogibanja dominantnim družbenim strukturam. Kljub temu pa lahko hkrati omejijo njihovo možnost povezovanja s podobno mislečimi posamezniki ter jih usmerjajo v virtualne družbene skupnosti na globalnih spletnih mestih (Stanislav, 2012).

Glede na razvoj digitalne intervencije, lahko v prihodnje pričakujemo več spletnih klinik (Fairburn & Patel, 2017), ki nam bodo prihranile pot, čas in stroške.

Uporaba IKT in predvsem digitalno opolnomočenje ima velike ekonomske učinke, zlasti na zaposlovanje, ki daje prednost tudi vključevanju prikrajšanih skupin na trg dela. Ravno tako pa digitalizacija spodbudi rast produktivnosti in zaposlovanja (Evangelista, Guerrieri, & Meliciani, 2014).

Digitalna inteligenca omogoča delo iz pisarne, od doma oziroma od koderkoli. Omogoča sodelovanje z ljudmi, ki jih še nikoli nismo srečali, s krajev, katerih še nikoli nismo obiskali. Omogočeno je tudi daljinsko upravljanje različnih naprav, notranje temperature, vlažnosti, osvetlitve in celo odpiranje in zapiranje oken. Vdelani računalniški čipi in senzorji omogočajo, da ni več treba ločeno nositi računalnik na sestanke. Računalniški programi in naprave se uporabljajo za opravljanje vedno več nalog z visoko ravno tehničnega znanja in koristmi, ki vključujejo nižje stroške, višjo kakovost, izboljšano varnost in zaščito okolja (Cascio & Montealegre, 2016). S tem se zmanjšuje obremenitev človeka.

Nosljive računalniške naprave, znane pod izrazom »wearables« so udobno nosljive na telesu (Tehrani & Michael, 2014) in samostojno zbirajo podatke iz telesa in okolja in/ali zagotavljajo informacije (Educase, 2013), kar posamezniku prihrani čas pri samoanalizi (npr. napredek pri športnikih) in čas, ki bi ga porabil za pridobivanje informacij.

Tehnologijo že uporabljamo za boljše upravljanje časa. E-pošte se dostavljajo takoj, namesto počasnih pošt, ki so potrebovale dni, komunikacijske naprave imamo vedno pri sebi v žepu, namesto da bi se zanašali na nosilne golobe, telegrafe in stacionarne telefone, ki bi lahko zamujali naša sporočila. Uporabljamo tipki za brisanje na prenosnih računalnikih namesto, da bi ponovno pisali celotne odseke. Siri, Google in vrsta drugih spletnih pomočnikov nam lahko prihranijo obisk knjižnice (Ramasubbu, 2016).

5.2.2 Slabosti rabe digitalne inteligence

Prisotnost mobilnih telefonov in drugih naprav lahko zavira intimnost pri interakciji z drugimi iz oči v oči (James, in drugi, 2017). Čeprav so virtualne ekipe preoblikovale predvsem delovne prakse številnih posameznikov in omogočile globalno upravljanje talentov, predstavljajo tudi kompleksne izzive pri upravljanju (Cascio & Shurygailo, 2003 in Golden & Veiga, 2008), kot so organizacija virtualnih ekip (bodisi domačih ali globalnih), vzpostavljanje zaupanja in motivacije med člani ekipe, ki niso prisotni na istem geografskem mestu, obravnava introvertiranih članov v virtualnem okolju, strukturiranje virtualnih sestankov in drugih interakcij, zagotavljanje učinkovite povratne informacije ter upravljanje z jezikovnimi raznolikostmi v ekipi (Cascio, 2011). Izkazalo se je tudi, da virtualno povezovanje, kot je videokonferenca sproža več komunikacijskih težav (Driskell, Radke, & Salas, 2003), ki zmanjšujejo medsebojno poznavanje med člani (Cascio & Montealegre, 2016).

Glede na izsledke raziskav pri starejših odraslih - pogosto pride do odvisnosti od tehnologije, kar pa zmanjša občutek pripadnosti in vključevanja v okolico (Wilson, 2018). Nevarnost tehnologije se pojavi, ko orodje uporabljamo brez potrebnih veščin in zavedanja, in orodje postane gospodar (Ramasubbu, 2016). Študija leta 2005 je pokazala, da so delavci na tehnološkem področju lahko osredotočeni le 11 minut, predno so bili moteni, in ko so bili moteni, so potrebovali 25 minut, da so ponovno pridobili fokus (Thompson, 2005), s tem vedenjem se izgublja čas (Ramasubbu, 2016).

5.2.3 Digitalna inteligenca in uspeh v upravljanju zasebnega in delovnega časa

Obstajajo orodja in aplikacije, kot sta Focus in Freedom, ki lahko preverjajo nekoristne dejavnosti in pomagajo pri boljšem upravljanju časa ter osredotočenosti, tako da blokirajo moteča spletna mesta in družbena omrežja ob določenih urah. Osredotočenost pa pomeni tudi organiziranost in jasnost glede tega, kaj je potrebno urediti, čemur zelo koristijo spletni/digitalni koledarji, orodja za ustvarjanje miselnih kart (npr. Mind42), opomniki in aplikacije beležke. Obstajajo tudi orodja, ki lahko združijo različne vidike upravljanja s časom v eno platformo (npr. My Life Organized, Remember The Milk, Wunderlist in Evernote) in orodja, ki spremljajo, koliko časa se porabi za določene dejavnosti ter tako pomagajo optimizirati način dela, da bi bile dosežene največje koristi (npr. Toggi in MyHours) (Ramasubbu, 2016). Raziskave kažejo tudi na to, da naši možgani delujejo v 90-minutnih ciklih počitek-aktivnost (Kleitman, 1987) in da nekateri kritični deli možganov postanejo aktivni med nedelovanjem (Chrustoff, Gordon, Smallwood, Smith, & Schooler, 2009), zato je nujen odmor vsako uro in pol, čemur lahko kot opomnik koristijo digitalna orodja (npr. Dejal TimeOut, Eyeleo in PC Work Break). Množica orodij za upravljanje časa je neuporabna brez temeljne človeške kompetence samodiscipline. Pomanjkanje discipline in predanosti lahko privede do odlašanja in zlorabe iste tehnologije, ki nam lahko pomaga povečati občutek zadovoljstva in dobrega počutja. (Ramasubbu, 2016).

6 Diskusija

Čeprav tehnologija omogoča globalno sodelovanje in dostop do informacij, pa lahko hkrati predstavlja izzive pri vzpostavljanju zaupanja, motivacije in organizaciji virtualnih ekip. Virtualno povezovanje, kot je videokonferenca, namreč sproža več komunikacijskih težav, ki zmanjšujejo medsebojno poznavanje med člani (Driskell, Radke, & Salas, 2003). To kaže, da kljub napredku digitalne inteligence obstajajo omejitve in izzivi, ki jih je treba premagati.

Pri upravljanju zasebnega in delovnega časa so ključne človeške kompetence, predvsem samodisciplina. Pomanjkanje discipline in predanosti namreč lahko privede do odlašanja in zlorabe iste tehnologije, ki nam lahko pomaga povečati občutek zadovoljstva in dobrega počutja (Ramasubbu, 2016). To nas spominja, da

tehnologija sama po sebi ni rešitev, temveč je le orodje, ki ga moramo pametno uporabljati v okviru svojih osebnih in poklicnih ciljev.

Za upravljanje lastnega časa tako v zasebnem kot delovnem življenju obstaja več digitalnih orodij, aplikacij, spletnih oziroma digitalnih koledarjev, orodij za ustvarjanje miselnih kart, opomnikov in aplikacij beležk. Prav vsi so ustvarjeni z namenom organizacije lastnega časa, jasnosti glede nalog, sledenju in doseganju ciljev. Na koncu pa je potrebno razumeti, da je digitalna inteligenca lahko odlično orodje za izboljšanje ravnotežja med zasebnim in delovnim življenjem, vendar moramo biti obenem pozorni na pasti in izzive, ki jih prinaša. Razprava o tem vprašanju je ključna za oblikovanje smernic, ki bodo posameznikom pomagale izkoristiti prednosti digitalne dobe, hkrati pa ohranjati kakovost svojega življenja.

7 Zaključek

Celovita analiza vloge digitalne inteligence in upravljanja časa v zasebnem in delovnem življenju razkriva številne plati sodobnega življenja v digitalni dobi. Čeprav prinaša mnogo pozitivnih vidikov, so tudi nekatere pasti, ki zahtevajo premišljeno uporabo tehnologije. Uporaba digitalnih tehnologij za koordinacijo in izmenjavo znanja lahko pripomore k optimalnemu ravnotežju med delom in zasebnim življenjem ter poveča delovno uspešnost. Ključnega pomena je razumnost pri implementaciji digitalnih orodij in strategij za doseganje optimalnih rezultatov. Obstoječe težave, kot so odvisnost od tehnologije, zmanjšanje medsebojnega poznavanja v virtualnih ekipah in izguba intimnosti pri medosebnih interakcijah, zahtevajo pozornost. Izpostavljamo pomembnost uravnoteženja in zavedanja potencialnih slabosti digitalne inteligence, še posebej v kontekstu socialnih interakcij in delovnih okolij. Na voljo so raznolika orodja oziroma aplikacije za optimizacijo časa in dela. Hkrati pa velja opozarjati, da je brez temeljne človeške kompetence samodiscipline množica orodij lahko neuporabna.

Skupaj z digitalno inteligenco odpiramo vrata možnostim in izzivom, ki jih prinaša sodobno življenje. Pomembno je, da ostajamo zavedni in premišljeni pri integraciji tehnologije v naše življenje, da dosežemo optimalno ravnotežje med produktivnostjo, zadovoljstvom in zasebnim življenjem.

Raziskovalna vrzel v trenutnem razumevanju vloge digitalne inteligence v uspešnosti razporejanja zasebnega in delovnega življenja se osredotoča na pomanjkanje celovitega raziskovanja, ki bi razkrilo kompleksnost interakcij med digitalno inteligenco ter vodenjem oziroma organizacijo posameznikovega časa in nalog v obeh sferah življenja. Doslej opravljene študije so pogosto osredotočene bodisi na vpliv digitalne inteligence v delovnem okolju ali na uporabo tehnologije v zasebnem življenju, vendar pa manjka poglobljenega razumevanja, kako se ti dve področji prepletata ter kako lahko digitalna inteligenca učinkovito podpira integracijo obeh vidikov življenja.

Nadaljnji načrt raziskave je raziskovanje kompleksnih interakcij med digitalno inteligenco, upravljanje s časom, delovnim okoljem in zasebnim življenjem. Osredotočeno tudi na raziskovanje vpliva individualnih razlik (npr. osebnih preferenc, vrednot, ciljev) na uporabo digitalne inteligence pri razporejanju časa; preučevanje, kako se različni posamezniki odzivajo na različne tehnološke pristope in kako ti vplivajo na njihovo uspešnost v obeh sferah življenja; ter; kako lahko tehnologija najbolje podpira usklajevanje med zasebnim in delovnim življenjem ter prispeva k izboljšanju uspešnosti posameznika. Temu bi sledil razvoj smernic in priporočil za optimalno integracijo digitalne inteligence v življenje posameznika. Za to bi bila potrebna tudi izvedba pilotske študije, kjer bi testirali predlagane smernice in priporočila v realnem okolju. Temu bi sledila evalvacija rezultatov in prilagajanje smernic glede na pridobljene ugotovitve. S tem načrtom raziskave bi lahko pridobili globlje razumevanje vloge digitalne inteligence v razporejanju časa, s poudarkom na integraciji zasebnega in delovnega življenja, kar bi lahko koristilo posameznikom, organizacijam ter razvijalcem digitalne tehnologije.

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PAMETNE SKUPNOSTI IN PAMETNA POLICIJSKA DEJAVNOST V SLOVENSКИH OBČINAH

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Po svetu se države in mesta osredotočajo na trajnostni razvoj z inovativnimi pristopi k družbenim problemom. Razvoj pametnih skupnosti vodi k učinkovitejšim, fleksibilnejšim in trajnostnim okoljem, izboljšuje kakovost življenja ter ponuja kakovostnejše storitve. Te skupnosti uvajajo inovacije na področjih energetike, mobilnosti, zdravstva, turizma, okolja, ekonomije, javnega upravljanja, šolstva in varnosti. Pametne skupnosti izkoriščajo informacijsko-komunikacijske tehnologije in inteligentne sisteme za reševanje varnostnih izzivov, kar vključuje tudi pametno policijsko delovanje. To je nov pristop v policijskem delu, osnovan na podatkih, ki združuje tehnologijo, raziskave in analitiko. Cilj je izboljšati preprečevanje in preiskovanje kriminalitete ter okrepiti na dejstvih temelječo policijsko delo. V Sloveniji smo septembra 2023 izvedli raziskavo med 57 odgovornimi za varnost v občinah, ki so ocenili razvoj pametnih skupnosti/mest. V prispevku so prikazani rezultati stopnje razvitosti posameznih področij pametnih skupnosti/mest v občinah ter predstavljeni projekti/rešitve s področja pametne policijske dejavnosti ali pametnega razvoja na področju zagotavljanja varnosti v lokalnih skupnostih.

Ključne besede:

pametne skupnosti, pametna policijska dejavnost, občine, informacijsko-komunikacijska tehnologija, Slovenija

SMART COMMUNITIES AND SMART POLICING IN SLOVENIAN MUNICIPALITIES

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Globally, nations and urban areas are emphasizing sustainable development through innovative solutions to societal issues. The evolution of smart communities fosters environments that are more effective, adaptable, and eco-friendly, enhancing quality of life and service deliverement. services. These communities are pioneering in fields like energy, mobility, healthcare, tourism, environment, economics, public governance, education, and security. They employ information-communication technologies and smart systems for addressing security concerns, incorporating smart policing. This novel police work strategy relies on data, merging technology, research, and analytics to bolster crime prevention and investigation, augmenting the scientific knowledge base. In September 2023 we conducted a survey involving 57 municipal safety officials in Slovenia, who evaluated the progress of smart communities/cities. The study reveals the advancement levels in various domains of smart communities/cities and highlights projects and solutions in smart policing or development related to ensuring safety in local communities.

Keywords:

smart
communities,
smart
policing,
municipalities,
information -
telecommunication
technology,
Slovenia

1 Uvod

Države in mesta po vsem svetu z vizijo in cilji trajnostnega razvoja stremijo k odkrivanju novih in inovativnih rešitev k reševanju družbenih problemov. Posledica tega so med drugim razvojne strategije usmerjene v *pameten razvoj* in *pametne skupnosti*, kar vključuje inovativne pristope k razvoju učinkovitejših, fleksibilnejših, trajnejših okolij in boljših storitev za zagotovitev višje kakovosti življenja. Središče pametnih skupnosti predstavljajo inovativni pristopi, ki presegajo tradicionalne metode in pristope in nudijo sveže perspektive za reševanje kompleksnih problemov. Varnost, kot eden izmed temeljnih stebrov kakovosti življenja, prav tako sledi tej paradigmi. Oblasti v lokalnem okolju (v občinah) z vidika zagotavljanja varnosti pomembno vplivajo na razvoj trajnostnih mest in skupnosti s spodbujanjem različnih pobud za varnost v skupnosti in zagotavljanjem, da se vsi člani skupnosti počutijo varne v svojih bivanjskih soseskah. Namen prispevka je analizirati, kako so v slovenskih občinah razvita posamezna področja pametnih skupnosti ter predstaviti projekte/rešitve s področja pametne policijske dejavnosti ali pametnega razvoja na področju zagotavljanja varnosti v lokalnih skupnostih.

2 Pametne skupnosti in pametna policijska dejavnost

Trajnostni razvoj in zagotavljanje varnosti prebivalcev sta ključna razvojna cilja vseh sodobnih držav. Kot odgovor na izzive na tem področju so se začeli razvijati projekti *pametnih skupnosti*, ki s pomočjo razvoja učinkovitejših, fleksibilnejših storitev stremijo k zagotavljanju višje kakovosti življenja prebivalcev (Bang idr., 2019). Pristopi so značilni predvsem za urbana središča (*pametna mesta*), vendar se vse pogosteje pojavljajo tudi v ruralnih skupnostih (*pametne vase*). Za pametne skupnosti je značilno soodvisno delovanje različnih deležnikov v lokalnem okolju, uporaba sodobne tehnologije, jasno opredeljeni strateški cilji in natančno določena področja delovanja. Področja delovanja pametnih skupnosti so raznobera in vključujejo promet oz. mobilnost, energetiko, zdravstvo in medicino, ekonomijo oz. gospodarstvo in kmetijstvo, okolje, javno upravljanje, izobraževanje, bivanje in tudi varnost (Prislán Mihelič idr., 2022). Razvoj *pametnih rešitev*, ki jih opredeljujemo kot integracijo različnih produktov, tehnologij in storitev za inovativno in učinkovito upravljanje prepoznanih potreb in problemov, poteka na osnovi *omogočitenih tehnologij* (te razumemo kot najsodobnejše in inovativne izume, ki omogočajo hiter razvoj in preboj), kar se kaže v razvoju različnih pametnih sistemov in rešitev na

področju upravljanja javnega življenja (npr. nadzorstveni, zdravstveni, prometni sistemi), bivanja v zasebnih domovih (npr. asistenca na domu posameznika) ali izvajanja organizacijskih, poslovnih, industrijskih, kmetijskih in drugih procesov (Prislan Mihelič idr., 2022). Vse to omogoča algoritmično, tehnološko podprto, upravljanje procesov v lokalnih skupnostih (Bang idr., 2019; Tulumello & Iapaolo, 2022).

Načela, na katerih temeljijo pametne skupnosti, so (Prislan Mihelič idr., 2022) *proaktivnost* (preprečevanje varnostne problematike in ne samo obravnava že poznanih problemov, kar vključuje identificiranje potencialnih nevarnosti in vzpostavljanje sistemov zgodnjega opozarjanja, policija in druge institucije pa izvajajo ciljno usmerjene patrulje in preprečujejo kriminalna dejanja pred njihovo izvršitvijo), *prilagodljivost* (ob zavedanju, da se pogoji in varnostne razmere nenehno spreminjajo, poteka nenehno prilagajanje strategij in taktik dela), *trajnost in odpornost* (ustvarjanje skupnosti, ki so trajnostne - učinkovito uporabljajo vire in zmanjšujejo vpliv na okolje; in odporne - lahko prenesejo ali hitro okreva v primeru nepredvidenih, izrednih dogodkov), *inovativnost* (uporaba novih tehnologij, strategij, pristopov in kreativnih idej za izboljšanje uspešnosti in učinkovitosti), *sodelovanje in partnerstvo* (tesno sodelovanje med policijo, redarstvi, zasebnimi varnostnimi podjetji, raziskovalci in drugimi deležniki v mestu. To vključuje pridobivanje informacij iz različnih virov, deljenje informacij, skupen pristop k odkrivanju problemov, rešitev in razvoju preventivnih strategij) in *vključevanje skupnosti* (vključevanje v skupnost in vključevanja članov iz skupnosti v odločanje in reševanje problemov). Med načeli delovanja pametnih skupnosti ima pomembno vlogo *odgovornost in transparentnost* (usmerjenost v vzpostavljanje zaupanja v skupnosti, zagotavljanje, da se ukrepi in odločitve sprejemajo na transparenten način, in da so vpleteni deležniki odgovorni za svoja dejanja), *na podatkih utemeljeno odločanje* (uporaba in združevanje raznovrstnih podatkov in napredne podatkovne analitike za odkrivanje vzorcev, sprejemanje odločitev, optimizacijo dela in izboljšanje storitev) ter *integracija sodobne tehnologije* (uporaba in združevanje naprednih tehnologij (npr. Internet stvari, umetna inteligenca, podatkovna analitika, avtonomna vozila, nosljive naprave, napredni detekcijski sistemi ipd.) za izboljšanje uspešnosti in učinkovitosti pri reševanju problematike v skupnosti).

Med najbolj pereče aktualne probleme, s katerimi se soočajo sleherne lokalne skupnosti, sodijo raznolike varnostne situacije, kot so krize, konflikti, naravne nesreče in kriminaliteta, ki zavirajo razvojne potenciale v skupnostih. Inovativne rešitve, ki se uporabljajo v namene zagotavljanja javne varnosti, tvorijo sistem *varnih skupnosti*. Integracija različnih naprednih informacijskih tehnologij krepi učinkovitost varnostnih procesov v lokalnem okolju. Uporaba naprednih tehnologij omogoča učinkoviteje preprečevati kriminaliteto in varnostne grožnje, večja pripravljenost in odzivnost različnih (varnostnih) organizacij na varnostne dogodke ter posledično prispeva k zagotavljanju varnih, zdravih in kakovostnih okolij bivanja za prebivalce (Bang idr., 2019; Lacinák & Ristvej, 2017). V okvirih pametnih in varnih skupnosti se varnostne organizacije, kot so na primer občinsko redarstvo, inšpekcijske službe, policija, vse bolj opirajo na informacijsko-komunikacijsko tehnologijo, inteligentne sisteme in napredne tehnološke rešitve, ki jim lahko pomagajo pri razreševanju varnostnih izzivov v lokalnem okolju (Tundis idr., 2020). Takšen pristop v literaturi pogosto poimenujejo *pametna policijska dejavnost*, ki predstavlja sodoben pristop policijskega dela, hkrati pa je to tudi novo področje v znanstvenem raziskovanju odzivanja na varnostne izzive.

Pametna policijska dejavnost temelji na oblikovanju inovativnih strategij (npr. pristopov k reševanju problemov, novih oblik sodelovanj, medagencijskih in raziskovalnih partnerstev) na osnovi izkoriščanja prednosti sodobne tehnologije in učinkovitejše uporabe podatkov. V najožjem smislu gre za *na podatkih osnovan pristop* policijske dejavnosti, ki vključuje integracijo raznolikih tehnologij, podprtih z raziskavami in uporabo potencialov velikih podatkov in podatkovne analitike. Tak pristop omogoča pretvorbo podatkov v uporabne informacije, z namenom spodbujanja inovativnosti, izboljšanja učinkovitosti delovanja institucij pluralne policijske dejavnosti v lokalnih okoljih, njene analitike in posledično ocenjevanja uspešnosti dela. Cilj je izboljšati učinkovitost na področju preprečevanja in preiskovanja kriminalitete ter povečati bazo znanja (Afzal in Panagiotopoulos, 2020; Coldren idr., 2013).

Razvojno gledano pionirje pametne policijske dejavnosti v praksi predstavljajo ZDA, kjer se je ta pristop začel intenzivneje razvijati leta 2009. Po prvih poskusih, ki so bili osredotočeni predvsem v iskanje rešitev za zmanjševanje nasilniške in premoženjske kriminalitete s pomočjo analize kriminalnih žarišč in razvijanje specializiranih preventivnih programov ter ustanavljanje delovnih skupin za učinkovito odzivanje

na varnostne probleme, so se kasnejši projekti usmerili v uvajanje nosljivih kamer, raziskovanje povezav med različnimi oblikami kriminalitete, videonadzor javnega prostora in obveščevalno ter napovedno policijsko dejavnost (Coldren idr., 2013). Ta razvojni trend se je prenesel tudi v druge države, razprave in iniciative na tem področju pa so v Evropi aktualne predvsem v zadnjem desetletju. Novejša prizadevanja na področju pametne policijske dejavnosti se ukvarjajo predvsem z možnostmi uporabe novih podatkov in razvojem *napovedne policijske dejavnosti*, napredne kriminalitetne analitike, napovednega profiliranja in analitike socialnih mrež (Afzal in Panagiotopoulos, 2020). Glavno vodilo pametnih in varnih skupnosti je proaktivno zagotavljanje javne varnosti, pri čemer se rešitve ne osredotočajo zgolj na stroškovne in časovne vidike učinkovitega delovanja, temveč tudi na krepitev zadovoljstva in občutka varnosti prebivalcev ter ustvarjanje koristi za vse deležnike v varnostnih procesih (Laufs idr., 2020). V pristopu pametnih in varnih skupnostih se tako združujejo koncepti učinkovitosti, uspešnosti in kakovosti posameznih storitev oziroma produktov.

Pametne skupnosti predstavljajo strateško razvojno usmeritev, ki združuje trajnostni razvoj, varnost in tehnološki napredek. Razvoj pametnih tehnologij in pristopov vpliva na izboljšanje življenjskih standardov, krepitev varnosti in spodbujanje inovacij. Zato nas je zanimalo, kako so te vsebine razvite v slovenskem lokalnem okolju. V študiji, ki jo predstavljamo v nadaljevanju, so sodelovali strokovnjaki, ki so v lokalnih skupnostih odgovorni za upravljanje področja zagotavljanja varnosti.

3 Opis metode, instrumentarija in vzorca

Za potrebe raziskave smo na Fakulteti za varnostne vede Univerze v Mariboru pripravili vprašalnik o razvitosti aktivnosti pametnih skupnosti in pametne policijske dejavnosti v slovenskih občinah. Zanimalo nas je, v kolikšni meri so odločevalci v lokalnih skupnostih pri načrtovanju programov dela in zagotavljanju varnosti osredotočeni na uresničevanje temeljnih načel delovanja pametnih skupnosti (devet načel; Cronbach $\alpha = .921$), kakšna je stopnja razvitosti posameznih področij pametnih skupnosti/mest v občini respondentov (deset področij), tretji vsebinski sklop je bil vezan na trditve, ki se vežejo organizacijo in aktivnosti v povezavi s pametno policijsko dejavnostjo (šest trditev; Cronbach $\alpha = .928$). V zaključku smo respondente prosili, da nam opišejo, kakšne projekte/rešitve s področja pametne policijske dejavnosti ali pametnega razvoja na področju zagotavljanja varnosti so v

njihovi občini preteklosti že izvedli, oziroma, kakšne projekte/rešitve s področja pametne policijske dejavnosti ali pametnega razvoja na področju zagotavljanja varnosti nameravajo v njihovi občini izvesti v prihodnje.

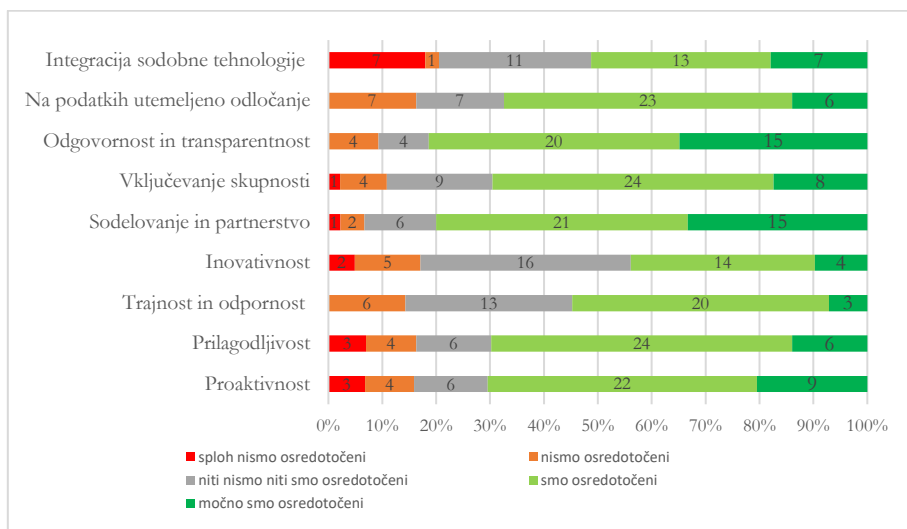
Vprašalnik smo konec avgusta 2023 postavili v e-platformi 1ka.arnes, povezavo do vprašalnika pa smo po elektronski pošti poslali na uradne naslove vseh 212 slovenskih občin. K sodelovanju smo povabili direktorje občinskih uprav in posameznike, odgovorne za varnost v občinah, kot so na primer vodje občinskih redarstev. Sodelovanje v raziskavi je bilo prostovoljno, udeležencem pa smo obljubili zagotovitev anonimnosti njihovih odgovorov. Do 9. septembra 2023 smo prejeli odgovore od 57 respondentov. Skupno je vprašalnik začelo izpolnjevati 105 posameznikov, vendar jih je 48 prenehalo pred dokončanjem. Respondenti so bili večinoma direktorji občinskih uprav (51%), vodje mestnih (občinskih) redarstev (19%) ali vodje medobčinskih uprav in inšpektoratov (30%). Skupina respondentov je obsegala mestne občine (30%), pretežno urbanizirane občine brez statusa mestne občine (28%) in pretežno ruralne občine (42%). Večina respondentov je prihajala iz podravske statistične regije (26%), sledijo respondenti iz pomurske in savinjske regije (13%), osrednjeslovenske regije (11%), jugovzhodne, primorsko-notranjske in goriške statistične regije (6%), obalno-kraške in koroške statistične regije (4%) ter posavske regije (2%). Zgolj iz zasavske statistične regije nismo dobili nobenega odgovora.

4 Rezultati

Razvoj pametnih skupnosti v povezavi z pametno policijsko dejavnostjo temelji na določenih načelih in usmeritvah. Zato smo respondente v raziskavi najprej seznanili s temi načeli, potem pa smo jih prosili, da ocenijo, koliko so pri načrtovanju programov dela in zagotavljanju varnosti v njihovih občinah osredotočeni na uresničevanje zgoraj opisanih temeljnih načel. Rezultati ocene respondentov so prikazani na Sliki 1 v nadaljevanju.

Rezultati kažejo, da odločevalci pri svojem delu pomembno sledijo temeljnim načelom delovanja pametnih skupnosti, saj so pri odločanju vsaj osredotočeni, če že ne močno osredotočeni skoraj na vsa temeljna načela (z izjemo inovativnosti) delovanja pametnih skupnosti. Predvsem so v slovenskih občinah, izhajajoč iz odgovorov respondentov, zavezani načelom odgovornosti in transparentnosti,

sodelovanju in krepitvi partnerstev ter vključevanju skupnosti. Pomembno so osredotočeni tudi na prilagodljivost ter proaktivno delovanje, v manjši meri pa na integracijo sodobne tehnologije, inovativnost ter zagotavljanje trajnosti in odpornosti. Ugotovimo lahko, da je nekaj načel močno uveljavljenih, nižjo stopnjo pa ugotavljamo na področjih, ki so povezana z investicijami (uporaba najsodobnejše tehnologije) in inovativnih pristopih. Žal so respondenti poročali tudi o manjši osredotočenosti na zagotavljanje trajnosti in odpornosti lokalnih skupnosti – anketiranje je potekalo v času neposredno po katastrofalnih poplavah v Sloveniji konec poletja 2023, in so bili, lahko bi sklepali, respondenti kritični do stanja na tem področju.

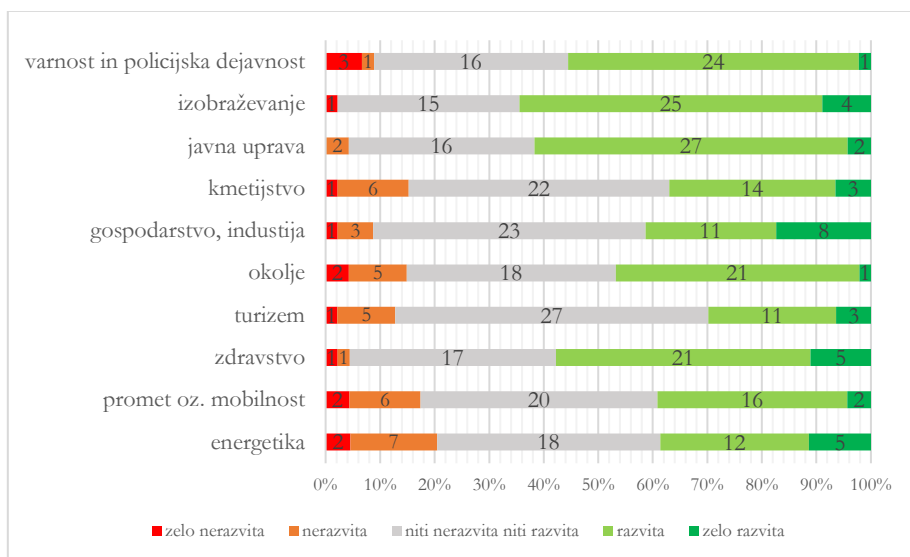


Slika 1: Osredotočenost na temeljna načela delovanja pametnih mest v slovenskih občinah

Vir: lasten

Na sliki 2 v nadaljevanju so prikazane ocene ravni razvoja posameznih področij pametnih skupnosti/mest v določeni občini. Različna področja, kot so energija, promet, zdravje, turizem, okolje, gospodarstvo, industrija, kmetijstvo, javna uprava, izobraževanje ter varnost in policijske dejavnosti, so ocenjena glede na njihov razvoj v skladu s principi pametnega razvoja in pametnih mest. Ocena je razdeljena na pet kategorij: zelo nerazvito, nerazvito, ne nerazvito ne razvito, razvito in zelo razvito. Na podlagi rezultatov lahko ugotovimo, da so področja z največ največ ocen »razvito« in »zelo razvito« izobraževanje, javna uprava in zdravstvo, kot dobro

razvito je ocenjeno tudi področje varnosti in policijske dejavnosti, kot manj razvita pa anketoranci navajajo energetiko, promet in mobilnost ter turizem. Pri večini področij pa smo ugotovili, da večina odgovorov spada med »ne nerazvito ne razvito«, kar nakazuje na potencial za izboljšave in nadaljnji razvoj v skladu s konceptom pametnih mest. Rezultati ponujajo vpogled v to, katera področja v slovenskih občinah so bolj ali manj razvita v kontekstu pametnih mest, kar je strateške upravljalce posameznih področij v slovenskih občinah lahko koristno za načrtovanje prihodnjih razvojnih strategij.



Slika 2: Ocena razvitosti posameznih področij delovanja pametnih skupnosti v Sloveniji

Vir: lasten

V Tabeli 1 v nadaljevanju so prikazani rezultati odgovorov respondentov na trditve, ki se vsebinsko vežejo na aktivnosti v povezavi z udejanjanjem pametnih skupnosti in pametne policijske dejavnosti. Anketiranci so kot relativno dobro razvite ocenili *varovanje podatkov in varstvo osebnih podatkov*, ki s povprečno oceno 3.23 (S.O. = 1.04) kaže, da je na tem področju dosežena relativno visoka raven zaupanja in zadovoljstva ter trditve »*Vpliv uvajanja pametne policijske dejavnosti na razvoj in konkurenčnost lokalne skupnosti*«. S povprečno oceno 3.57 (S.O. = 1.07) so ocene na tem področju med najvišjimi, kar kaže na optimizem glede pozitivnih učinkov pametne policijske dejavnosti na lokalno skupnost.

Nasprotno, področja, kjer nastajajo problemi ali so manj razvita, vključujejo *ustrezno infrastrukturo za pametno policijsko dejavnost* – s povprečno oceno 2.26 (S.O. = 0.99) so ocene na tem področju med najnižjimi, kar nakazuje na pomisleke in pomanjkljivosti glede infrastrukture. Pri oceni *nadzora in evalvacija aktivnosti v okviru pametne policijske dejavnosti* smo izmerili povprečje 2.78 (S.O. = .97), kar nakazuje, da obstaja potreba po izboljšavah na področju nadzora in evalvacije aktivnosti. Ti rezultati kažejo, da medtem ko so nekatera področja, kot sta varovanje podatkov in vpliv na lokalno skupnost, relativno dobro razvita, so druga področja, kot sta infrastruktura in nadzor, področja, kjer je potreben dodaten razvoj in izboljšave.

Na koncu smo anketirance prosili, da na kratko opišejo, kakšne projekte/rešitve s področja pametne policijske dejavnosti ali pametnega razvoja na področju zagotavljanja varnosti so v njihovi občini v preteklosti že izvedli. Anketiranci so poročali o 27 različnih aktivnostih, velika večina jih je bil vezana na urejanje cestnega prometa (na primer, več jih je poročalo o namestitvah prikazovalnikov hitrosti, tabel »Vi vozite«, opozorilnih tabel za prekoračitev hitrosti, postavitvi stacionarnega merilnika hitrosti, mobilni aplikaciji za meritve hitrosti in proaktivnem usmerjanju nadzora hitrosti s pomočjo elektronskega zajema podatkov). V povezavi z urejanjem prometa so respondenti poročali tudi o pametnih parkirnih sistemih, pametnem nadzoru parkirišč, digitaliziranem omejevanju vrste prometa v peš conah in o zbiranju podatkov o prometu z uporabo senzorjev. Zelo pogosto so poročali tudi o vzpostavitvi nadzornih kamer, o videonadzoru določenih javnih parkirišč, o zmanjševanju vandalizma na javnih objektih z videonadzorom ter opremljanju vozil javnega potniškega prometa s kamerami. Poročali so tudi o vzpostavitvi varovane soseke, o izvajanju skupnih patrolj, o integraciji varnostnih sistemov na določenih zgradbah s povezavo z varnostnim podjetjem. Med projekte so uvrstili tudi sisteme o spremljanju proženja zemeljskih plazov ter vzpostavitvi socialnih omrežij za komuniciranje s prebivalci.

Glede projektov/rešitve s področja pametne policijske dejavnosti ali pametnega razvoja na področju zagotavljanja varnosti v prihodnje so poročali o namenu vzpostavitve nadzornih kamer na javnih prostorih, postavitvi samodejnih merilcev hitrosti pred osnovnimi šolami ter stacionarnih merilnikov hitrosti v povezavi z video-nadzornim sistemom. Zanimiv pa je bil tudi naslednji komentar: *»Idej je veliko vendar predvsem na področju varstva osebnih podatkov trčimo na ovire formalne narave pri uvajanju novih tehnologij tehničnega nadzora in spremljanja prostora v smislu varnostnega nadzorstva«.*

Tabela 1: Ocena aktivnosti v povezavi s pametno policijsko dejavnostjo v slovenskih občinah

	Sploh se ne strinjam	Se ne strinjam	Niti se strinjam niti se ne strinjam	Se strinjam	Močno se strinjam	M	S.O.
Pri načrtovanju projektov/aktivnosti pametne policijske dejavnosti imamo ustrezno politično podporo.	3 (8%)	4 (11%)	13 (34%)	11 (29%)	7 (18%)	3.31	1.16
Pri načrtovanju projektov/aktivnosti pametne policijske dejavnosti imamo ustrezno infrastrukturo.	5 (12%)	12 (29%)	14 (34%)	9 (22%)	1 (2%)	2.26	.99
Pri načrtovanju projektov/aktivnosti pametne policijske dejavnosti imamo ustrezne kadrovske zmogljivosti (znanja in kompetence).	6 (15%)	8 (20%)	10 (24%)	15 (37%)	2 (5%)	2.89	1.18
Zagotovljeno imamo zadostno in ustrezno varovanje podatkov in varstva osebnih podatkov za implementacijo projektov/aktivnosti pametne policijske dejavnosti.	4 (10%)	3 (7%)	14 (33%)	18 (43%)	3 (7%)	3.23	1.04
Aktivnosti v okviru pametne policijske dejavnosti so ustrezno nadzorovane in evalvirane.	4 (11%)	7 (20%)	14 (40%)	10 (29%)	0 (0%)	2.78	.97
Uvajanje aktivnosti v okviru pametne policijske dejavnosti bi okrepilo razvoj in konkurenčnost lokalne skupnosti.	3 (8%)	1 (3%)	11 (28%)	19 (48%)	6 (15%)	3.57	1.07

Glede projektov/rešitve s področja pametne policijske dejavnosti ali pametnega razvoja na področju zagotavljanja varnosti v prihodnje so poročali o namenu vzpostavitve nadzornih kamer na javnih prostorih, postavitvi samodejnih merilcev hitrosti pred osnovnimi šolami ter stacionarnih merilnikov hitrosti v povezavi z video-nadzornim sistemom. Zanimiv pa je bil tudi naslednji komentar: *»Idej je veliko vendar predvsem na področju varstva osebnih podatkov trčimo na ovire formalne narave pri uvajanju novih tehnologij tehničnega nadzora in spremljanja prostora v smislu varnostnega nadzorstva«.*

5 Zaključek

Ugotovitve raziskave ponujajo vpogled v trenutno stanje in potencial za nadaljnji razvoj pametnih skupnosti in pametne policijske dejavnosti v Sloveniji. Če povzamemo glavne ugotovitve raziskave, potem lahko rečemo, da odločevalci v slovenskih občinah uspešno sledijo temeljnemu načelom pametnih skupnosti. Posebno pozornost namenjajo načelom odgovornosti, transparentnosti, sodelovanja, krepitvi partnerstev in vključevanju skupnosti. Manjša osredotočenost je zaznana na področjih, ki zahtevajo večje investicije, kot je uporaba najsodobnejše tehnologije. Z vidika razvoja posameznih področij lahko ugotovimo, da so po mnenju respondentov najbolj razvita izobraževanje, javna uprava in zdravstvo, kot dobro razvito je ocenjeno tudi področje varnosti in policijske dejavnosti. Z vidika pametne policijske dejavnosti so bile na področju varovanja podatkov in vpliva pametne policijske dejavnosti na lokalno skupnost doseženo relativno visoke ravni zaupanja in zadovoljstva. Po drugi strani pa obstajajo pomisleki glede infrastrukture in potreba po izboljšavah v nadzoru in evalvaciji aktivnosti.

Ugotovimo lahko, da ima dosednji razvoj pametnih skupnosti pozitiven vpliv na življenje prebivalcev v lokalnih okoljih na različnih področjih. Pametne skupnosti z uporabo tehnologije izboljšujejo storitve, kot so upravljanje prometa, energetska učinkovitost in zbiranje odpadkov, kar prispeva k *boljši kakovosti življenja prebivalcev*. Napredni nadzorni sistemi in tehnologije, kot so pametne kamere in senzorji, lahko pomagajo pri preprečevanju kriminala in izboljšanju odzivnosti v nujnih primerih, kar zagotavlja *varnejše okolje za prebivalce*. Pametne skupnosti pogosto privabljajo podjetja in talent, kar, skupaj z inovacijami v tehnologiji, prispeva k *gospodarskemu razvoju*. Pametne skupnosti se osredotočajo tudi na trajnostne prakse, kot so pametno upravljanje z viri in zmanjšanje ogljičnega odtisa, kar je ključnega pomena za *obranjanje okolja in s tem krepijo okoljsko trajnost*. Tehnologija omogoča boljše upravljanje

mest in vključevanje prebivalcev v odločevalske procese, kar vodi k *večji transparentnosti, vključenosti* in preko tega h *krepitvi (občutka) skupnosti*. Pametne skupnosti *spodbujajo inovacije in izobraževalne priložnosti*, saj nudijo platformo za razvoj in testiranje novih tehnologij in tako delujejo vključujoče in nediskriminatorno.

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KAKOVOST DELOVNEGA OKOLJA V POVEZAVI S TVEGANJEM ZA POJAV IZGORELOSTI ZAPOSLENIH V ZDRAVSTVENI NEGI

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Zdravstvena nega je poklic, kjer so zaposleni izpostavljeni večjim obremenitvam in stresu na delovnem mestu. Povezan je tudi z višjo ogroženostjo za pojav izgorelosti. Namen raziskave je bil ugotoviti, doživljanje delovnega okolja s strani zaposlenih v zdravstveni negi ter ali se kakovost delovnega okolja povezuje s pojavom izgorelosti. Uporabljena je bila kvantitativna metodologija raziskovanja. Podatki so bili pridobljeni z vprašalnikom za oceno kakovosti delovnega okolja in oceno prisotnosti izgorelosti. Raziskava je bila izvedena med zaposlenimi v zdravstveni negi. Podatki so bili analizirani s pomočjo programa IBM SPSS Statistics 28.0. Ugotovljeno je bilo, da pri 47 % zaposlenih v zdravstveni negi prisotna izgorelost. Prav tako je 48 % ocenilo svoje delovno okolje kot srednje kakovostno in 16 % kot slabo kakovostno. Ugotovljena je bila statistično pomembna povezava med kakovostjo delovnega okolja in pojavom izgorelosti med zaposlenimi v zdravstveni negi. Slabša kakovost delovnega okolja vodi so nezadovoljstvo z delom in možnosti pojava izgorelosti, kar pa lahko privede do slabših izidov pri pacientih.

Ključne besede:

zdravstvena
nega,
izgorelost,
kakovost,
delovno
okolje,
tveganja

THE QUALITY OF THE WORKING ENVIRONMENT IN ASSOCIATION WITH THE RISK OF BURNOUT OF NURSING EMPLOYEES

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Nursing is one of the professions exposed to higher workloads and stress at work, and has a high degree of risk for burnout syndrome. The purpose of the research was to determine how nursing employees experience the work environment and whether the quality of the work environment is associated with the risk of burnout syndrome. The research was based on quantitative methodology. A questionnaire was used as a research instrument to assess the quality of the work environment and to assess the degree of burnout. The research was conducted among nursing employees. Data were analyzed using IBM SPSS Statistics 28.0. It was found that 47% of employees in nursing are at risk of burnout at work. Also, 47% rated their working environment as medium quality and 15% as poor quality. A statistically significant relationship was found between the quality of the work environment and the risk of burnout syndrome among employed in nursing. Low-quality working life associated with employees' dissatisfaction an increased risk of burnout, affecting on patients' outcomes care.

Keywords:

nursing,
burnout,
quality,
working
environment,
risk

1 Uvod

Kakovost delovnega okolja Jurovič (2009) opredeli kot sredstvo za povečevanje produktivnosti, ki prispeva k večji motiviranosti in zadovoljstvu zaposlenih, izboljšanju komunikacije ter zmanjšanju stresnih situacij in zmanjšanju odpora do sprememb. Koncept kakovosti življenja, ki je povezan z delom, je pridobil mednarodni pomen v različnih poklicih in je postal ključni dejavnik pri zadrževanju zaposlenih v organizacijah (Silarova, Brookes, Palmer, Towers, Hussein, 2022). Na delovno zadovoljstvo vpliva sama kakovost delovnega okolja. Prav tako pa kakovost delovnega okolja vpliva tudi na druge aspekte posameznikovega življenja, vključno z njegovo družino ter družbenimi odnosi (Javanmardnejad, Bandari, Heravi-Karimooi, Rejerh, Sharif Nia, Montazeri, 2021).

Kot vsi poklici v zdravstvu je tudi zdravstvena nega med tistimi poklici, kjer so zaposleni pod večjim stresom in obremenitvijo na delovnem mestu, kar povečuje njihovo tveganje za pojav izgorelosti, ki je opredeljen kot stanje tako fizične, kakor tudi čustvene izčrpanosti (Khamisa, Oldenburg, Peltzer, Ilic, 2015). Kakovost delovnega okolja in zadovoljstvo zaposlenih v zdravstvu prispevata k večji učinkovitosti zaposlenih, manjši odsotnosti in manjšemu številu odhodov z delovnega mesta. Prav tako kakovost delovnega okolja in zadovoljstvo zaposlenih vplivata na varnost in zadovoljstvo pacientov (Javanmardnejad, et al., 2021). Zaposleni v zdravstveni negi se v svojem vsakodnevem delu pogosto srečujejo s hudo bolnimi in umirajočimi pacienti ter drugimi stresnimi dejavniki. Njihovo delo postaja vedno bolj zahtevno, kar skupaj s pogosto izpostavljenostjo negativnemu stresu lahko vodi v izgorelost (Kavšak, Prosen, 2021). Raziskava v času epidemije COVID-19 v Sloveniji pokazala, da se je delež zaposlenih v zdravstveni negi, ki je pod stresom gibal med 37 % in 65 % (Dobnik, Lorber, 2023). Tudi druge raziskave v Sloveniji (Dobnik, Maletič, Skela-Savič 2018; Lorber, Treven, Mumel, 2020, Šajn Lekše, Drnovšek, Žibert, Milavec Kapun, 2021) so pokazale, da približno tretjina zaposlenih v zdravstveni negi poroča o stresu na svojem delovnem mestu. Ugotovili so, da se zaposleni v zdravstveni negi najpogosteje srečujejo s stresorji, kot so prevelika količina dela, izključenost iz procesa odločanja, nizko plačilo in pomanjkanje podpore s strani nadrejenih. Ob tem pa izpostavili, da je izgorelost prepoznana kot resen zdravstveni problem, saj lahko povzroči depresijo, zmanjšanje kognitivnih sposobnosti, dolgotrajne odsotnosti z dela, zmanjšano profesionalnost, zlorabo substanc in večjo verjetnost strokovnih napak pri zaposlenih. Ohue,

Moriyama, Nakaya (2011) ugotavljajo, da je postala izgorelost med zaposlenimi v zdravstveni negi zaskrbljujoča, saj raziskave kažejo na močno povezavo med izgorelostjo, nezadovoljstvom na delovnem mestu in odhodom zaposlenih iz zdravstvene nege. Prav tako izpostavljajo, da izgorelost zaposlenih v zdravstveni negi vodi do slabše kakovosti oskrbe, nezadovoljstva pacientov in slabših rezultatov pri delu s pacienti. Tudi Khamisa, Oldenburg, Peltzer, Ilic (2015) poudarjajo, da je izgorelost med zaposlenimi v zdravstveni negi pogostejša kot v drugih zdravstvenih poklicih, saj je delo v zdravstveni negi čustveno in fizično zahtevno ter predstavlja stalni izziv in lahko tudi zmanjša njihovo učinkovitost. Howell (2021) pa izgorelost predstavi celo kot epidemijo, ki ne prizadene le posameznikov, ampak na zdravstveni sistem, saj povzroča finančne posledice v zdravstvenih institucijah in vodi do tega, da zaposleni zapuščajo svoja delovna mesta.

Namen raziskave je bil ugotoviti, kako zaposleni v zdravstveni negi doživljajo kakovost delovnega okolja ter ali se kakovost delovnega okolja povezuje s pojavom izgorelosti zaposlenih v zdravstveni negi.

2 Metodologija

Izvedena je bila presečna raziskava, v katero so bili vključeni zaposlenimi v zdravstveni negi v bolnišnicah na sekundarni ravni.

2.1 Opis vzorca

V raziskavo je bilo vključenih 372 zaposlenih v zdravstveni negi, od tega 350 (94 %) žensk in 22 (6 %) moških. Najmlajši sodelujoči je imel 21 let, najstarejši pa 61 let. Povprečna starost sodelujočih je bila $36,72 \pm 10,12$ leta. Največ sodelujočih je zaposlenih med 10 in 15 let v zdravstveni negi. Minimalni čas zaposlitve je bil 1 leto, najdaljši pa 40 let. Povprečna delovna doba sodelujočih je bila $13 \pm 9,66$ let. V raziskavi je sodelovalo 171 (46 %) zaposlenih s srednješolsko izobrazbo, 182 (49 %) z visoko strokovno izobrazbo in 19 (5 %) z magistrsko stopnjo izobrazbe.

2.2 Zbiranje podatkov

Kot raziskovalni instrument je bil uporabljen vprašalnik sestavljen iz treh delov. V prvem delu vprašalnika smo vključili demografske podatke, drugi del se je nanašal na kakovost delovnega okolja, kar smo ocenjevali s pomočjo lestvice kakovosti

življenja na delovnem mestu (Easton, Van Laar, 2012), ki je sestavljen iz 23 trditvev, do katerih so se anketirani opredeljevali na 3-stopenjski lestvici. Cronbachova alfa koeficient lestvice kakovosti življenja je znašal 0,81. V tretjem delu vprašalnika smo ocenjevali pojav izgorelosti pri zaposlenih za kar smo uporabili (Schaufeli, De Witte, Desart, 2020), ki je sestavljen iz 12 trditvev, do katerih so se anketirani opredeljevali na 5-stopenjski Likertovi lestvici. Cronbachova alfa koeficient vprašalnika za stopnjo izgorelosti je znašal 0,87.

2.3 Statistična analiza

Narejena je bila deskriptivna analiza za oceno izgorelosti in kakovosti delovnega okolja med zaposlenimi v zdravstveni negi zaposlenih v bolnišnici. Podatke smo predstavili s pomočjo deskriptivne statistike. Uporabljen je bil Hi-kvadrat test za ugotavljanje povezanosti kakovosti delovnega okolja in prisotne stopnje izgorelosti. Za raven statistične pomembnosti smo uporabili $p < 0,05$. Statistična analiza je bila izvedena s programom SPSS 28.0 (IBM Corp, ZDA).

3 Rezultati

V raziskavi smo ugotovili, da je kar 145 (39 %) sodelujočih pogosto ali vedno mentalno izčrpanih, prav tako je 149 (40 %) tudi fizično izčrpanih. Kar 182 (49 %) nima težav biti navdušen nad svojim delom, medtem, ko jih 283 (76 %) ne čuti odpora do svojega dela. Rezultati pokažejo, da ima 89 (24 %) občasno težave s koncentracijo in 97 (26 %) se pri svojem delu včasih ali pogosto težko zbere. 327 (88 %) jih nikoli ali le redko naredi napako pri delu zaradi razmišljanja o drugih stvareh.

Iz tabele 1 je razvidno, da je najvišjo stopnjo strinjanja glede prisotnosti simptomov izgorelosti zaznati pri trditvi, da se sodelujoči počutijo mentalno izčrpani, sledita pa trditvi, da se udeleženci počutijo fizično izčrpani ter, da si težko povrnejo energijo. Glede na dobljene rezultate smo ugotovili, da pri 193 (52 %) sodelujočih tveganje za pojav izgorelosti ni prisotno, medtem ko pri skoraj polovici (48 %; $n = 178$) sodelujočih obstaja tveganje za pojav izgorelosti.

Tabela 1: Rezultati trditvev za oceno stopnje izgorelosti

Trditve	$\bar{x} \pm s$
Počutim se mentalno izčrpano.	2,99±0,98
Težko si povrnem energijo.	2,53±0,89
Počutim se fizično izčrpano.	2,65±0,92
Težko najdem navdušenje za svoje delo.	2,12±0,99
Čutim močan odpor do svojega dela.	1,62±0,72
Dvomim o tem, da moje delo drugim kaj pomeni.	2,02±0,83
Pri delu čutim, da ne morem nadzorovati svojih čustev.	1,73±0,63
Presenečen/a sem, kako se čustveno odzivam pri delu.	2,02±0,78
Pri delu se lahko nehote pretirano odzovem.	1,86±0,71
Pri delu težko ostanem zbran/a.	1,71±0,68
Imam težave s koncentracijo.	1,66±0,58
Pri delu delam napake, ker razmišljam o drugih stvareh	1,42±0,64

V nadaljevanju nas je zanimala ocena kakovosti delovnega okolja. Ugotovili smo, da 60 (16%) sodelujočih ocenjuje kakovost delovnega okolja kot nizko, 179 (48 %) ocenjuje kakovost delovnega okolja kot srednjo, medtem, ko 134 (36 %) sodelujočih ocenjuje kakovost delovnega okolja kot visoko. Rezultati so pokazali, da se precejšen delež (med 31 % in 53 %) sodelujočih do 21 od 23 trditvev, s katerimi so ocenjevali kakovost delovnega okolja, niso znali opredeliti (so ostali nevtralni). V nadaljevanju smo ugotovili, da obstaja pojavnost izgorelosti pri sodelujočih z višjo kakovostjo delovnega okolja v manjšem deležu (26 %; $n = 97$), kot pri tistih udeležencih, ki ocenjujejo kakovost delovnega okolja kot nizko (50 %; $n = 186$) ali srednjo (51 %; $n = 190$). S pomočjo hi kvadrat testa smo ugotovili, da se kakovost delovnega okolja zaposlenih v zdravstveni negi povezuje s pojavom tveganja izgorelosti ($\chi^2(2) = 24,040$; $p < 0,001$).

4 Razprava

V raziskavi smo ugotovili, da je polovica sodelujočih ocenila, da je njihovo delovno okolje srednje kakovostno, kar tretjina pa kot visoko kakovostno delovno okolje. Podobno so ugotovili tudi Moradi, Maghaminejad, Azizi-Fini (2014), kjer je prav tako dobra polovica zaposlenih v zdravstveni negi poročala o srednji kakovosti delovnega okolja, vendar pa je v njihovi raziskavi kar tretjina zaposlenih v zdravstveni negi poročala tudi o nizki kakovosti delovnega okolja. Precej drugačne

ugotovitve pa izpostavljajo Raeissi, Rajabi, Ahmadizadeh, Rajabkhah, Kakemam (2019), ki ugotovijo, da je kar 2/3 zaposlenih v zdravstveni negi navedlo, da z delovnim okoljem niso zadovoljni. V raziskavi so ugotovili, da je na nezadovoljstvo vplivalo slabo reševanje kadrovskih težav, nepodpora vodij, visoka izpostavljenost stresu, ne vključenost pri odločanju in neustrezno plačilo.

Naše ugotovitve kažejo, da skoraj polovica sodelujočih na delovnem mestu pogosto čuti visoko raven stresa. Podobno so ugotovili tudi Raeissi, Rajabi, Ahmadizadeh, Rajabkhah, Kakemam (2019), saj je tudi v njihovi raziskavi polovica zaposlenih v zdravstveni negi ocenila, da so pri delu izpostavljeni stresu, kar ima negativen vpliv tako na duševno, kakor tudi na telesno zdravje. Večina drugih raziskav v Sloveniji med leti 2018 in 2023 je pokazala, da v povprečju približno dobra tretjina zaposlenih v zdravstveni negi poroča o stresu na delovnem mestu (Dobnik, Lorber, 2023; Dobnik, Maletič, Skela-Savič, 2018; Lorber, Treven, Mumel, 2020, Šajn Lekše, Drnovšek, Žibert, Milavec Kapun, 2021), razen v prvih valovih epidemije COVID-19 (Dobnik, Lorber, 2023). Ugotovitve kažejo, da slabo vodenje in slabi medosebni odnosi na delovnem mestu prispevajo k slabši kakovost v zdravstveni negi, kar predstavlja pomemben stresni dejavnik povezan tudi z izgorelostjo na delovnem mestu.

Incidenca izgorelosti zaposlenih v zdravstveni negi se je v zadnjih letih povečala, vendar se razlikuje med državami, prav tako pa prihaja do razlik med področji dela zaposlenih v zdravstveni negi. V raziskavi je bilo ugotovljeno, da pri skoraj polovici sodelujočih obstaja tveganje za izgorelost. V raziskavi (Dobnik, Lorber, 2023) je bilo ugotovljeno, da se je delež zaposlenih v zdravstveni negi, kjer so se pojavljali simptomi izgorelosti v času med drugim in četrtem valom epidemije COVID-19 zmanjšal za 30 %, vendar je ob koncu četrtega vala bila prisotnost simptomov izgorelosti še vedno prisotna pri 36 % zaposlenih v zdravstveni negi, kar je primerljivo z drugimi raziskavami. Prav tako so Khatatbeh, et al. (2022) ugotovili, da so bila pri polovici zaposlenih v zdravstveni negi prisotni simptomi izgorelosti in slaba kakovost življenja. Tudi Meneguín, et al. (2023) ugotavljajo, da je pri zaposlenih v zdravstveni negi prisotna dokaj visoka stopnja izčrpanosti, ki privede do sindroma izgorelosti. Rezultate so pripisali vse kompleksnejšim pacientom, triizmenskim urnikom ter nezadovoljstvu z delovnim okoljem. Moradi, Maghaminejad, Azizi-Fini. (2014) so ugotovili, da je eden glavnih virov stresa med zaposlenimi v zdravstveni negi neizkušenosť oziroma manj delovnih izkušenj. Prav tako so ugotovili, da so

zaposlenih v zdravstveni negi z višjo stopnjo izobrazbe poročali o višji kakovosti delovnega okolja in nižji pojavnosti izgorelosti na delovnem mestu. Druga raziskava v Sloveniji (Lorber, Dobnik, 2023) v času epidemije COVID-19 je pokazala, da je večina zaposlenih v zdravstveni negi ocenila kakovost svojega delovnega okolja prav tako na srednji ravni in da se kakovost delovnega okolja pozitivno povezuje s počutjem in zadovoljstvom na delovnem mestu. Tudi ugotovitve sistematičnega pregleda avtorjev Ghahramani et al, (2021) kažejo, da je stopnja izgorelosti med zaposlenimi v zdravstveni negi običajno na zmerni do visoki ravni, še posebej v tistih zdravstvenih institucijah, kjer je delovno okolje manj kakovostno. Glede na navedeno se strinjamo z Moradi Maghaminejad, Azizi-Fini (2014), ki izpostavijo, da se lahko poveča učinkovitost zaposlenih ter zniža izgorelost med zaposlenimi v zdravstveni negi prav z ocenjevanjem in izboljšanjem kakovosti delovnega okolja. Prav tako se strinjamo z Laubič (2016), ki pravi, da je zelo pomembno, da stresne situacije pri delu s pacienti ne vplivajo na kakovost storitev. Zato je pomembno zavedanje managementa, da je ključnega pomena pravočasno prepoznavanje simptomov izgorelosti in seznanjenost zaposlenih v zdravstveni negi z ukrepi za zmanjšanje izgorelosti ter načini za povečanje zadovoljstva na delovnem mestu.

5 Zaključek

Zaposleni v zdravstveni negi so se in se še vedno srečujejo z izgorelostjo in številnimi psihološkimi težavami. Spremljanje izgorelosti in kakovosti delovnega okolja je ključnega pomena za ohranjanje duševnega zdravja zaposlenih v zdravstveni negi in bi moralo postati del vsakodnevne prakse.

Za zagotavljanje učinkovite psihološke podpore zaposlenim v zdravstveni negi je potrebno ustvariti zdravo delovno okolje, ki bo spodbujalo dobo počutje in ohranjalo zdravje zaposlenih. Ob tem se je potrebno zavedati tudi trajnostnega razvoja zaposlenih v zdravstveni negi, ne le na lokalni, temveč tudi na državni ravni, za boljše pogoje dela in kakovostno delovno okolje, ki bo prispevalo k psihološkemu blagostanju in duševnemu zdravju zaposlenih v zdravstveni negi.

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IZZIV ZDRAVSTVENEGA IN SOCIALNEGA VARSTVA: PRIMER EPIDEMIOLOŠKE OCENE PREVALENCE DEMENCE V SLOVENIJI - PRIMERJAVA OBDOBJA PRED IN PO COVID 19

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SZO je demenco razglasila za svetovno javnozdravstveno prioriteto 21-tega stoletja, med pandemijo je demenca postala javnozdravstvena kriza. Namen raziskave je bil ugotoviti ali pojavnost demence po obdobju covid 19 upada. Metode: Izračunali smo stopnje prevalence demence za Slovenijo, standardizirane na starost in spol, po posameznih letih 2018-2021. Primerjali smo stopnje prevalence demence pred in po obdobju covid 19. Izračunali smo projekcije demence za 2030 in 2050. Rezultati: Delež prebivalcev Slovenije z demenco konstantno narašča, 2019 je znašal 1,71%, 2020 1,74%, 2021 1,75%, ocena za 2030 je 2,15% in za 2050 3,25%. Razprava: Med pandemijo je bila najvišja umrljivost med starejšimi prebivalci, še posebej med ljudmi z demenco. Najvišjo presežno umrljivost Slovenija beleži v novembru 2020, ko je umrlo za 92 % več prebivalcev kot povprečno v istem obdobju 2015 - 2019. Kljub temu izsledki naše raziskave potrjujejo, da tudi po pandemiji covid 19 problematika demence narašča. Vlada RS je julija 2023 sprejela Strategijo obvladovanja demence v Sloveniji do leta 2030, ki naslavlja številne izzive v zdravstvenem in socialnem varstvu.

Ključne besede:

demenca,
pandemija
covid,
javno
zdravstvena
kriza,
prevalenca
demence,
izziv

THE CHALLENGE OF HEALTH AND SOCIAL CARE: A CASE OF THE EPIDEMIOLOGICAL ESTIMATE OF THE PREVALENCE OF DEMENTIA IN SLOVENIA - COMPARISON OF THE PERIOD BEFORE AND AFTER COVID19

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WHO declared dementia as a global public health priority of the 21st century, during the pandemic covid 19 dementia became a public health crisis. The aim of the research was to assess whether the prevalence of dementia is declining after the COVID 19 period. Methods: We calculated the prevalence rates for dementia for Slovenia, standardized by age and sex, by individual years 2018-2021. We compared prevalence rates before and after the COVID 19 period. We calculated projections for 2030 and 2050. Results: The share of the population of Slovenia with dementia is constantly increasing, in 2019 it was 1.71%, in 2020 1.74%, in 2021 1.75%, for 2030 estimate is 2.15% and in 2050 3.25%. Discussion: During the pandemic covid 19 the highest mortality rate was among older people, especially among people with dementia. The highest excess mortality rate in Slovenia was recorded in November 2020, when 92% more people died than the average in the same period of 2015-2019. Nevertheless, the results of our research confirm that even after the COVID 19 pandemic, the problem of dementia is increasing. In July 2023, the Government of the Republic of Slovenia adopted the Strategy for the Management of Dementia in Slovenia until 2030, which addresses numerous challenges in health and social care.

Keywords:

dementia,
covid 19
pandemic,
public
health
crisis,
prevalence of
dementia,
challenge

1 Uvod

Demenca je kronična napredujoča nevrodegenerativna bolezen, ki je najpogostejša pri starejši populaciji. Starost in demenca sta tudi največja dejavnika tveganja za obolevnost in umrljivost za boleznijo covid-19 (Xia et al., 2021). Leta 2015 je v svetu živelo 55 milijonov ljudi z demenco, na vsake tri sekunde se je pojavil nov primer (WHO, 2021). Leta 2019 je bilo več kot 57 milijonov ljudi z demenco (GBD 2019, 2022). SZO ocenjuje, da bo do leta 2030 v svetu 82 milijonov ljudi z demenco, do leta 2050 več kot 150 milijonov (WHO, 2023; GBD 2019, 2022). V EU (EU27) je leta 2018 živelo 7,9 milijonov ljudi z demenco, v Sloveniji 34.137 (Alzheimer Europe). Število ljudi z demenco v EU se bo do leta 2050 podvojilo in narastlo na 14,3 milijona oziroma na 18,8 milijona za širšo evropsko regijo (Alzheimer Europe). Slovenija se uvršča v sam vrh držav po številu ljudi z demenco na 1000 prebivalcev, tako se je leta 2011 z več kot 15-timi ljudmi z demenco na 1000 prebivalcev uvrščala v sam vrh držav, takoj za Japonsko, Italijo in Nemčijo, do leta 2040 pa lahko upravičeno pričakujemo, da bo z 32-timi ljudmi z demenco na 1000 prebivalcev na drugem mestu, takoj za Japonsko (OECD, 2023).

SZO je demenco razglasila za svetovno javnozdravstveno prioriteto 21-tega stoletja (WHO & Alzheimer's Disease International, 2012). 11. marca 2020 je SZO razglasila pandemijo covid-19 (Karadag, 2020). Med pandemijo je demenca postala javnozdravstvena kriza (World economic forum, 2021). Epidemija covida-19 je Slovenijo močno prizadela in negativno posegla v število prebivalcev Slovenije ter s tem, po podatkih SURS-a, povzročila negativni naravni prirast. Največji vpliv se je kazal v zadnjem četrletju 2020, ko je Slovenija predvsem zaradi visoke umrljivosti v novembru in decembru 2020 utrpela v letu 2020 najvišji negativni naravni prirast po letu 1945 (SURS). V letu 2020 je umrlo za 19 % več prebivalcev kot povprečno v letih 2015–2019, najvišja presežno umrljivost je Slovenija beležila novembra 2020, ko umrlo za 92 % več prebivalcev kot povprečno v istem obdobju v letih od 2015 do 2019. V aprilu 2021 je bila presežna umrljivost še vedno pozitivna in sicer 7,2 % (SURS).

Vlada RS je julija letos sprejela Strategijo obvladovanja demence v Sloveniji do leta 2030 in decembra letos Akcijski načrt (Ministrstvo za zdravje, 2023). Glede na visoko pozitivno presežno umrljivost v povezavi s covid 19, ki je prizadela predvsem starejše prebivalce Slovenije pri katerih je demenca najpogostejša, so se porajala

vprašanja ali pojavnost demence še vedno predstavlja javnozdravstveno prioriteto. V prispevku smo ocenili prevalenco demence v Sloveniji v obdobju 2018-2021, primerjali prevalenco pred in po obdobju covid 19, ocenili dinamiko in trende prevalence ter naredili projekcije prevalence demence za Slovenijo za leto 2030 in 2050.

2 Metode

V prvem koraku smo izračunali število moških in žensk v vsaki od izbranih starostnih skupin, 30–59, 60–64, 65–69, 70–74, 75–79, 80–84, 85–89 ter v starosti 90 in več let za leto 2018, leto 2019, leto 2020 in leto 2021 v Sloveniji, pri čemer smo uporabili podatke prebivalstva Slovenije Statističnega urada Republike Slovenije (SURS) za izbrana leta.

V naslednjem koraku smo uporabili metodologijo European Collaboration on Dementia (EuroCoDe) (Alzheimer Europe, 2019), EuroCoDe-ve starostno/po spolu specifične stopnje prevalence za demenco smo aplicirali za izračune za vsako skupino po spolu in starosti od starostne skupine 60-64 let naprej. Za kategorijo v starosti od 30-59 let metodologija EuroCoDe ne premore starostno/po spolu specifičnih stopenj prevalence, zato smo v tem primeru uporabili relevantne EURODEM specifične stopnje prevalence po spolu za starostno skupino 30–59 let (Hofman et al., 1991). Zaradi povečane umrljivosti v povezavi s covid 19, predvsem med starejšo populacijo, smo zaradi primerjave podatkov izbrali dve leti pred pojavom covid 19 (2018 in 2019) in dve leti po pojavu covid 19 (2020 in 2021). Ocenili smo tudi razlike v prevalence demence po posameznih obdobjih (2018-2021).

V zadnjem koraku smo na enak način izračunali še projekcije prevalence demence za leti 2030 in 2050 na podlagi ocen števila prebivalcev Slovenije za leto 2030 in za leto 2050 (SURS).

3. Rezultati

3.1 Prevalenca demence

V tabelah 1.-4. so prikazani izračuni števila primerov demence v Sloveniji po spolu, starostnih skupinah in v deležu glede na celotno prebivalstvo po izbranih letih 2018 (Tabela 1.), 2019 (Tabela 2.), 2020 (Tabela 3.) in 2021 (Tabela 4.).

V obdobju od leta 2018 do 2021 smo imeli v Sloveniji skupno 143975 primerov demence, v povprečju na leto 35994 primerov demence. V enakem obdobju smo imeli v Sloveniji 100074 primerov demence pri ženskah in 43902 primerov demence pri moških, v povprečju letno 25018 primerov demence pri ženskah in 10976 primerov demence pri moških (Tabela 1.- Tabela 4.).

Tabela 1: Ocenjeno število ljudi z demenco po starostni skupini in po spolu ter skupno, Slovenija, 2018

Razpon starosti v letih	Skupaj	Moški			Ženske			Skupaj
	Število vseh prebivalcev	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Skupno število ocenjenih primerov demence
30-59*	895980	463867	0,2	928	432113	0,1	432	1360
60-64	145944	72635	0,2	145	73309	0,9	660	805
65-69	128962	62728	1,1	690	66234	1,5	993	1683
70-74	89608	40840	3,1	1266	48768	3,4	1658	2924
75-79	79372	33536	7,0	2348	45836	8,9	4079	6427
80-84	58051	21611	10,7	2312	36440	13,1	4774	7086
85-89	35221	10473	16,3	1707	24748	24,9	6162	7869
90 +	16119	3524	29,7	1047	12595	44,8	5643	6690
Skupaj	1449257	709214		10443	740043		24401	34844
Vsi prebivalci skupaj	2070050	% celotne populacije 1,68						

Vir: lastni izračuni Vir: stopnje prevalence demence starostno specifične in po spolu, povzete po: Alzheimer Europe, 2019; Hofman et al., 1991; SURS za število prebivalcev

Tabela 2: Ocenjeno število ljudi z demenco po starostni skupini in po spolu ter skupno, Slovenija, 2019

Razpon starosti v letih	Skupaj	Moški			Ženske			Skupaj
	Število vseh prebivalcev	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	
30-59*	900173	468938	0,2	938	431235	0,1	431	1369
60-64	145715	72501	0,2	145	73214	0,9	659	804
65-69	133003	65002	1,1	715	68001	1,5	1020	1735
70-74	92576	42528	3,1	1318	50048	3,4	1702	3020
75-79	80635	34168	7,0	2392	46467	8,9	4136	6528
80-84	59155	22433	10,7	2400	36722	13,1	4811	7211
85-89	36072	10961	16,3	1787	25111	24,9	6253	8040
90 +	16990	3810	29,7	1132	13180	44,8	5905	7037
Skupaj	1464319	720341		10827	743978		24917	35744
Vsi prebivalci skupaj	2089310	% celotne populacije 1,71						

Vir: lastni izračuni Vir: stopnje prevalence demence starostno specifične in po spolu, povzete po: Alzheimer Europe, 2019; Hofman et al., 1991; SURS za število prebivalcev

Tabela 3: Ocenjeno število ljudi z demenco po starostni skupini in po spolu ter skupno, Slovenija, 2020.

Razpon starosti v letih	Skupaj	Moški			Ženske			Skupa
	Število vseh prebivalcev	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	
30-59*	898574	469730	0,2	939	428844	0,1	429	1368
60-64	144449	71909	0,2	144	72540	0,9	653	797
65-69	135564	66074	1,1	727	69490	1,5	1042	1769
70-74	101248	46901	3,1	1454	54347	3,4	1848	3302
75-79	77562	33021	7,0	2311	44541	8,9	3964	6275
80-84	60447	23332	10,7	2497	37115	13,1	4862	7359
85-89	37062	11568	16,3	1886	25494	24,9	6348	8234
90 +	17972	4165	29,7	1237	13807	44,8	6185	7422
Skupaj	1472878	726700		11195	746178		25331	36526
Vsi prebivalci skupaj	210012	% celotne populacije 1,74						

Vir: lastni izračuni Vir: stopnje prevalence demence starostno specifične in po spolu, povzete po: Alzheimer Europe, 2019; Hofman et al., 1991; SURS za število prebivalcev

Tabela 4: Ocenjeno število ljudi z demenco po starostni skupini in po spolu ter skupno, Slovenija, 2021.

Razpon starosti v letih	Skupaj	Moški			Ženske			Skupaj
	Število vseh prebivalcev	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Skupno število ocenjenih primerov demence
30-59*	895921	468462	0,2	937	427459	0,1	427	1364
60-64	144104	71549	0,2	143	72555	0,9	653	796
65-69	137282	66950	1,1	736	70332	1,5	1055	1791
70-74	111499	52082	3,1	1615	59417	3,4	2020	3635
75-79	75057	32092	7,0	2246	42965	8,9	3824	6070
80-84	61550	23944	10,7	2562	37606	13,1	4926	7488
85-89	37065	11945	16,3	1947	25120	24,9	6255	8202
90 +	18196	4213	29,7	1251	13983	44,8	6264	7515
Skupaj	1480674	731237		11437	749437		25424	36861
Vsi prebivalci skupaj	2107007	% celotne populacije 1,75						

Vir: lastni izračuni Vir: stopnje prevalence demence starostno specifične in po spolu, povzete po: Alzheimer Europe, 2019; Hofman et al., 1991; SURS za število prebivalcev

3.2 Projekcije prevalence demence za 2030 in 2050

V Tabeli 5. in Tabeli 6. so prikazane ocene projekcij prevalence demence za prebivalce Slovenije v letu 2030 in 2050.

Ocenjeno število ljudi z demenco po posameznih letih glede na spol in skupno prikazuje slika 1. Demenca je pogostejša pri ženskah, število ljudi se z leti povečuje tako pri ženskah kot moških, vsako naslednje leto je število ljudi z demenco višje od predhodnega.

Razlika v številu ljudi z demenco, po spolu in skupno po posameznih obdobjih (2018-2019, 2019-2020, 2020-2021) je prikazana na sliki 2. V prvem izbranem obdobju 2018-2019 (pred epidemijo) je bila razlika v številu ljudi z demenco med leti 2018 in 2019 najvišja, tako pri ženskah kot moških in skupno, najnižja je bila v med leti 2020 in 2021 (najbolj aktivna epidemija), tako pri ženskah kot moških in skupno.

Tabela 5: Projekcija števila demenc po starostnih razredih in po spolu ter skupno, Slovenija, 2030

Razpon starosti v letih	Skupaj	Moški			Ženske			Skupaj
	Število vseh prebivalcev	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Skupno število ocenjenih primerov demence
30-59*	835447	449974	0,2	900	385473	0,1	385	1285
60-64	145696	74051	0,2	148	71645	0,9	645	793
65-69	138070	67747	1,1	745	70323	1,5	1055	1800
70-74	127070	60399	3,1	1872	66671	3,4	2267	4139
75-79	110396	50110	7,0	3508	60286	8,9	5365	8873
80-84	70321	29202	10,7	3125	41119	13,1	5387	8512
85-89	43402	15539	16,3	2533	27863	24,9	6938	9471
90 +	25481	7131	29,7	2118	18350	44,8	8221	10339
Skupaj	1495883	754153		14949	741730		30263	45212
Vsi prebivalci skupaj	2106316	% celotne populacije 2,15						

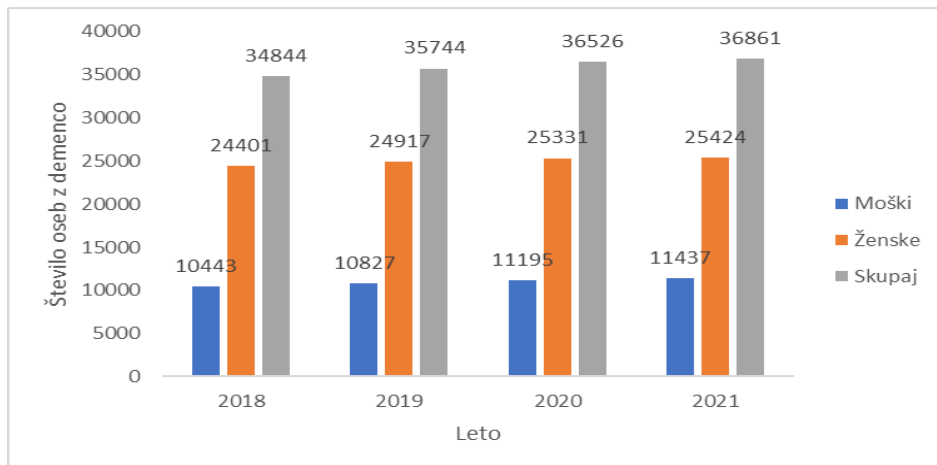
Vir: lastni izračuni Vir: stopnje prevalence demence starostno specifične in po spolu, povzete po: Alzheimer Europe, 2019; Hofman et al., 1991; SURS za število prebivalcev

Tabela 6: Projekcija števila demenc po starostnih razredih in po spolu ter skupno, Slovenija, 2050

Razpon starosti v letih	Skupaj	Moški			Ženske			Skupaj
	Število vseh prebivalcev	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Skupno število ocenjenih primerov demence
30-59*	718381	387679	0,2	775	330702	0,1	331	1106
60-64	136405	73990	0,2	148	62415	0,9	562	710
65-69	142163	75176	1,1	827	66987	1,5	1005	1832
70-74	138324	71082	3,1	2204	67242	3,4	2286	4490
75-79	118167	58066	7,0	4065	60101	8,9	5349	9414

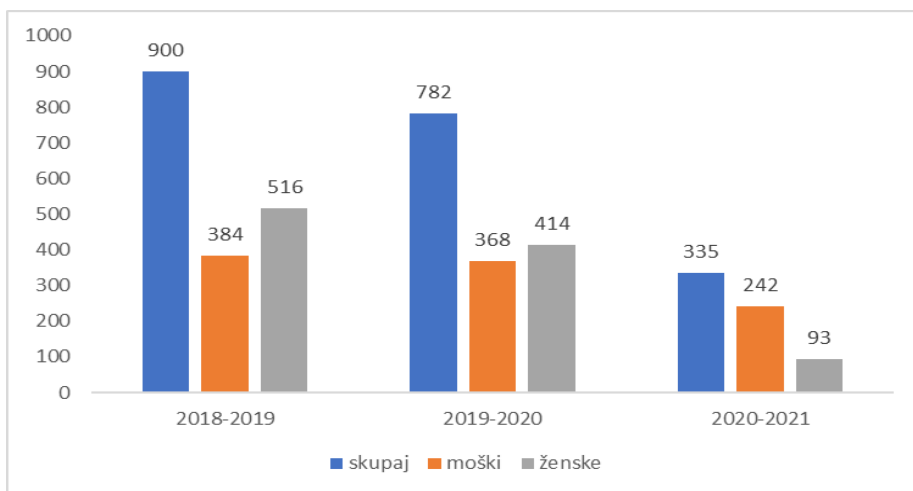
Razpon starosti v letih	Skupaj	Moški			Ženske			Skupaj
	Število vseh prebivalcev	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Skupno število ocenjenih primerov demence
80–84	102498	46271	10,7	4951	56227	13,1	7366	12317
85–89	73640	29800	16,3	4857	43840	24,9	10916	15773
90 +	52410	17547	29,7	5211	34863	44,8	15619	20830
Skupaj	1481988	759611		23038	722377		43434	66472
Vsi prebivalci skupaj	2043751	% celotne populacije 3,25						

Vir: lastni izračuni Vir: stopnje prevalence demence starostno specifične in po spolu, povzete po: Alzheimer Europe, 2019; Hofman et al., 1991; SURS za število prebivalcev



Slika 1: Ocena prevalence demence (število ljudi) po spolu in skupno, Slovenija, 2018-2021

Vir: lasten izračun

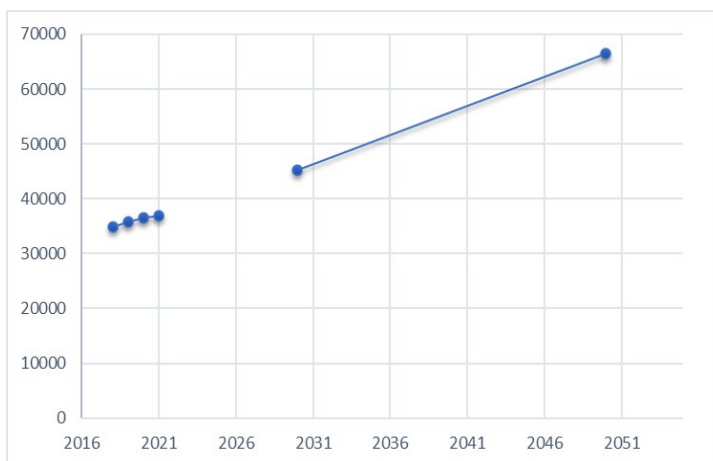


Slika 2: Razlika v številu ljudi z demenco, po spolu in skupno po posameznih obdobjih 2018-2019, 2019-2020, 2020-2021, Slovenija

Vir: lasten izračun

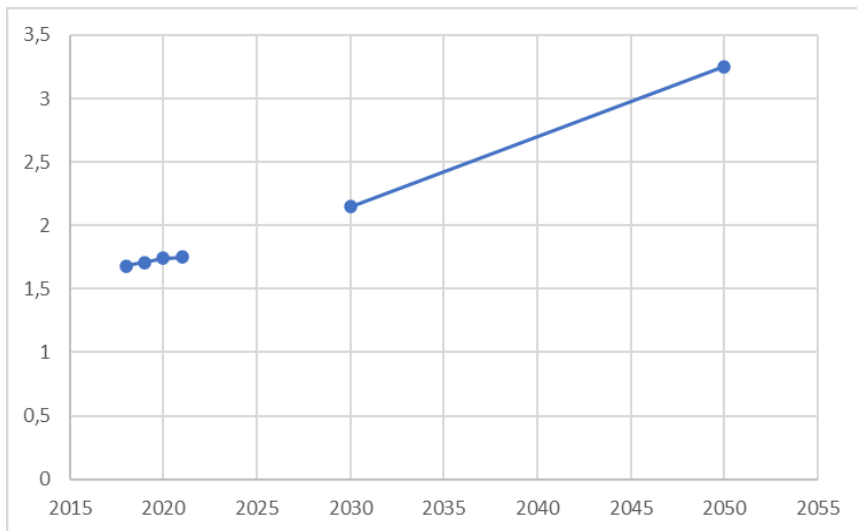
3.3 Trendi

Na sliki 3. je prikazana dinamika števila ljudi z demenco v Sloveniji od 2018 do 2050, na sliki 4. delež (%) demence med vsemi prebivalci Slovenije od 2018 do 2050.



Slika 3: Število ljudi z demenco v Sloveniji od 2018 do 2050

Vir: lasten izračun



Slika 4: Delež (%) demence med vsemi prebivalci Slovenije od 2018 do 2050

Vir: lasten izračun

4 Diskusija in zaključek

Pandemija covid-19 je močno prizadela socialno varstvene ustanove - domove starejših občanov (DSO), predvsem tiste, v katerih je prišlo do vdora SARS-CoV-2 in hitrega širjenja okužb. V več državah po svetu so DSO predstavljali epicentre okužb, bolezni in umrljivosti (Ryoo et al., 2020; Seshadri et al., 2021; Trabucchi & De Leo, 2020). Glede na visoko pozitivno presežno umrljivost (novembra 2020 je umrlo 92 % več ljudi kot v istem mesecu v obdobju 2015-2019) (SURS), ki je najbolj prizadele osebe z demenco, bi lahko utemeljeno pričakovali, da bi prevalenca demence v letih 2020 in 2021 bila nižja kot v primerjavi z leti 2019 in 2018. Naši izračuni kažejo, da je prevalenca demence z leti, kljub pandemiji covid 19, še naprej z leti naraščala, tako pri ženskah kot moških ter skupno. Po drugi strani je razlika v številu oseb z demenco bila najvišja v obdobju 2018-2019 in je nato upadala. V obdobju 2019-2020 smo imeli za 13,1% ali za 1,1-krat manj in v obdobju 2020-2021 za 62,8% ali 2,7-krat manj primerov demence kot v primerjavi z 2018-2019. Pri ženskah je bilo v obdobju 2019-2020 za 19,8% ali 1,25-krat manj, v obdobju 2020-2021 za 82% ali 5,5-krat manj primerov demence kot v primerjavi z 2018-2019. Pri moških je bilo v obdobju 2019-2020 za 4,2% ali 1,04-krat manj, v obdobju 2020-

2021 za 37% ali 1,59-krat manj primerov demence kot v primerjavi z 2018-2019. Ženske so bile bolj prizadete v primerjavi z moškimi, še posebej v obdobju 2020-2021 (med epidemijo), ko je bila 2,6-krat večja razlika primerov demence pri moških v primerjavi z ženskami. Pred tem je bilo vedno večja razlika primerov demence pri ženskah v primerjavi z moškimi. Razmerje razlike primerov demence ženske proti moškim za 2018-2019 je bilo 1,34, za 2019-2020 je bilo 1,21. Podatki za svet, Evropo in Slovenijo kažejo, da je demenca pogostejša pri ženskah, razmerje ženske proti moškim je v večini primerov med 2 in 3 (Alzheimer Europe, 2019; GBD 2019, 2022; Lovrečič et al., 2020; Lovrečič in Lovrečič, 2022; Lovrečič et al., 2021).

V Sloveniji smo leta 2021 imeli petino prebivalcev Slovenije, starih 65 let ali več, dobrih 5% je bilo starejših od 80 let. Za leto 2030 pričakujemo, da bo prebivalcev, starih 65 let in več že četrtnina, skoraj 7% v starosti nad 80 let (SURs). Naši izračuni kažejo, da lahko upravičeno pričakujemo naraščanje prevalece demence tudi v prihodnje, projekcije za leti 2030% in 2050 kažejo, da bo naraščal tudi delež ljudi z demenco med prebivalstvom (2,15% in 3,25% celotne populacije). Stroški zdravstvenega varstva in dolgotrajne oskrbe posameznikov z Alzheimerjevo boleznijo in drugimi demencami so visoki, demenca se uvršča med najdražje kronične bolezni (Hurd et. al., 2013; 2023 Alzheimer's disease facts and figures, 2023).

Navkljub nekaterim omejitvam podatki omogočajo trenutni vpogled v razširjenost demence med prebivalstvom Slovenije in oceno gibanja števila ljudi z demenco pred in po epidemiji covid 19, omogočajo oceno razširjenosti pojava v prihodnje in uporabne informacije za načrtovanje učinkovitih zdravstvenih in socialnih storitev, kot tudi ozaveščanje glede demence med splošno in strokovno javnostjo na nacionalni ravni. Podatki so pomembni za načrtovalce politike glede na posebnosti Slovenije (po številu ljudi z demenco na prebivalce se uvrščamo v vrh držav, ki se soočajo z velikim deležem starajočega prebivalstva, kapacitete socialnovarstvenih nastanitev so omejene, prav tako se soočamo s pomanjkanjem strokovnega kadra v socialnovarstvenih zavodih, starejše ženske, ki živijo same imajo večje tveganje za revščino ipd).

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OCENA EKONOMSKIH STROŠKOV DEMENCE V SLOVENIJI

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Alzheimerjeva bolezen in druge demence predstavljajo najdražjo kronično bolezensko stanje, ki prizadene bolnika, svojce in širšo družbo, bolniki so vse bolj odvisni od pomoči drugih, največkrat za bolnike skrbijo svojci. Metode: Opravili smo sistematičen pregled znanstvene literature glede ocen ekonomskih stroškov demence, pregledali smo metodologijo ocen in strukturo stroškov. Rezultati: Na osnovi izbrane metodologije smo izračunali stopnjo prevalence demence v Sloveniji za leto 2019, standardizirano na starost in spol, ter ekonomske stroške demence. Izsledki naše raziskave presegajo dosedanje ocene ekonomskega bremena demence v Sloveniji. Razprava: Breme demence je visoko in predstavlja pomemben delež BDP. Demenca je pomemben javnozdravstveni in socialnovarstveni problem, ki se je tekom pandemije covid 19 poglobljajal, tako v zdravstvenem kot socialnovarstvenem sistemu. Zaradi demografskih sprememb in podaljševanja življenjske dobe narašča število oseb z demenco. Med letoma 2000 in 2019 je umrljivost zaradi demence v svetu porasla za 145%. Leta 2019 se je vrh G20 z deklaracijo zavezal k skupnemu pristopu za obvladovanje demence. V Sloveniji je potrebno upoštevati dodatne posebnosti. Ustrezen informacijski sistem bi omogočil rutinsko spremljanje stroškov.

Ključne besede:

demenca,
prevalenca,
ekonomsko
breme,
direktni
stroški
zdravstva,
direktni
stroški
socialnega
varstva,
stroški
neformalne
oskrbe

ASSESSMENT OF THE ECONOMIC COSTS OF DEMENTIA IN SLOVENIA

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Background: Alzheimer's disease and other dementias represent the most expensive chronic medical conditions that affect the patient, their relatives and the wider society. Patients are increasingly dependent on the help of others, most of the time patients are cared for by relatives. **Methods:** We performed a systematic review of the scientific literature regarding estimates of the economic costs of dementia, reviewed the methodology of the estimates and the cost structure. **Results:** Based on the chosen methodology, we calculated the prevalence rate of dementia in Slovenia for the year 2019, standardized by age and gender, as well as the economic costs of dementia. The results of our research exceed the previous assessment of the economic burden of dementia in Slovenia. **Discussion:** The burden of dementia is high and represents a significant proportion of GDP.

Keywords:

dementia,
prevalence,
economic
burden,
direct
health
costs,
direct
social
care
costs,
costs of
informal
care

Dementia is an important public health and social care problem, which has deepened during the covid 19 pandemic, both in the health and social care systems. Due to demographic changes and the increase in life expectancy, the number of people with dementia is increasing. Between 2000 and 2019, mortality from dementia worldwide increased by 145%. In 2019, the G20 summit committed itself to a common approach to managing dementia with a declaration. In Slovenia, additional special features must be taken into account. An adequate information system would enable routine cost monitoring.

1 Uvod

Demenca predstavlja javnozdravstveno prioriteto. Stroški zdravstvenega varstva in dolgotrajne oskrbe posameznikov z Alzheimerjevo boleznijo in drugimi demencami so visoki, demenca se uvršča med najdražje kronične bolezni (Hurd et. al., 2013; 2023 Alzheimer's disease facts and figures, 2023). Po podatkih Svetovne zdravstvene organizacije (SZO) je leta 2015 v svetu živelo 55 milijonov ljudi z demenco, vsako leto je bilo dodatno okrog 10 milijonov novih primerov oziroma na vsake tri sekunde nov primer (WHO, 2022). Leta 2019 je bilo več kot 57 milijonov ljudi z demenco (GBD 2019 Dementia Forecasting Collaborators (2022)). Do leta 2030 bo po ocenah SZO v svetu 82 milijonov ljudi z demenco, do leta 2050 več kot 150 milijonov (WHO, 2023) oziroma 153 milijonov ljudi z demenco (GBD 2019 Dementia Forecasting Collaborators, (2022)). Po podatkih SZO so stroški demence v svetu za leto 2015 znašali 818 milijard ameriških dolarjev (US\$), v letu 2019 1300 milijard US\$, do 2030 bodo narastli na 2000 milijard US\$ dolarjev (WHO, 2023). Najvišji delež stroškov, do 70%, pripada Evropi in Severni Ameriki (Wimo et. Al, 2013). Okrog polovice stroškov predstavlja neformalna oskrba, ki jo zagotavljajo svojci (v povprečju 5 ur nege ali nadzora dnevno) (WHO, 2023).

V EU (EU27) je leta 2018 živelo 7,9 milijonov ljudi z demenco, v Sloveniji 34.137 (Alzheimer Europe). Število ljudi z demenco v EU se bo do leta 2050 podvojilo in narastlo na 14,3 milijona oziroma na 18,8 milijona za širšo evropsko regijo (Alzheimer Europe). Jönsson in sod. (2023) so ocenjevali letne stroške demence na osebo v Evropi, ki so se razlikovali med državami in regijami ter znašali od najvišjih 73.712 € do najnižjih 7.938 €.

Izračuni stroškov demence najpogosteje vključujejo direktne stroške zdravstva in stroške socialnega varstva ter stroške neformalne oskrbe. Direktni stroški zdravstva se nanašajo na sistem zdravstvene oskrbe, kot so stroški bolnišnične oskrbe, zdravila in ambulantni pregledi. Direktni stroški socialnega varstva se nanašajo na formalne storitve, ki se izvajajo zunaj sistema zdravstvene oskrbe, vključno s skupnostnimi storitvami, kot so nega na domu, oskrba s hrano in prevoz ter oskrba v socialnovarstvenem zavodu. Za neformalno oskrbo ocenjujejo koliko časa družinski oskrbovalci porabijo za oskrbo, pomoč pri vsakodnevnih aktivnostih in nadzora nad osebo (Alzheimer's Disease International, 2010; Alzheimer's Disease International, 2015; World Health Organization, 2021; Wimo et al., 2011).

Namen prispevka je bil sistematičen pregled literature s področja ocene skupnih letnih stroškov demence v svetu, Evropi in Sloveniji ter izračun stroškov demence za Slovenijo.

2 Metode

V prvem delu je bil izveden sistematični pregled znanstvene literature, v drugem delu smo izračunali stroške demence za Slovenijo v letu 2019.

2.1 Metode pregleda

Izvedli smo sistematični pregled literature za obdobje zadnjih 20 let, od 1. januarja 2004 do 1. decembra 2023, v podatkovni bazi PubMed. Uporabili smo ključne besede v angleškem jeziku: »dementia«, »costs«, v kombinacijah z »world region«, »Europe«, »EU« in »Slovenia«. Vključitveni kriteriji so bili: objave od leta 2004 dalje, angleški jezik, dostopno celotno besedilo in recenzirane publikacije. Dodatno smo identificirali še zadetke iz drugih virov (na osnovi citirane literature identificiranih in izbranih objav, ki so jih objavile mednarodne strokovne organizacije in kjer je bilo smiselno).

2.2 Izračun stroškov za Slovenijo

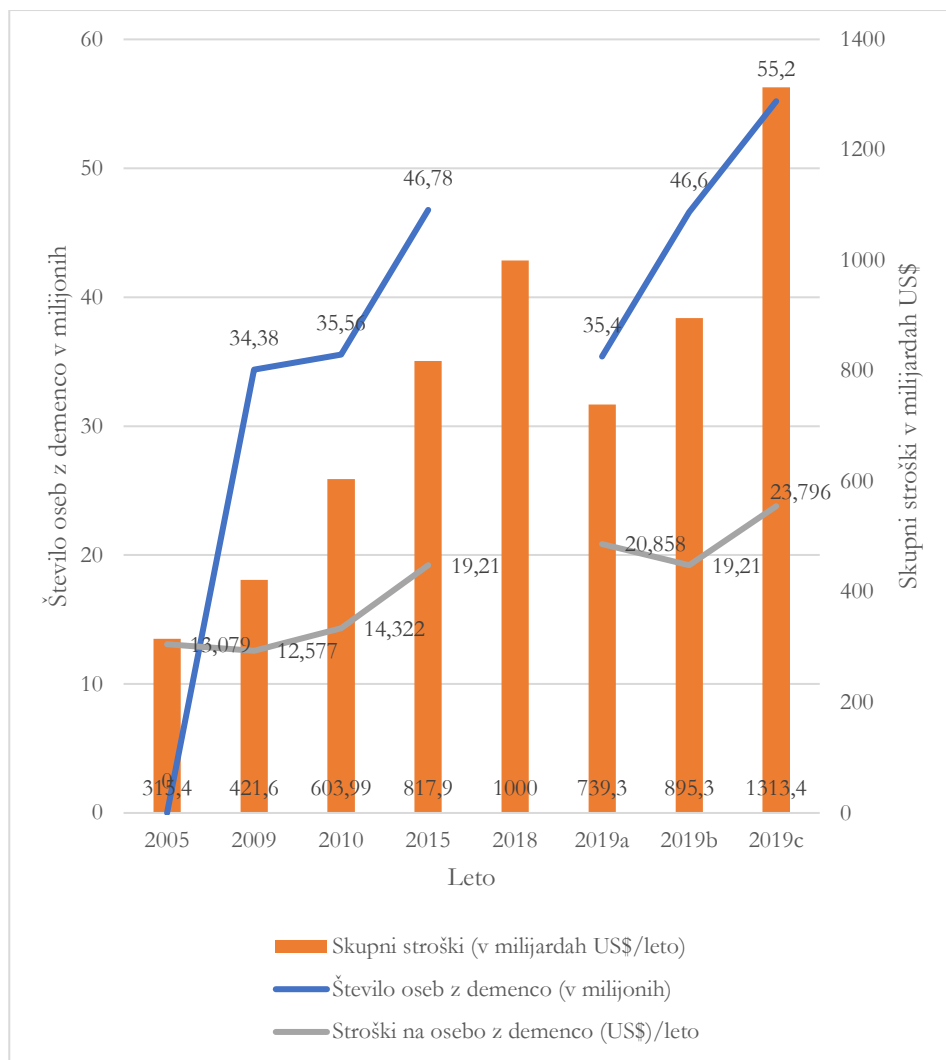
Prevalence demence za Slovenijo na nacionalni ravni so bile izračunane za leto 2019 in na osnovi stopenj prevalence za demenco, ki so bile izdelane v okviru evropskega projekta European Collaboration on Dementia (EuroCoDe) (Hofman et al., 1991; Alzheimer Europe, 2019), ki je najpogosteje uporabljena in priporočena metoda za izračun prevalence demence, ter na osnovi podatkov prebivalstva Statističnega urada Slovenije za leto 2019 (SISTAD). V nadaljnjih korakih smo izračunali letne stroške demence glede na delež BDP v Sloveniji v letu 2019, glede na strukturo stroškov ter stroške glede na osebo z demenco.

3 Rezultati

3.1 Rezultati pregleda literature

V podatkovni bazi Pub Med smo identificirani 119 zadetkov za področje svetovne regije, 18 zadetkov za področje Evrope/EU in 7 zadetkov za Slovenijo. Po pregledu naslovov in izvlečkov smo izločili tiste prispevke, ki niso vsebovali podatkov za stroške demence, po nadaljnjem vsebinskem pregledu identificiranih objav dodatno tiste, ki niso vsebovali podatkov o skupnih stroških demence za vsaj polovico sveta (za svetovno regijo), za vsaj polovico držav v Evropi oz. EU (za evropsko regijo) ali za vsaj polovico prebivalcev evropske EU in za Slovenijo (vse oblike demenc in skupni stroški). Identificirali smo 6 objav za svetovno regijo, 10 za evropsko regijo in 2 za Slovenijo. Dodatno smo našli še 3 objave za svetovno regijo, 4 za evropsko regijo iz drugih virov.

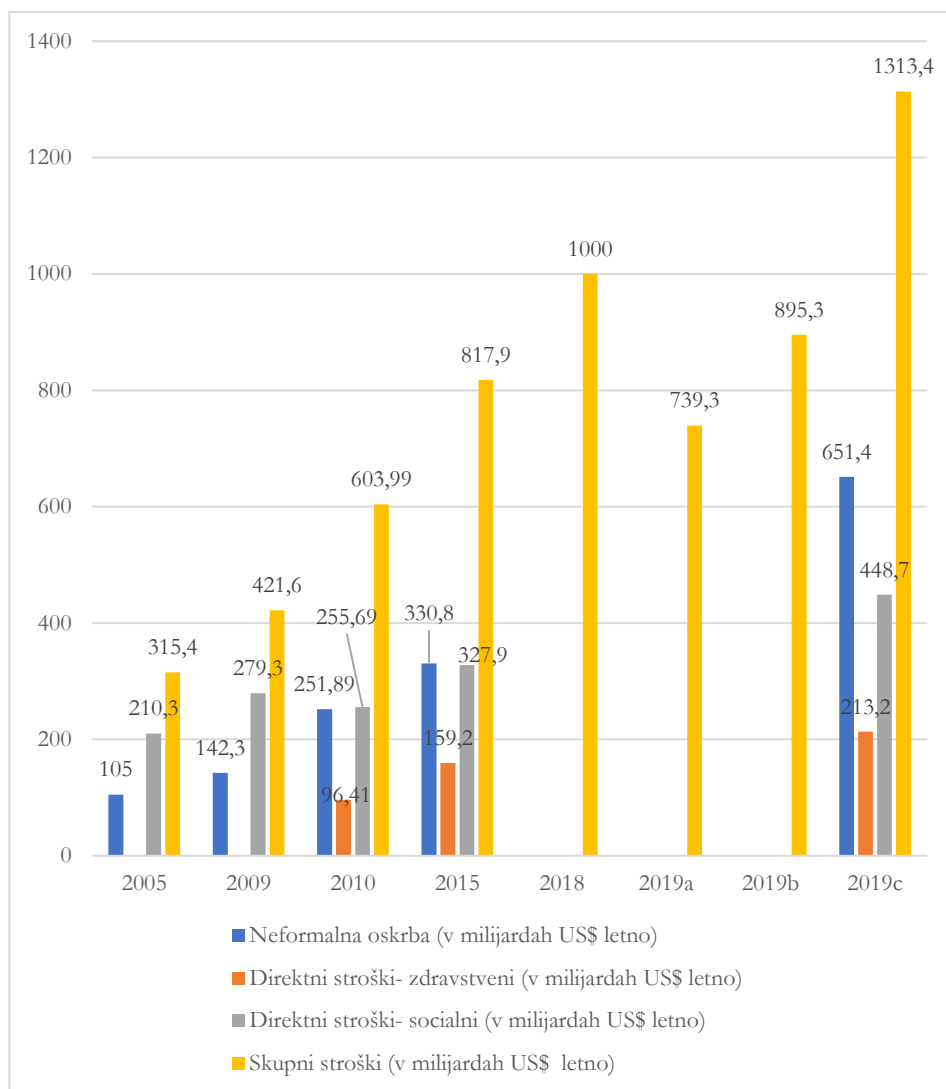
Rezultati pregleda literature so predstavljeni na sliki 1 in 2. za svetovno regijo, sliki 3. in 4. za evropsko regijo.



Legenda: US\$ ameriški dolarji

Slika 1: Prikaz dinamike števila oseb z demenco (v milijonih), skupnih stroškov demence (v milijardah US\$ letno) in stroškov na osebo z demenco (v US\$ letno) letno za svetovno regijo in po izbranih letih za obdobje 2005 - 2019

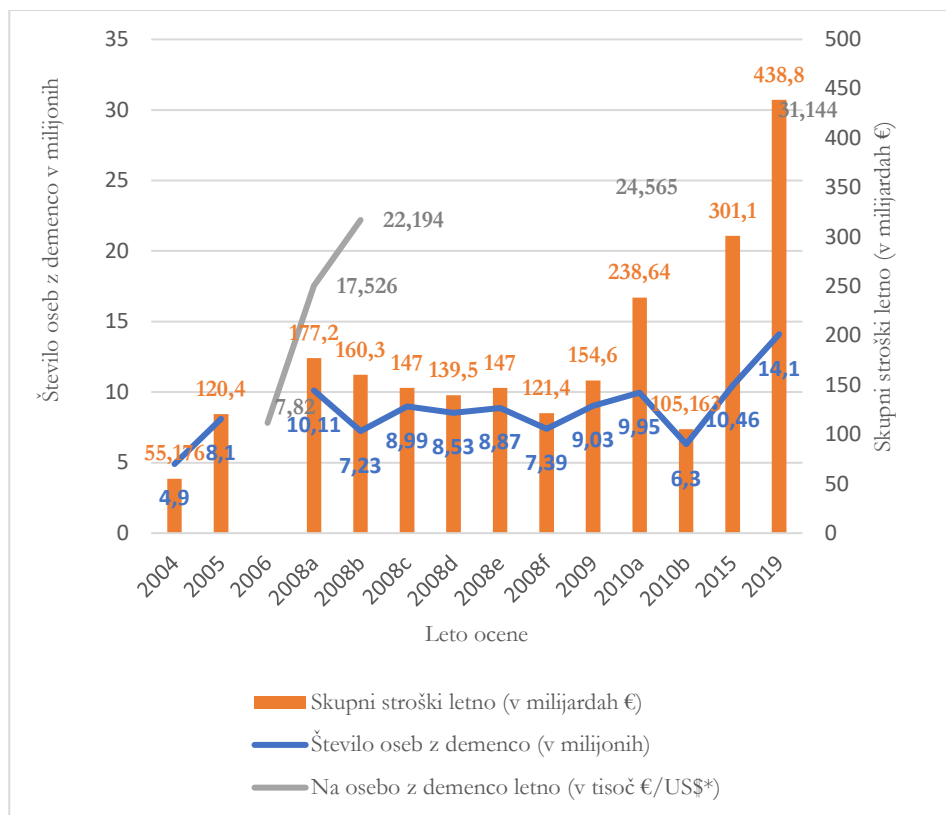
Viri: 2005 (Wimo et al., 2007), 2009 (Wimo et al., 2010), 2010 (Wimo & Prince, 2010; Wimo et al., 2013), 2015 (Wimo et al., 2017; Alzheimer's Disease International, 2015), 2018 (Alzheimer's Disease International, 2015), 2019a (Wimo & Prince, 2010), 2019b (Prince et al., 2015), 2019c (Wimo et al., 2023; WHO, 2021)



Legenda: US\$ ameriški dolarji

Slika 2: Ocena stroškov za demenco za svetovno regijo po strukturi ocenjenih stroškov letno (skupni stroški, stroški neformalne oskrbe, direktni stroški zdravstva in direktni stroški socialnega varstva) in po izbranih letih za obdobje 2005 – 2019

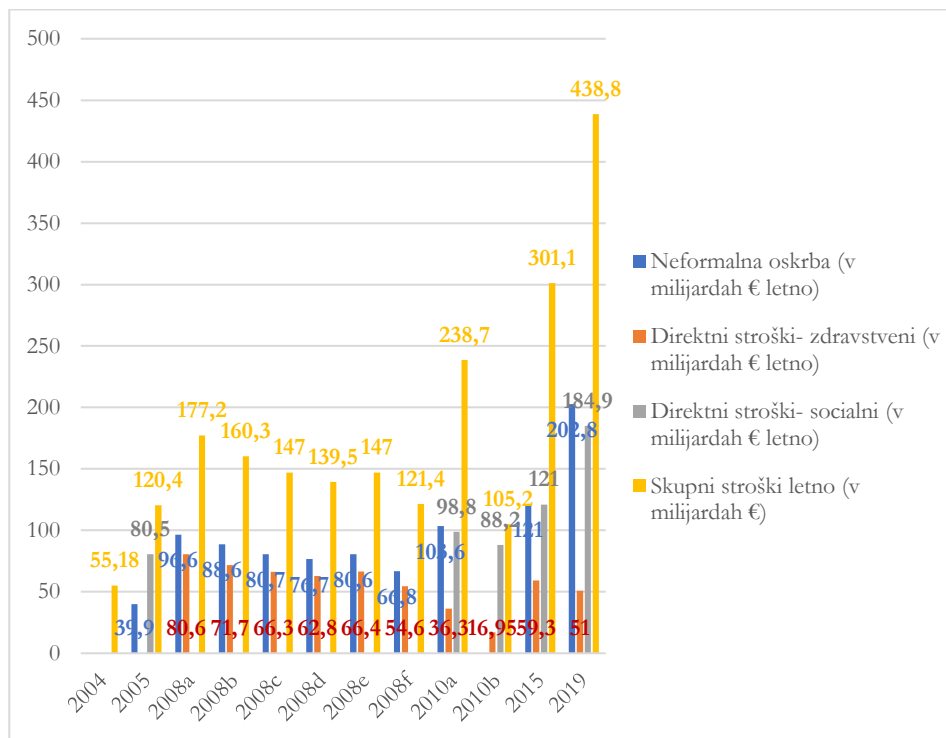
Viri: 2005 (Wimo et al., 2007), 2009 (Wimo et al., 2010), 2010 (Wimo, & Prince, 2010; Wimo et al., 2013), 2015 (Wimo et al., 2017; Alzheimer's Disease International, 2015), 2018 (Alzheimer's Disease International, 2015), 2019a (Wimo & Prince, 2010), 2019b (Prince et al., 2015), 2019c (Wimo et al., 2023; WHO, 2021)



Slika 3: Prikaz dinamike števila oseb z demenco (v milijonih), skupnih stroškov demence (v milijardah € letno) in stroški na osebo z demenco (v tisoč € letno) letno za Evropo¹ in po izbranih letih za obdobje 2004 - 2019

Viri: 2004 (Andlin-Sobočki et al., 2005), 2005 (Wimo et al., 2007), 2006 (Gustavsson et al., 2010), 2008a (Wimo et al., 2011), 2008b (Wimo et al., 2011), 2008c (Hofman et al., 1991), 2008d (Ferri et al., 2005), 2008e (Swedish Council on Health Technology Assessment, 2008), 2008f (Lobo et al., 2000), 2009 (Wimo et al., 2010), 2010a (Wimo, & Prince, 2010), 2010b (Gustavsson et al., 2011), 2015 (Alzheimer's Disease International, 2015), 2019 (Wimo et al., 2023)

¹ Za leto 2004: vključene EU 25: Avstrija, Belgija, Ciper, Češka, Danska, Estonija, Finska, Francija, Nemčija, Grčija, Madžarska, Irsko, Italija, Latvija, Litva, Luksemburg, Malta, Nizozemska, Poljska, Portugalska, Slovaška, Slovenija, Španija, Švedska, Združeno kraljestvo, Norveška, Švica. Za leta 2005, 2008a,c-f, 2009, 2010a-b, 2015, 2019: Evropa = evropska regija SZO: Avstrija, Belgija, Češka, Danska, Finska, Francija, Nemčija, Grčija, Islandija, Irsko, Izrael, Italija, Luksemburg, Malta, Nizozemska, Norveška, Ruska federacija, Slovenija, Španija, Švedska, Švica, Turčija, Združeno kraljestvo. Za leto 2006: EU-12: Francija, Nemčija, Nizozemska, Švica Italija, Španija, Grčija, Romunija Švedska, Danska, Belgija, Združeno kraljestvo. Za leto 2008b, 2010b: EU 27: Avstrija, Belgija, Bolgarija, Hrvaška, Ciper, Češka, Danska, Estonija, Finska, Francija, Nemčija, Grčija, Madžarska, Irsko, Italija, Latvija, Litva, Luksemburg, Malta, Nizozemska, Poljska, Portugalska, Romunija, Slovaška, Slovenija, Španija, Švedska. Za leto 2018: Avstrija, Belgija, Češka, Danska, Estonija, Francija, Nemčija Italija, Slovenija, Španija, Švedska.



Slika 4: Ocena stroškov za demenco v Evropi¹ po strukturi ocenjenih stroškov letno (skupni stroški, stroški neformalne oskrbe, direktni stroški zdravstva in direktni stroški socialnega varstva) in po izbranih letih za obdobje 2005 – 2019

Viri: 2004 (Andlin-Sobocki, et al., 2005), 2005 (Wimo et al., 2007), 2006 (Gustavsson et al., 2010), 2008a (Wimo et al., 2011), 2008b (Wimo et al., 2011), 2008c (Hofman et al., 1991), 2008d (Ferri et al., 2005), 2008e (Swedish Council on Health Technology Assessment, 2008), 2008f (Lobo, et al., 2000), 2009 (Wimo et al., 2010), 2010a (Wimo, & Prince, 2010), 2010b (Gustavsson et al., 2011), 2015 (Alzheimer's Disease International, 2015), 2019 (Wimo et al., 2023).

Wimo in sod. (2010) so ocenili skupne stroške demence v Sloveniji za leto 2009 na 635,3 milijonov US\$, Meijer in sod. (2022) so za leto 2018 ocenili skupne stroške demence za Slovenijo na 655,8 milijonov €.

3.2 Rezultati izračunov za Slovenijo

V tabeli 1. so prikazani izračuni stopenj prevalece demence, standardizirani glede na starost in spol.

Tabela 1: Ocenjeno število oseb z demenco po standardizirani stopnji po starostni skupini, po spolu in v deležu glede na prebivalstvo, Slovenija, 2019

Razpon starosti v letih	Moški			Ženske			Skupaj		
	Število prebivalcev	Prevalenca (%)	Število ocenjenih primerov demence	Število prebivalcev	Prevalenca (%)	Število ocenjenih	Število vseh prebivalcev	Prevalenca (%)	Skupno število
30–59*	466.998	0,2	934	432.234	0,1	432	899.232	0,15	1.366
60–64	72.401	0,2	145	73.040	0,9	657	145.441	0,6	802
65–69	63.965	1,1	704	67.075	1,5	1.006	131.040	1,3	1.710
70–74	41.529	3,1	1.288	49.373	3,4	1.679	90.902	3,3	2.967
75–79	33.916	7,0	2.374	46.163	8,9	4.109	80.079	8,1	6.483
80–84	22.096	10,7	2.364	36.661	13,1	4803	58.757	12,1	7.167
85–89	10.642	16,3	1.735	24.907	24,9	6202	35.549	22,3	7.937
90 +	3.684	29,7	1.094	13.043	44,8	5843	16.727	41,5	6.937
Skupaj	715.231	1,5	10.638	742.496	3,3	24731	1.457.727	2,4	35.369
Vsi prebivalci skupaj	1.049.277	1,0		1.044.783	2,4		2.094.060	1,7	

Vir: lastni izračuni

Stopnje prevalence demence starostno specifične in po spolu (povzeto po Alzheimer Europe, 2019; * Hofman et al., 1991). Vir podatkov števila prebivalcev: SISTAD

V letu 2019 smo po izračunu imeli v Sloveniji 35.369 oseb z demenco. Po podatkih Statističnega urada RS je bil BDP v Sloveniji v 2019 ocenjen na 48.393 milijonov EUR, BDP na prebivalca je v povprečju znašal 23.165 EUR (SURS, 2019). Stroški demence so po ocenah za leto 2019 v svetu v povprečju znašali 0.76 % svetovnega BDP (Wimo et al., 2023; WHO, 2021). 0.76 % BDP za leto 2019 v Sloveniji predstavlja 367.786.800 eurov. Stroški demence so po ocenah za leto 2019 za Evropo v povprečju znašali 1,02 % BDP (Wimo et al., 2023; WHO, 2021). 1,02 % BDP v Sloveniji predstavlja 493.608.600 eurov.

Tabela 2: Ocena stroškov demence po strukturi stroškov (neformalna oskrba, direktni stroški zdravstva, direktni stroški sociala in skupni stroški) ter na osebo z demenco, Slovenija, 2019

Stroški	Delež* (%)	Euro letno	Euro letno na osebo z demenco
Neformalna oskrba	46,2	228.047.200	6447,66
Direktni stroški zdravstva	11,6	57.258.600	1618,9
Direktni stroški socialnega varstva	42,2	208.302.800	5889,4
skupaj	100	493.608.600	13955,97

Vir: lastni izračuni; Viri strukture stroškov v deležih*: (Wimo et al., 2019; WHO, 2021)

Razprava z zaključki

V pričujočem prispevku smo s pomočjo pregleda znanstvene literature ugotavljali obseg, dinamiko in kjer je bilo možno, strukturo skupnih ekonomskih stroškov demence glede na direktne stroške zdravstva, socialnega varstva in neformalne oskrbe, po izbranih letih za obdobje zadnjih 20 let, posebej za svetovno regijo, za evropsko regijo ter za Slovenijo. Ob tem smo spremljali tudi prevalenco demence ter letne stroške demence na osebo z demenco. Kljub heterogenosti pregledanih raziskav (v primerih evropske regije so bile v različnih raziskavah vključene različne skupine držav EU25, EU27, evropska regija SZO; struktura stroškov demence je bila omejena na posamezne primere), je bila razlika minimalna in rezultati raziskav primerljivi. Stroški demence v vseh primerih z leti naraščajo vzporedno z demografskimi spremembami, ki vodijo v podaljševanje življenjske dobe prebivalstva, s starostjo narašča tveganje za demenco, kar se odraža z naraščanjem števila ljudi z demenco (Jönsson et al.; 2023; Wimo et al., 2023).

Pri oceni prevalence za Slovenijo (35.369 primerov demence med prebivalci Slovenije v starosti 30 let in več za leto 2019) so naši rezultati povsem primerljivi z ugotovitvami mednarodnih strokovnih organizacij: 34.137 primerov demence med prebivalci v starosti 60 let in več za leto 2018 (Alzheimer Europe; Alzheimer Europe, 2019). Minimalna razlika gre na račun razlike v letu izračuna, vključenosti vzorca prebivalcev: nad 30 let vs. 60 let starosti ter izračuna na dejanskem številu prebivalcev Slovenije - v našem primeru). Podatki so primerljivi tudi z izračuni, ki smo jih v preteklosti za Slovenijo že opravili (Lovrečič et al., 2020; Lovrečič & Lovrečič, 2020) ter z ugotovitvami različnih tujih avtorjev in mednarodnih strokovnih organizacij (Lovrečič et al., 2021).

Letni povprečni skupni stroški demence glede na delež BDP (povprečje za svetovno regijo in povprečje za evropsko regijo, ki je najbolj približana Sloveniji), glede na strukturo skupnih stroškov in glede na osebo z demenco je prvi poskus ocene skupnih stroškov demence v Sloveniji. Predhodne ocene stroškov demence v Sloveniji, objavljene v recenziranih revijah, so bile bistveno nižje od naših ugotovitev in/ali so se nanašale na posamezno podskupino ljudi z demenco: ocena stroškov možganskih obolenj v Sloveniji za leto 2004 je pokazala, da so skupni stroški demence predstavljali 148 milijonov €/standard kupne moči (Vodušek et al., 2008), za leto 2010 so bili ocenjeni povprečni stroški za možganske bolezni in za demenco so znašali 214,9 milijonov €² (Bon et al., 2013), stroški za leto 2015 v višini 105 milijonov € so se nanašali na oceno stroškov zdravstvene obravnave, stroške diagnosticiranja in zdravljenja demence v Centru za kognitivne motnje, Univerzitetnega kliničnega centra v Ljubljani (Županič et al., 2022).

Naši izračuni nakazujejo, da so ocenjeni stroški demence za leto 2019 v Sloveniji med 368 in 494 milijonov eurov, od tega neformalna oskrba predstavlja najvišji strošek. Glede na število primerov demence bi lahko letni stroški na osebo znašali 13956 €. To je bistveno več kot je bila ocena 74 €³ za leto 2004 (Vodušek et al., 2008) in kot ocena za leto 2010, ki je znašala 9427 €⁴ (Bon et al., 2013). Naša ocena je primerljiva z ocenjenimi letnimi stroški na osebo z demenco v svetu za leto 2019, ki so v povprečju znašali 23796 US \$ (Wimo et al., 2023; WHO, 2021) in z oceno za leto 2010 za Evropo v višini 24565 US \$ (Wimo, & Prince, 2010).

Ocene stroškov za demenco so zahtevne, saj je le polovica ljudi z demenco diagnosticiranih, posledično je problematika podcenjena, pri čemer stroški zdravstva predstavljajo najmanjši delež v strukturi stroškov. Potrebno je čimprejšnje prepoznavanje bolezni in zgodnja diagnostika, saj z ustrezno obravnavo lahko upočasnimo proces bolezni, hkrati lahko natančneje beležimo in spremljamo stroške v zdravstvu. Največji delež stroškov gre na račun neformalne oskrbe, ki jo večinoma izvajajo svojci in je stroškovno podcenjena. V tem delu bi bilo smiselno razviti informacijski sistem za ovrednotenje in spremljanje stroškov gospodinjstva in svojcev, ki utrpijo največje breme demence.

² prilagojenih na pariteto kupne moči (€ PKM)

³ /standard kupne moči

⁴ prilagojenih na pariteto kupne moči (€ PKM)

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TELEMEDICINA IN DRUGE PODPORNE TEHNOLOGIJE PRI OSEBAH Z DEMENCO NA DOMU: POROČANE IZKUŠNJE OSEB Z DEMENCO IN NJIHOVE OCENE UPORABNOSTI

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Uvod: Po ocenah bo do leta 2050 v svetu 151 milijonov oseb z demenco. Demenca je med najpogostejšimi vzroki odvisnosti od pomoči drugih. Vzporedno z naraščanjem pogostosti demence narašča povpraševanje po storitvah zdravstvenega in socialnovarstvenega varstva, značilnost Slovenije je neenaka dostopnost do teh storitev, hkrati se soočamo s kritičnim pomanjkanjem strokovnega kadra zato so potrebne alternativne rešitve. Metode: Izvedli smo pregled literature v podatkovni bazi PubMed po metodologiji PRISMA. Osredotočili smo se na tiste prispevke, ki so vsebovali poročane izkušnje in ocene uporabnosti s strani oseb z demenco, ki so moderne tehnologije predhodno uporabile. Rezultati: V času pandemije covid-19 se je razširila uporaba modernih tehnologij, še posebej v času popolnega zaprtja družbe (lockdown), kar je omogočalo osebam z demenco in njihovim oskrbovalcem vzdrževanje socialnega stika, pomoč pri aktivnostih ter stika s službami zdravstvenega varstva. Zaključek: Telemedicina in druge podporne tehnologije pripomorejo k premostitvi vrzeli med potrebami in dostopnostjo storitev zdravstvenega varstva, pa tudi na drugih področjih v kolikor so osnovane in prilagojene potrebam oseb z demenco.

Ključne besede:

telemedicina,
elektronske
informatijske in
komunikacijske
tehnologije,
podporne
tehnologije,
covid 19,
demenca

TELEMEDICINE AND OTHER SUPPORTIVE TECHNOLOGIES FOR PEOPLE WITH DEMENTIA AT HOME: REPORTED EXPERIENCES OF PEOPLE WITH DEMENTIA AND THEIR UTILITY ASSESSMENTS

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Introduction: According to estimates, there will be 151 million people with dementia in the world by 2050. Dementia is among the most common causes of dependence on help from others. In parallel with the increase in the frequency of dementia, the demand for health and social care services is increasing, a characteristic of Slovenia is unequal access to these services, at the same time we are facing a critical shortage of professional staff therefore alternative solutions are needed. **Methods:** We performed a literature review in the PubMed database using the PRISMA methodology. We focused on those papers that contained reported experiences and assessments of usability by people with dementia themselves who had previously used modern technologies. **Results:** During the covid-19 pandemic, the use of modern technologies spread, especially during the complete closure of society (lock down), which enabled people with dementia and their caregivers to maintain social contact, help with activities and contact healthcare services. **Conclusion:** Telemedicine and other support technologies help to bridge the gap between the needs and accessibility of health care services, as well as in other areas, as long as they are based and adapted to the needs of people with dementia.

Keywords:
telemedicine,
electronic
information and
communications
technology,
supportive
technologies,
covid 19,
dementia

1 Uvod

Telemedicina (TM) predstavlja orodje, ki omogoča zagotavljanje zdravstvenih storitev na daljavo prek telekomunikacijske tehnologije (Gentry et al., 2019). Prva omemba "telemedicine" sega v leto 1897, ko je pediater na daljavo, preko telefona poslušal otrokov kašelj in diagnostično izključil davico pri čemer je bil otrok doma v postelji (Board on Health Care Services & Institute of Medicine, 2012). Ameriški inštitut za medicino (Institute of Medicine -IOM) je TM opredelil kot "uporabo elektronskih informacijskih in komunikacijskih tehnologij (IKT) za zagotavljanje in podporo zdravstvenemu varstvu, kadar razdalja ločuje udeležence" (IOM, 1996). TM in telezdravje vključujeta uporabo zdravstvenih informacij, ki se izmenjujejo prek elektronskih komunikacij z različnih lokacij z namenom izboljšanja zdravstvenega stanja bolnika. Telezdravje je krovni termin za vse zdravstvene storitve, ki se izvajajo s pomočjo informacijske in komunikacijske tehnologije, z izvajanjem zdravstvenih storitev na daljavo ter vključuje širšo skrb za zdravje in ni vezana le na bolne ljudi, ampak vključuje tudi postopke za ohranjanja zdravja. Bolniki se fizično nahajajo na drugi lokaciji kot zdravnik ali drugi zdravstveni delavec (American Telemedicine Association (ATA), 2020). TM definira rabo sodobne informacijske tehnologije, z namenom zagotavljanja zdravstvenih storitev bolnikom na daljavo in vključuje vse od zdravstvenega posveta in diagnostike do zdravljenja na daljavo (ATA, 2020).

Svetovna zdravstvena organizacija (SZO) je 11. marca 2020 razglasila svetovno pandemijo covid-19 (WHO, 2021). Uporaba TM se je s pojavom pandemije močno povečala (Shaver, 2022). Veliko ljudi se je prilagodilo novemu načinu dela in odnosu do uporabe IKT. Dokazano je, da so starejši ob uporabi IKT med pandemijo občutili olajšanje zaradi občutka povezanosti v socialnih omrežjih in skupnostih (Gedde et al., 2021; Park et. al, 2023). IKT lahko pripomore tudi k zmanjšanju težav s spominom, orientacijo, varnostjo, oskrbo, prejemanjem zdravil, kognitivno terapijo, aktivnim preživljanjem prostega časa z različnimi spletnimi aktivnostmi in izobraževanjem (Gathercole et al., 2021; Shaver, 2022; Park et. al, 2023).

V pričujočem pregledu literature smo zbrali poročane izkušnje in ocene uporabnosti s strani oseb z demenco, ki so TM, IKT predhodno uporabile na domu med in po epidemiji covid 19.

2 Metode

Izvedli smo sistematični pregled literature v skladu s smernicami metodologije PRISMA (angl. Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Page et al., 2021).

2.1.1 Strategija iskanja

Za sistematično iskanje smo uporabili podatkovno bazo PubMed. Pri iskanju smo uporabili naslednje ključne besede/zveze v angleškem jeziku (dementia, Alzheimer disease, telemedicine, telehealth, home) s pomočjo "Boolean operatorjev" (AND, OR). Iskalna strategija je bila: ("dementia" OR "Alzheimer's disease") AND ("telecare" OR "telehealth" OR "telemedecine" OR "ICT" OR "virtual visit" OR "assitive technology" OR innovation OR "AI") AND ("home dwelling" OR "home support" OR "homebound" OR "in-home" OR "home resident" OR "home based" OR "living at home" OR "home-setting").

2.1.2 Rezultati iskanja

V sistematičen pregled literature smo vključili objave v angleškem jeziku, med 1.3.2020 in 1.3.2023, izbrali smo obdobje, ki sovпада z epidemijo covid 19, ki je predstavljala razmah uporabe telemedicine. Identificirali smo 96 zadetkov.

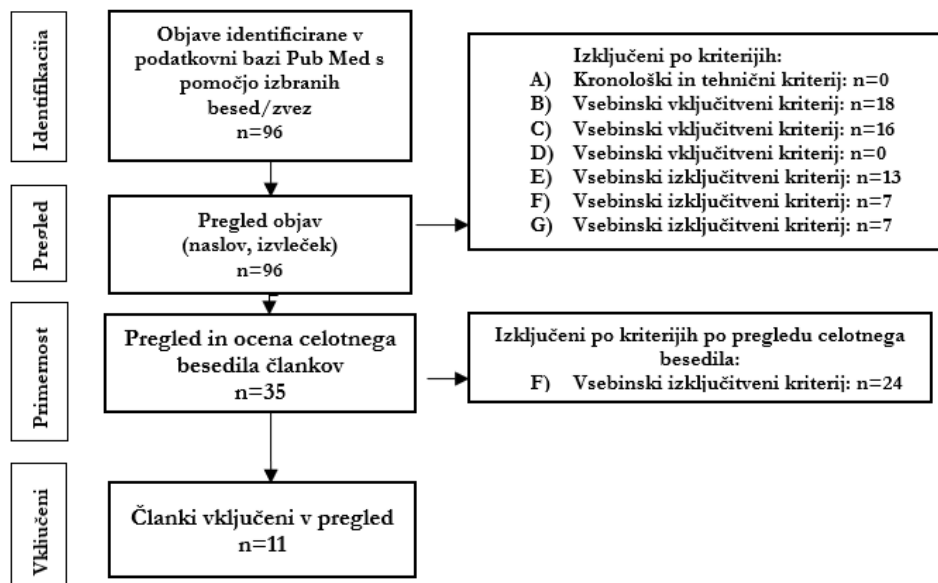
Vključili smo objave s posebej dokumentirano uporabnostjo telezdravja ali podpornih tehnologij pri ljudeh z Alzheimerjevo boleznijo ali demenco in z oskrbo na domu.

Oblikovali smo kriterije za identifikacijo ustreznih objav:

- A. Kronološki in tehnični kriterij: objavljeni članki med 1.3.2020 in 1.3.2023 in v angleškem jeziku;
- B. Vsebinski kriterij: objave, ki so proučevale uporabo TM, IKT, telezdravja in umetno inteligenco za izboljšanje počutja/zdravja;
- C. Vsebinski kriterij: raziskave, ki so vključevale osebe z Alzheimerjevo boleznijo ali drugimi demencami;

- D. Vsebinski kriterij: udeleženci raziskave so živeli v domačem okolju;
- E. Vsebinski kriterij: raziskave, ki so vključevale le neformalne oskrbovalce oseb z demenco;
- F. Vsebinski kriterij: raziskave, ki niso vsebovale povratnih informacij glede uporabe TM, IKT s strani oseb z demenco;
- G. Drugo: raziskave z uporabo telemedicine za diagnostiko, sistematični pregledi literature, metaanalize, raziskovalni protokoli, knjige, posterji.

V naslednjem koraku smo po pregledu naslovov in izvlečkov, na osnovi kriterijev, izločili 61 objav, ki niso ustrezale vsebinskim kriterijem A)-G). Za 35 objav smo pregledali celotno besedilo. V zadnjem koraku smo izbrali 11 objav, ki so vsebovale povratne informacije o TM, IKT s strani oseb z demenco (Slika 1).



Slika 1: Shematski prikaz pregleda literature z upoštevanjem kriterijev

3 Rezultati

Tabela 1. prikazuje izbrane objave po avtorju, letu, državi, metodi namenu, vzorcu in glavnih rezultatih.

Tabela 1: Pregled izbranih objav s poročanimi izkušnjami, ocenami uporabnosti s strani oseb z demenco, ki so tehnologije predhodno uporabile na domu

Avtor/Leto/Država	Metode	Nameni	Vzorec	Rezultati
Gathercole et. al, /2021/ Združeno kraljestvo	Randomizirana kontrolirana študija	Ugotoviti ali podporne tehnologije (PT) in teleoskrba podaljšajo čas, ko lahko ljudje z demenco še naprej samostojno živijo doma in ali so stroškovno učinkovite	495 oseb z demenco	<p>248 prejelo PT in teleoskrbo (102 moška in 146 žensk, povprečna starost 81,0 ($\pm 8,2$) let) in 247 v kontrolni skupini (omejen paket; 103 moški in 144 žensk, povprečna starost 80,8 ($\pm 7,4$) let.)</p> <p>Rezultati so pokazali slabo ujemanje med PT in potrebami po oskrbi na daljavo ter priporočili za oceno ($\tau=0,242$; $p<0,000$) ter zmerno ujemanje med priporočili za PT in oskrbo na daljavo ter napravami ($\tau=-0,470$; $p<0,000$).</p> <p>Celoten paket AT in oskrbe na daljavo ni podaljšal časa, ko so udeleženci z demenco ostali v skupnosti in ni povečal zdravstvenih in socialnih stroškov udeležencev ali družbenih stroškov.</p>
Puaschitz, Jacobsen, Berge & Husebo/ 2023/Norveška	Mešane	Raziskati dostopnost, izkušnje in uporabo notranjih alarmov za pomoč (pritisek tipke za priklic) med osebami z demenco in njihovimi neformalnimi oskrbovalci	278 dvojic: osebe z demenco in njihovi oskrbovalci, od tega 82 dvojic po 2 letih	<p>Povprečna starost bolnikov 83 let; 74,6 % žensk. Polovica bolnikov je živela sama, 58 % oskrbovalcev njihov otrok. 62,2 % bolnikov je imelo dostop do alarma za pomoč.</p> <p>54% bolnikov se ni zavedalo, da imajo alarm, 46% ga ni imelo pri sebi, v 19 % ga je uporabil le oskrbovalec, v 8% pa je bil uporabljen le kot lažen alarm. 28 % bolnikov je odgovorilo, da jim naprava daje lažen občutek varnosti (9,9 % oskrbovalcev); 14 % bolnikov je odgovorilo, da naprava nima nobene vrednosti (31,4 % oskrbovalcev). Oskrbovalci so pogosteje odgovorili, da naprava ni bila v uporabi (23,6 %) v primerjavi z bolniki (14 %).</p> <p>Po dveh letih se je povečalo število nameščenih alarmov iz 39,5 % na 68 %; povečala pogostost neuporabe socialnih alarmov z 17,7 % (12 mesecev) na 23,5 % (po 2 letih); osebe z demenco so se počutile manj varne 70 % (12 mesecev) in 60,8 % (po 2 letih); povečali so se občutki tesnobe.</p> <p>Dostop do alarma povezan z naraščajočo starostjo (86–97 let, $p = 0,005$) in če živijo sami ($p < 0,001$).</p>

Avtor/Le to/Držav a	Metode	Namen	Vzorec	Rezultati
Collins, Mohamed & Bayer/2021/Združeno kraljestvo	PDSA (Plan, Do, Check, Act) metoda	Ocena izvedljivosti telekonference (TK) in videokonference (VK) Centrov za demenco pri osebah z demenco, ki so čakale na prvi pregled med pandemijo covid 19.	100 zaporednih pacientov na čakalnem seznamu za prvi pregled	<p>100 zaporednih pacientov na čakalnem seznamu za prvi pregled: 45 se je odločilo za osebni pregled v kliniki, 21 za VK, 6 TK, 16 ni bilo dosegljivih in so jim ponudili termin za osebni pregled v kliniki, 12 pregledanih na domu/ hospitalizirani/umrli.</p> <p>Glavni razlog za odločitev za osebni pregled je bil v 80% nedostopnost interneta (brez naprav ali ne zna uporabljati interneta). Glavna razloga odločitve za VK in TK sta bila nepripravljenost priti v bolnišnico (59 %), priročnost (41%).</p> <p>Povprečna starost vseh udeležencev je bila 77.5 let, udeležencev VK 75 ($\pm 15,4$) let in TK 87,3 ($\pm 3,9$) let. Stopnja udeležbe je bila 100 % za VK in TK, 77 % za osebni pregled v kliniki.</p> <p>Izvedljivost (uspešna posvetovanja) je bila 90 % za VK in 67 % za TK</p> <p>V 94 % primerov VK so bolniki poročali: »Z zdravnikom sem se lahko pogovarjal, kot bi se na običajnem pregledu v bolnišnici in v 100 % primerov TK »Na splošno sem bil zadovoljen s svojim pregledom v kliniki«.</p>
Goodman-Casanova, Dura-Perez, Guzman-Parra, Cuesta-Vargas & Mayoral-Cleries/ 2020/Španija	Randomizirana kontrolirana študija	Ocena vpliva zagotavljanja televizijske in telefonske zdravstvene in socialne podpore ter ocena učinkov televizijske asistencne integrirane tehnologije TV-AssistDem.	93 udeležencev z blago kognitivno motnjo/blago demenco	<p>Intervencijska skupina N=47 (51 %) in kontrolna skupina N=46 (49 %). Povprečna starost udeležencev 73,3 ($\pm 6,1$) let, 65 % žensk. Med dvema skupinama ni bilo pomembnih razlik pri: sociodemografskih značilnostih, spremenljivkah zdravstvenega stanja ali v povezani s Covid-19 ter glede splošnega zdravja, duševnega zdravja, dobrega počutja ali spanja. Anketiranci s TV-AssistDem so izvajali več vaj za spomin kot kontrolni udeleženci (24/93, 52 % proti 8/93, 17 %; $p < 0,001$).</p> <p>Rekreacijske dejavnosti so pokazale koristi pri obvladovanju zahtevnih situacij in so pripomogle k boljшему obvladovanju posledic socialne izolacije.</p>
Sari, Burtora, Lee & Hill/2023/Indonezija	Pre in post intervencijska	Raziskati izvedljivost, učinke telezdravja- fizioterapija na daljavo (12 tednov), trajanje izvajanja samostojnih vaj po 6-tednih	30 dvojic, osebe z demenco in njihovi neformalni oskrbovalci	<p>Od 15 bolnikov so se 4 umaknili med 12-tedensko intervencijo in eden med 6-tedenskim samostojnim izvajanjem vaj. Vse osebe so lahko izvajale vaje. O padcih, eželenih dogodkih niso poročali.</p> <p>Povprečna stopnja sodelovanja med 12-tedensko intervencijo fizioterapije na daljavo je bila 84,1 % in 66,7 % v obdobju izvajanja samostojnih vaj po 6 tednih.</p> <p>Udeleženci so zaznali pozitivne zdravstvene in psihološke koristi in so bili s programom zadovoljni. Program telezdravja je izvedljiv in varen ter ima lahko koristi za zdravje.</p> <p>Raven telesne dejavnosti, nekateri vidiki delovanja (spodnje okončine) in invalidnosti, koristi vadbe za zdravje, užitek pri vadbi in kakovost življenja so se znatno izboljšale po 12 in po 18 tednih.</p>

Avtor/Le to/Držav a	Metode	Namen	Vzorec	Rezultati
Stara, Vera, Bolliger, Rossi, Felici, Di Rosa, de Jong & Paolini/2021/ Italija	Mešana	Oceniti uporabnost in sprejemljivost virtualne pogovorne agentke Anne, oceniti sposobnost ciljnih uporabnikov, da samostojno uporabljajo sistem in iz njega prejemajo dragocene informacije.	20 oseb z demenco	6 moških in 14 žensk. 6 udeležencev je že imelo izkušnje z uporabo tabličnih računalnikov za prostočasne aktivnosti in je imelo srednjo ali visoko stopnjo izobrazbe. Udeleženci so bili povprečno stari 75,5 ($\pm 4,2$) let. Udeleženci so virtualno pogovorno agentko Anne dojemali: kot način za izboljšanje počutja (70 %), kot prijateljico 40 %, v 30 % ni bilo povezave med kakovostjo življenja in Anne. Nihče od udeležencev ni odstopil od preskušanja, vsi pa so podali koristne povratne informacije za lažje razumevanje zbranih podatkov. Anne so dojemali kot spremljevalko, ki lahko pomaga pri težavah s spominom in pripomore k boljšem počutju, služila je kot vir zabave in kot način za obravnavo upoštevanja načrtov zdravljenja.
Marin, DeCaro, Schiloski, Elshaar, Dwyer, Vives-Rodriguez, Palumbo, Turk., & Budson/2022/ZDA	Randomizirana, kontrolirana študija	Ocena izvedljivosti individualiziranega kognitivnega usposabljanja z uporabo konstantne terapije (KT) pri bolnikih na domu.	19 udeležencev z blago kognitivno motnjo ali demenco	10 v skupini KT in 9 v kontrolni skupini (KS). Povprečna starost bolnikov v skupini KT je bila 72,5 let, v KS 75,0 let. Podatke so zbirali 48 tednov. Stopnja sodelovanja v raziskavi po 24 tednih je bila 80 % v KT in 55 % v KS. Celotna vzdržna uspešnost pri računalniško podprtih nalogah kaže, da je individualiziran pristop k usposabljanju, ki ga modelira KT, primeren za populacijo z Alzheimerjevo boleznijo. V povprečju so udeleženci v skupini KT uporabljali aplikacijo 121,4 dni (od 168 dni), pri čemer so aplikacijo uporabili 31,7 minut na dan. Računalniško podprto kognitivno usposabljanje lahko vodi do izboljšav v kognitivni uspešnosti na področju izvršilnih funkcij.
Park, Mishra, York, Enriquez, Lindsay, Barchard, Vaziri & Najafi/2022/ZDA	Študija dokazovanja koncepta	Ocena sprejemljivosti in izvedljivosti interaktivnega vadbenega sistema	14 oseb z blago kognitivno motnjo ali demenco	Udeleženci so bili v povprečju stari 68,1 ($\pm 5,4$) let, 12 žensk, 2 moška. Za 35,7 % udeležencev je bilo ugotovljeno, da jih zelo skrbi padec, 28,6 % je imelo tveganje za klinično depresijo. Po zaključku 6 tednov vadbe tele Exergame na domu so udeleženci občutno izboljšali kognitivne sposobnosti, znižala se je tesnoba. Odnos do uporabe sistema je bil pozitiven. Rezultati podpirajo sprejemljivost, izvedljivost, zaznane koristi, potencialno korist za ohranjanje kognitivnih funkcij.

Avtor/Lectro/Država ^a	Metode	Namen	Vzorec	Rezultati
Harris, Boyd, Evans, Cheston, Noonan, Ingram, Jarvis & Ridgers/2021/Združeno kraljestvo	Preliminarna ocena	Razviti napravo za spodbujanje, ki bi jo lahko neodvisno uporabljal oseba z demenco in njen oskrbovalec v domačem okolju z malo ali brez usposabljanja	14 dvojic (oseba z demenco in oskrbovalec)	<p>Od 14 bolnikov z demenco so se 3 umaknile pred začetkom programa. Osebe z demenco so bile v povprečju stare 81 ($\pm 5,9$) let, 4 moški, 7 žensk. Ljudje z demenco in njihovi oskrbovalci lahko uspešno uporabljajo tablični računalnik z zaslonom na dotik in programsko opremo za pozivanje k dokončanju nalog brez dodatne podpore.</p> <p>Na koncu 4-tedenskega preskušanja je vseh 11 dvojic poročalo, da jim je uspelo vsaj eno dejavnost razčleniti na korake in jih nato naložiti v tablico.</p> <p>8/11 dvojic je poročalo, da je oseba z demenco lahko prebrala navodila na tablici in jim sledila, da je uspešno opravila vsaj en korak v nalogi.</p> <p>Od 22 ciljev oseb z demenco je bilo: 14 v celoti izpolnjenih, 1 delno izpolnjen in 7 neizpolnjenih.</p> <p>Večina doseženih ciljev (8) se je nanašala na osamosvojitve.</p>
Park, Hung, Randhawa, Surage, Sullivan, Levine & Ortega/2023/ZDA	Kvalitativna	Prepoznavanje prednosti, izzivov in spodbujevalnih dejavnikov pri virtualni jogi in druženju	8 oseb z demenco	<p>Fokusnih skupin se je udeležilo 8 oseb z demenco, 5 moških in 3 ženske. Povprečna starost je bila 81,4 ($\pm 8,7$) let.</p> <p>8-tedenska spletna intervencija joge se je izkazala kot koristna za čustveno regulacijo in duševno zdravje, boljši spanec in telesno izboljšanje.</p> <p>Prvi izziv so bile tehnološke težave zaradi nepoznavanja videokonferenc, drugi je bila omejena socialna interakcija.</p>
Ladckjer Larsen, Waldorff, Hansen & la Cour/2022/Danska	Kvalitativna	Identificirati ovire in prednosti za uporabnost tehnologije, ki temelji na gibanju	4 od 23 oseb z demenco	<p>4 bolniki (stari od 67 do 82 let), 3 moški in 1 ženska. Dva udeleženca sta uživala, saj sta lahko nadzorovala pogostost in intenzivnost vadbe, za ostale je bila težava v tehnologiji, postavitvi naprave ali pomanjkanju motivacije za samostojno opravljanje vadbe in na splošno niso bili zadovoljni z zamenjavo skupinske vadbe z vadbo na domu.</p> <p>Ni jasnega odgovora ali povečuje kakovost življenja, predstavlja možnost dodatka k skupinskemu treningu.</p>

Indonezijski avtorji (Sari, Burton, Lee & Hill, 2023) so proučevali izvedljivost, učinke in stopnjo sodelovanja pri telezdravju-fizioterapiji na daljavo. Udeleženci z demenco so izvajali 12-tedenski fizioterapevtski program telezdravstvene vadbe prek spleta z nadzorom fizioterapevta in neformalnega oskrbovalca in so nadaljevali s samostojnimi vajami še šest tednov (brez spletnega nadzora fizioterapevta). Avtorji zaključujejo, da je program telezdravja izvedljiv in varen ter ima lahko koristi za zdravje oseb z demenco, ki živijo v skupnosti.

V italijanski raziskavi (Stara, Vera, Bolliger, Rossi, Felici, Di Rosa, de Jong & Paolini, 2021) so avtorji ocenjevali uporabnost in sprejemljivost entitet, ki temeljijo na zaslonu in so zasnovane za spodbujanje človeških pogovornih veščin iz »oči v oči«, kar omogoča naravno interakcijo med človekom in strojem oziroma virtualni pogovornim agentom Anne (Embodied Conversational Agents -ECA). Za Anne je bil dosežen pozitiven odziv s povprečno oceno 67,1 (v primerjavi s sprejemljivo povprečno oceno 68). Na splošno so udeleženci pokazali pozitiven pristop do Anne: po 4 tednih uporabe so bili manj zaskrbljeni zaradi interakcije z Anne in bolj veščini osnovnih funkcij, polovica je zaznala vlogo ECA. Zdi se, da bi lahko bili ECA obetaven način za obvladovanje zdravja in dobrega počutja oseb z demenco, če bi bili zasnovani, razviti in ocenjeni v okolju uporabnikov in skupaj z njimi. Avtorji zaključujejo, da se je smiselno usmeriti v proces bolezni od najzgodnejših faz in slediti osebi skozi celotno pot, da bi pripomogli k spodbujanju zdravega staranja in izboljšali življenje starejših oseb, njihovih družin in celotne skupnosti.

Avtorji Marin, DeCaro, Schiloski, Elshaar, Dwyer, Vives-Rodriguez, Palumbo, Turk & Budson (2022) so v ZDA ocenjevali izvedljivosti domačega, samostojnega in dolgoročnega individualiziranega kognitivnega usposabljanja z uporabo konstantne terapije (KT) pri bolnikih z Alzheimerjevo boleznijo in oceno predhodne učinkovitost programa usposabljanja za KT z oceno kognitivnih sposobnosti in vsakodnevnega funkcioniranja. Pred začetkom intervencije so bili udeleženci usposobljeni za uporabo aplikacije KT in kako krmariti po Apple iPadu (kako dostopati do aplikacije, preklapljati med nalogami in dokončati vsako posamezno nalogo). iPade so udeležencem posodili, če jih niso imeli. Dolgotrajna uporaba programa KT in uspešnost pri računalniško podprtih nalogah je bila izvedljiva pri populaciji bolnikov z Alzheimerjevo boleznijo. Računalniško podprto kognitivno usposabljanje lahko vodi do izboljšav na področju izvršilnih funkcij. Bolniki so sčasoma bolj natančno izvajali naloge na področjih: spomin (vizualni in slušni), pozornost in računanje. Zmanjšala se je zakasnitev pri nalogah povezanih z vizualno-prostorsko obdelavo, vidnim in slušnim spominom, pozornostjo, kvantitativnim sklepanjem in veščinami računanja. Hitrejši reakcijski čas lahko pomeni izboljšanje hitrosti obdelave, pa tudi izboljšano prilagodljivost računalniškim nalogam. Hitrejši reakcijski čas, ki ni povezan z izboljšano natančnostjo, lahko predstavlja tudi povečano dezinhibicijo med izvajanjem naloge.

Rezultati ameriške raziskave (Park, Mishra, York, Enriquez, Lindsay, Barchard, Vaziri & Najafi, 2022) podpirajo sprejemljivost, izvedljivost, zaznane koristi, potencialno korist za ohranjanje kognitivnih funkcij pri osebah z blago kognitivno motnjo in demenco ter pozitiven odnos do uporabe sistema. Udeleženci so bili vključeni v interaktivni vadbeni sistem s senzorji, imenovan tele-Exergame, za izboljšanje ravnotežja in kognitivnih sposobnosti med motečim pogojevanjem z nadzorom na daljavo preko vmesnika za telemedicino.

Avtorji Harris, Boyd, Evans, Cheston, Noonan, Ingram, Jarvis & Ridgers (2021) so za osebe z demenco razvili prototipni paket: tablični računalnik z zaslonom na dotik z uporabniku prijaznim vmesnikom, programsko opremo po meri in pripadajočim priročnikom. Namen je bil uporabiti komplet orodij za izvajanje aktivnosti (npr. pripraviti preprost prigrizek, prižgati glasbo/TV ipd). Med udeleženci so bile osebe z demenco in njihovi oskrbovalci (dvojice). Avtorji izpostavljajo, da lahko ljudje z demenco in njihovi oskrbovalci uspešno uporabljajo tablični računalnik z zaslonom na dotik in programsko opremo za pozivanje k dokončanju nalog brez dodatne podpore.

Avtorji Ladekjær Larsen, Waldorff, Hansen & la Cour (2022) so v danski kvalitativni raziskavi proučevali dejavnike, ki vplivajo na uporabo tehnologije, ki temelji na gibanju (Motion-Based Technology- MBT). Intervenca je temeljila na spletnem administrativnem sistemu. Inštruktor (fizioterapevt) je sestavil program usposabljanja na osnovi telesnih zmožnosti vsakega udeleženca in je bil nameščen na napravi, ki se uporablja na domu (zaslon na dotik, kamera, modem). Program je udeleženca vodil prek besedila na zaslonu, zvoka in videa. Kamera je registrirala gibanje udeleženca s povratnimi informacijami iz naprave, če so bile vaje izvedene nepravilno. Podatki naprave so bili dostopni vodilnemu fizioterapevtu. Raziskava je bila izvedena z uporabo več kvalitativnih metod (opazovanja udeležencev, polstrukturirani individualni intervjuji, intervjuji s fokusnimi skupinami in neformalni intervjuji med opazovanjem udeležencev). Raziskava je izpostavila možne koristi in izzive tehnologije, ki temelji na gibanju: občutek izgube priložnost biti s podobno mislečimi člani pri skupinski vadbi; zaslon je lahko povečal občutek svobode in neodvisnosti ali je povzročil konflikte med zakonci.

4 Diskusija in zaključek

Leta 2019 je bilo v svetu več kot 57 milijonov oseb z demenco, do leta 2050 bo po projekcijah več kot 153 milijonov oseb z demenco (GBD 2019 Dementia Forecasting Collaborators, 2022). V EU (EU27) je leta 2018 živel 7,9 milijonov oseb z demenco, v Sloveniji 34.137 (Alzheimer Europe). Do leta 2050 naj bi se v Evropi število primerov demence povečalo za 74 % (Wafa et al., 2020; GBD 2019 Dementia Forecasting Collaborators, 2022), kar je predvsem posledica podaljševanja pričakovane življenjske dobe in naraščanje deleža prebivalstva starega 80 let ali več. Oba pogoja pojasnjujeta pomemben delež stroškov invalidnosti in oskrbe pri prebivalstvu, starejšem od 80 let. Vzporedno naj bi se stroški oskrbe oseb z demenco do leta 2050 povečali za 270 % (Cimler et al., 2019). Z zamikom nastopa bolezni demence za pet let bi lahko do leta 2040 zmanjšali stroške demence za 40 %, tako bi v prihodnje lahko deloma zmanjševali stroške z zamikom začetka bolezni (in s tem invalidnosti), upočasnitvijo bolezni, poleg tega bi bilo potrebno osredotočiti preventivo predvsem v predklinične faze bolezenskega procesa hkrati bi bilo smiselno krepiti zdravje in zamakniti staranje možganov (Alzheimer's Association, 2015). Ob hkratnem hitrem naraščanju primerov demence, naraščanju stroškov in ob pomanjkanju kapacitet za socialnovarstvene namestitve ter ob pomanjkanju strokovnega kadra bi bila lahko v pomoč tudi TM in IKT, ki predstavljajo učinkovita orodja ne glede na geografsko lokacijo (König et al., 2021). Novi znanstveni in tehnološki razvoj lahko ponudi nove rešitve za potrebe starejših oseb z demenco, kot so okrevanje, neodvisnost in podaljšanje zdravega življenja (Gedde et al., 2021; Harris et al., 2021).

Norveški avtorji so ugotovili, da se pri osebah z demenco, ki živijo doma povečuje zanimanje in uporaba za IKT, pred pandemijo je 71 % vključenih v raziskavo uporabljala IKT (predvsem tradicionalne naprave, kot so varnostni gumbi, varovala za štedilnik, senzorske tehnologije npr. GPS in detektor padca in podpora za jemanje zdravil), kot odziv na covid 19 se je zanimanje za IKT povečalo za 17% (Gedde et al., 2021). Pandemija je izpostavila pomembno vlogo TM v sistemu zdravstvenega varstva. Starejše je smiselno seznaniti in opolnomočiti za uporabo IKT in jim približati tak način koriščenja zdravstvenih storitev (Gedde et al., 2021).

Raziskava izvedena v Honk-Kongu je pokazala splošne koristi telezdravja prek videokonference za osebe z demenco in je kljub omejitvam pandemije pripomogla k ohranitvi in izboljšanju zdravja oseb z demenco (Lai et al, 2020). Tehnologija, ki omogoča osebam z demenco dostop do TM ob uporabi aplikacij za pametne telefone, prenosnih naprav, računalniških programov in e-učenja, bi lahko izboljšala odpornost in dobro počutje tako oseb z demenco kot njihovih oskrbovalcev (Collins et al, 2021; Goodman-Casanova et al., 2020; Harris et al., 2021; Park et al., 2023; Park et al., 2022; Sari et al., 2023; Stara et al., 2021).

Možnosti interdisciplinarnega obvladovanje bolezni na daljavo bo povečalo sodelovanje med različnimi deležniki, zdravstvenimi in socialnimi službami, združenji bolnikov, informatiki in raziskovalci. Rezultat za bolnike z demenco je lahko izboljšanje kognitivnih sposobnosti in vsakodnevnih življenjskih aktivnosti, ki pripomorejo k bolj samostojnem življenju na domu (Collins et al, 2021; Goodman-Casanova et al., 2020; Marin et al., 2022; Sari et al., 2023).

Iz pregleda literature izhaja, da osebe z demenco, ki živijo doma lahko uporabljajo TM in IKT, slednje so jim lahko v pomoč, lahko podajajo lastne izkušnje in oceno uporabnosti, smiselno je razvijati tehnologijo na osnovi potreb oseb z demenco in skupaj z njimi (Collins et al, 2021; Goodman-Casanova et al., 2020; Harris et al., 2021; Park et al., 2023; Park et al., 2022; Sari et al., 2023; Stara et al., 2021).

Omejitve pregleda literature vključuje kratko časovno obdobje, vendar se je uporaba TM in IKT med osebami z demenco povečala v času pandemije Covid-19 in po njej. Druge omejitve so bile heterogenost študij, težave s primerljivostjo, relativno majhno število raziskav in vzorcev, subjektivno dojetje izkušenj zlasti pri ljudeh s kognitivnimi motnjami.

Prednosti prispevka so predvsem ozaveščanje glede omejene raziskanosti tematike, še posebej glede izkušenj in uporabnosti TM, IKT pri osebah z demenco, ki živijo doma ter glede potencialnih možnosti za razvoj področja.

Pregled literature poudarja pomen uporabe tehnologij pri osebah z demenco, možnosti, da ostanejo dlje časa v domačem okolju in da lahko osebe z demenco tudi ocenjujejo, katere tehnologije so jim najbolj v pomoč.

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DEMENCA IN UMETNA INTELIGENCA: UPORABA ASISTENČNIH SOCIALNIH ROBOTOV

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Ozadje: Pri svetovnem prebivalstvu se podaljšuje življenjska doba, z naraščanjem starosti se povečuje tveganje za demenco. Po napovedih bomo do leta 2050 imeli na svetu več kot 150 milijonov oseb z demenco, ki so z napredovanjem bolezni vse bolj odvisne od pomoči drugih in socialnovarstvene namestitve. Trenutno v svetu potekajo raziskave uporabnosti umetne inteligence (UI) na področju demence. **Metode:** V skladu z metodologijo PRISMA smo pregledali obstoječo literaturo v podatkovni bazi PubMed na podlagi izbranih ključnih besed. **Rezultati:** Možnosti uporabe UI in asistenčnih socialnih robotov (ASR) na področju demence so obetavne. UI lahko pomembno pripomore na področju diagnosticiranja bolezni, spremljanja napredovanja bolezni in pri oskrbi ter podpori oseb z demenco na domu, kar predstavlja možnost daljšega bivanja v domačem okolju in daljšo samostojnost oseb z demenco. **Zaključek:** Ob naraščajočih potrebah oseb z demenco, ki so vse bolj odvisne od pomoči drugih, in ob pomanjkanju strokovnega kadra v sistemu zdravstva in sociale lahko predstavlja UI pomemben doprinos k zdravstvenemu in socialnem varstvu ter k boljši kakovosti življenja.

Ključne besede:

demenca,
umetna
inteligenca,
asistenčni
socialni
roboti,
zdravstveno
varstvo,
socialno
varstvo

DEMENTIA AND ARTIFICIAL INTELLIGENCE: USE OF SOCIAL ASSISTIVE ROBOTS

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Background: As the world's population lives longer, the risk of dementia increases with age. According to projections, by 2050 there will be more than 150 million persons with dementia in the world. As the disease progresses they are increasingly dependent on the help of others and social care facilities. Currently, research regarding the use of artificial intelligence (AI) in the field of dementia is ongoing worldwide. **Methods:** In accordance with the PRISMA methodology, we reviewed the existing literature in the PubMed database based on selected keywords. **Results:** The possibilities of using UI and assistive social robots (ASR) in the field of dementia are promising. UI can significantly help in the field of diagnosing dementia, monitoring the progression of the disease, and in the care and support of persons with dementia at home, which represents the possibility of a longer stay in the home environment and longer independence of persons with dementia. **Conclusion:** Given the growing needs of people with dementia who are increasingly dependent on the help of others and the lack of professional staff in the health and social care system, UI can make an important contribution to health and social care and to a better quality of life.

Keywords:

dementia,
artificial
intelligence,
assistive
social
robots,
health
care,
social
care

1 Uvod

Demenca predstavlja vodilni vzrok v svetu za invalidnost in odvisnost od pomoči drugih pri starejših. Demenca ni normalen pojav staranja temveč je bolezen, ki vpliva na spomin, kognitivne sposobnosti in vedenje ter posledično ovira sposobnost opravljanja vsakodnevnih aktivnosti, s tem postaja oseba z demenco vse bolj odvisna od pomoči drugih. S staranjem tveganje za demenco narašča. Približno 50 milijonov ljudi po vsem svetu ima demenco, po ocenah se bo število do leta 2050 potrojilo na 152 milijonov (WHO, 2018). Demenca ja najpogostejša v starosti, ko imajo osebe tudi več pridruženih kroničnih bolezni (Lee et al., 2019). Zaradi specifične bolezni je nega na domu oseb z demenco zahtevna, pogosto zanje skrbijo neformalni oskrbovalci, ki so družinski člani. Poleg tega je povpraševanje po institucionalnih nastanitvah večje od dejanskih možnosti, zato so pogosto družinski člani primorani skrbeti za osebe z demenco tudi v bolj napredovanih fazah bolezni (Kuo T-C et al., 2008).

Umetna inteligenca (UI) (artificial intelligence - AI) je zmožnost stroja, da izkazuje človeške lastnosti, kot so mišljenje, učenje, načrtovanje in kreativnost (Evropski parlament, 2021). Leta 1956 se je v Dartmouthu (Dartmouth College) začela zgodovina UI kot znanosti in inženiringa izdelave inteligentnih strojev. Takrat se je prvič zbrala skupina matematikov in računalniških znanstvenikov, ki je pričela z raziskovanjem tega področja (Kun-Hsing et al., 2018; Mishra in Li, 2020; Rijcken, 2019). V zdravstvu se UI uporablja za analizo velikih količin zdravstvenih podatkov ter iskanjem vzorcev, ki bi pripeljali do novih odkritij v medicini in izboljšali diagnostiko (Evropski parlament, 2021).

Na področju demence izstopa razvoj in uporaba UI predvsem za diagnostiko, ki je natančna in hitra (Tsoi et al., 2023). Na raziskovalnem področju potencial uporabe UI vključuje vse od presejanja in odkrivanja, diagnosticiranja do napovedovanja bolezni (Merkin et al., 2022; Tsoi et al., 2023). UI služi pri napovedovanju bolezni ter kognitivnem presejanju, na področju kognitivne stimulacije, je v pomoč pri negi in obravnavi oseb z demenco (Ford et al., 2023; Ranson et al., 2023). UI je v pomoč tudi pri izvajanju posebnih testov in preiskav za učinkovitejše obvladovanje demence (de la Fuente Garcia, 2020; Eun et al., 2022).

Posebno področje, kjer se prepletata UI in robotika predstavljajo socialni roboti, še posebej asistenčni socialni roboti (ASR) (socially assistive robots - SAR). Slednji na področju demence predstavljajo naprave, ki pomagajo ljudem pri njihovi socialni interakciji. Imajo lahko obliko robotskih hišnih ljubljencev (RHL), spremljevalcev, servisnih robotov ali njihovih kombinacij (Bedaf et al., 2015; Fardeau et al., 2023). V zdravstvu se ASR uporabljajo na različnih področjih, od vodenja razgovora na pregledu (van der Putte et al., 2019), izvajanja terapevtskih nalog s kognitivnim treningom (Kim et al., 2015), pomoči pri razvrščanju terapije npr. tablet (Wilson et al., 2016), zmanjševanju stresa in izboljšanju razpoloženja (Kang et al., 2020), spodbujanju socialnih interakcij pri osebah z demenco (Kang et al., 2020).

Namen pregleda literature je bil ugotoviti kakšne so možnosti uporabe socialnih robotov z umetno inteligenco ali asistenčnih socialnih robotov (ASR) pri obravnavi bolnikov z demenco in kakšni so učinki teh intervencij.

2 Metode

Izvedli smo sistematični pregled literature v skladu s smernicami metodologije PRISMA (angl. Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Page et al., 2021). Za sistematično iskanje smo uporabili podatkovno bazo PubMed. Pri iskanju smo uporabili naslednje ključne besede/zveze v angleškem jeziku (dementia and socially assistive robots). Osnovna iskalna strategija je bila: ("dementia" OR "Alzheimer's disease" OR "cognitive impairment") AND ("social robots" OR "socially assistive robots").

V sistematičen pregled literature smo vključili objave od leta 2018 (6 let). Identificirali smo 72 zadetkov.

Oblikovali smo kriterije za identifikacijo ustreznih objav:

- A. Kronološki in tehnični kriterij: objavljeni članki od leta 2018 v angleškem jeziku;
- B. Vsebinski kriterij: raziskave, ki so vključevale osebe z Alzheimerjevo boleznijo ali drugimi demencami;
- C. Vsebinski kriterij: raziskave, ki so vključevale socialne robote, asistenčne socialne robote;

- D. Vsebinski kriterij: raziskave, ki so vključevale preučevanje učinkov uporabe socialne robote, asistenčne socialne robote;
- E. Izključitveni kriterij: raziskovalni protokoli, knjige, posterji, raziskave na živalskih modelih, etika, metodologija, strategija, drugo.

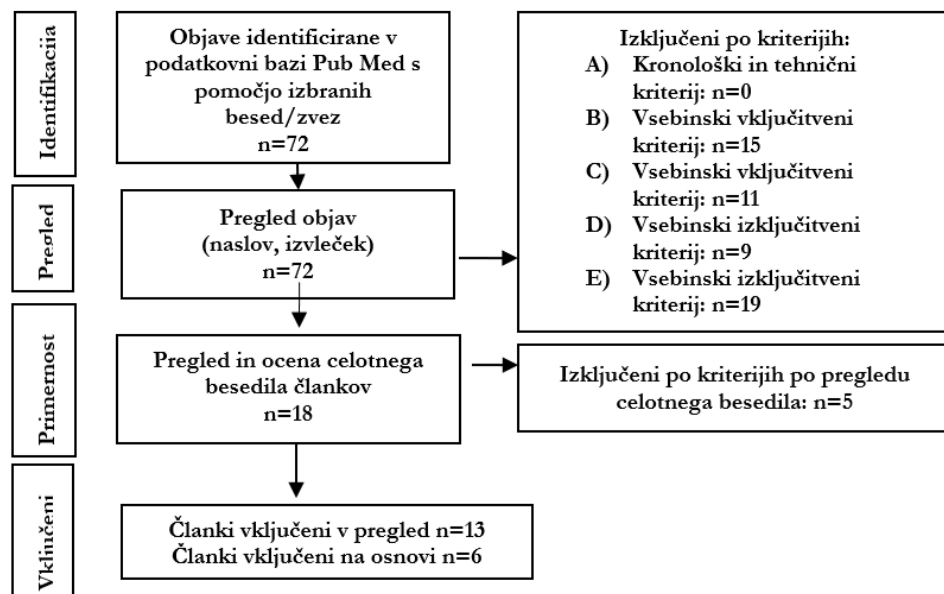
V naslednjem koraku smo po pregledu naslovov in izvlečkov, na osnovi kriterijev, izločili 54 objav, ki niso ustrezale vsebinskim kriterijem (A-E).

Za 18 objav smo pregledali celotno besedilo. V zadnjem koraku smo izbrali 13 objav, ki so strezale kriterijem (Slika 1). S pregledom referenc pri pregledu besedil v polnem obsegu smo vključili še 6 zadetkov.

3 Rezultati

3.1 Rezultati iskanja literature

Shematski prikaz pregleda literature je prikazan na Sliki 1.



Slika 1: Shematski prikaz pregleda literature z upoštevanjem kriterijev

3.2 Rezultati pregleda literature

V tabeli 1. je prikazan pregled uporabe socialnih robotov z umetno inteligenco pri osebah z demenco po posameznih socialnih robotih in glavnih ugotovitvah.

Tabela 1: Pregled glavnih ugotovitev uporabe posameznih socialnih robotov z umetno inteligenco pri osebah z demenco

Socialni robot	Metode	Avtor, leto	Glavni rezultati
PARO	Kvalitativna	Moyle et al., 2018	Izboljša kvaliteto življenja: zmanjšuje vznemirjenost, pomaga pri osamljenosti, izboljšuje socialne veščine, občutke zaupanja, izboljšuje komunikacijo, občutke pripadnosti, občutek za skrb drugega. Izboljša razpoloženje. Prilagoditve k izboljšanju zdravja s preprečevanjem padcev zaradi tavanja
PARO	Kvalitativna	Moyle et al., 2019b	Positivne koristi, izboljšuje razpoloženje, izboljša počutje, spodbuja komunikacijo, oseba ima občutek nadzora nad lastnimi odločitvami in spoštovanja pravic.
PARO	Kvalitativna	Moyle et al., 2019a	Nudi stimulacijo, tolažbo, spodbuja druženje, zmanjšuje tesnobo, izboljša dobro počutje, spodbuja verbalno in vizualno sodelovanje, izboljšuje izražanje ugodja, zmanjšuje nevtralnno čustvovanje, zmanjšuje vznemirjenost, občutki odgovornosti za skrb in občutke povezanosti.
PARO	Kvalitativna	Pu et al., 2020	Dojemanje robota kot prijatelja, s katerim se lahko pogovarjajo, z občutki sproščenosti in tolažbe. Manj občutkov osamljenosti, sramežljivosti, zaskrbljenosti. Distrakcija, prinaša srečo in veselje, modulira razpoloženje in zmanjšuje potrebo po protibolečinskih zdravilih.
PARO	Sistematični pregled literature	Kang et al., 2020	Spodbuja spremembe v pozitivnem razpoloženju, vključno z dobrim počutjem in nasmehom. Ugodni učinki na manjšo porabo zdravil. Izboljšanje kognitivnih sposobnosti ni glavni cilj.
PARO	Sistematični pregled literature	Góngora Alonso et al., 2019	Positiven vpliv na osebe (komunikacija in pripravljenost za delo z osebami z demenco). Pri uporabi robota izboljšanje kognitivnih funkcij, zlasti izvršilnih in spominskih funkcij. Pozitivni učinki na razpoloženje, dobro počutje. Podpora samostojnosti z izboljšanjem komunikacijskih sposobnosti, ki so pomembne pri vsakodnevnih aktivnostih. Podpora za samostojnost. Zmanjšanje stresa (nižja raven kortizola v slini in izboljšanje spanja).

Socialni robot	Metode	Avtor, leto	Glavni rezultati
PARO	Měšana	Demange et al., 2018	<p>Prijetna izkušnja povečuje subjektivno dojetanje čustvenega dobrega počutja.</p> <p>Kvalitativni del raziskave: spodbuja izražanje čustev, interpretacija vedenja robota in sprožanje spominov.</p> <p>Kvantitativni del raziskave: učinek intervencije z robotom je večji pri vznemirjenih bolnikih v primerjavi z depresivnimi bolniki. Ugoden učinek na vznemirjene bolnike so pripisali akutnemu pomirjujočemu učinku taktilne stimulacije in zmanjšanju ravni kortizola.</p> <p>Zmanjševanje negativnih občutkov zlasti pri bolnikih v ustanovah, ki lahko trpijo zaradi bolečin in/ali drugih kroničnih bolezni.</p>
PARO	Sistematični pregled literature	Hung et al., 2019	<p>Izboljša družbeno angažiranost, izboljša udeležbo v dejavnostih in spodbuja komunikacijo. Občutki pripadnosti in topline. Manjša poraba zdravil (psihotropnih zdravil). Zmanjšuje stres osebja in izgorelosti negovalcev. Koristi pri zmanjševanju psiholoških in vedenjskih simptomov demence.</p> <p>Izboljša kakovost življenja z zmanjšanjem simptomov demence.</p>
PARO	Sistematični pregled kvalitativnih in kvantitativnih raziskav	Abbott et al., 2019	<p>Spodbuja druženje, angažiranost, verbalno komunikacijo (z roboti ali z drugimi). Robota dojemajo kot prijatelja. Spodbuja spomine kar vodi v boljšo komunikacijo z osebjem in družinskimi člani. Pozitiven odziv bolnikov je prepoznan s strani osebja institucije in je v pomoč pri izboljšanju negovalne skupnosti. Pogovor z robotom izboljša zaupanje in je v pomoč pri komunikaciji z osebjem, ugodno vpliva na razpoloženje. Pozitivni učinki so se odražali kot več telesnih stikov, božanje, objemanje, pa tudi v izboljšanju razpoloženja, zmanjševanje depresivnih simptomov, manj vedenjskih težav. Varovanci so bili bolj pozorni, ko so bili vključeni v aktivnosti z robotom. Robot predstavlja zabaven način preusmerjanja, predvsem pri vznemirjenih ali žalostnih bolnikih, predstavlja priložnost za igro in zabavo. Robot predstavlja možnost tehte pri zaključevanju življenja in verbalizaciji čustev. Robot predstavlja priložnost za komunikacijo, izražanje misli, občutkov, frustracij. Kvalitativni rezultati predstavljajo številne pozitivne vidike in izboljšave. Kvantitativni rezultate niso pokazali značilnih razlik v primerjavi z obravnavo, ki ne vključuje uporabo robota ali z uporabo plišastih igrač.</p>

Socialni robot	Metode	Avtor, leto	Glavni rezultati
Robotski hišni ljubljenčki (Robopets)	Sistematični pregled literature, mešana	Abbott et al., 2019	<p>Povečujejo samozavest oseb z demenco. Pozitivne koristi v smislu druženja in sodelovanja (interakcija z robotom je povzročila verbalne odzive, komunicirali so neposredno z robotom ali z drugimi), robota so doživljali kot prijatelja. Spodbuja spomin kar pripomore k komunikaciji. Pozitivni učinki so bili zaznani tudi pri osebju institucij, ki je doživljalo izboljšano okolje in skupnost. Pozitivni vedenjski odzivi so bili poročani kot dotikanje, božanje, držanjem in objemanje, kar je izboljšalo razpoloženje in zmanjšalo vedenjske težave.</p> <p>Kvalitativni rezultati kažejo številne pozitivne vidike, v izboljšavah in splošni oceni robota.</p> <p>Kvantitativni rezultati kažejo, da ni značilnih razlik v analizah v primerjavi intervencij s plišastimi igračami ali brez robota.</p>
Humanoidni asistenčni socialni roboti	Kvalitativna	Zuschneegg et al., 2021	<p>Izboljša komunikacijo/stik z drugimi (npr. omogoči telefonske klice, zagotovi družbo). Omogoča ohranjanje medosebnih odnosov.</p> <p>Pomaga pri izogibanju nevarnosti (npr. prepozna nevarnost, organizira pomoč); pomaga pri dnevni aktivnosti (npr. opomni na srečanja, gospodinjske obveznosti, pomaga pri prehranjevanju/pitju, pomoč pri kuhanju; pomagajo pri mobilnosti/drži telesa (npr. daje opomnike/navodila za telesno vadbo); pozitivno vplivajo na ohranjanje bolnikove samostojnosti.</p>
Silbot robot	Kvalitativna	Law et al., 2019	<p>Robot nudi druženje in zmanjšuje osamljenost, psihološki stres (tudi zmanjšanje stresnih hormonov in krvnega tlaka).</p> <p>Druženje z robotom je pritegnilo udeležence. Robot pomaga pri varnosti pacienta (povečuje sposobnost samooskrbe in se lahko odzove v nujnih primerih); pomaga pri avtonomiji za bivanje na domu; pomaga pri spremljanju zdravljenja in dobrega počutja; pomaga pri zmanjševanju tesnobe in vznemirjenosti (tj. pomaga pri preusmerjanju in načrtovanju dneva).</p>
MARIO	Kvalitativna	Casey et al., 2020	<p>Bolnikom je bila všeč izkušnja, komentirali so, da jim je pomagal pozabiti, da imajo demenco (zaradi česar so se počutili bolj samozavestne, razumljene in so uživali v izkušnji). Potencial za izboljšanje medosebnih odnosov v kontekstu zdravstvenega varstva (izboljšuje družbeno angažiranost in spodbuja komunikacijo). Spodbuja druženje, občutke povezanosti, zmanjšuje občutke osamljenosti in socialne izolacije (prinaša zabavo in razvedrilo). Povečuje bolnikovo avtonomijo (individualizirana možnost izbora kaj želi početi) in s tem kakovosti oskrbe starejših ljudi.</p>
NAO	Sistematični pregled literature	Robaczewski et al., 2021	<p>Pozitiven vpliv NAO pri interakciji z ljudmi z demenco ali blago kognitivno okvaro (preprosta uporaba, je lahko kognitivni trener ali spremljevalec; povečuje družabnost in zmanjšuje osamljenost). Zmanjšuje apatijo, pozitiven vpliv pri blodnjah in vznemirjenosti.</p> <p>Ta pristop je dobra nefarmakološka intervencija (poveča angažiranost uporabnikov in lahko izboljša nevropsihiatrične simptome). Izboljša razpoloženje.</p>

Socialni robot	Metode	Avtor, leto	Glavni rezultati
Asistenčni socialni roboti (ASR)	Kvalitativna	Cruz-Sandoval et al., 2019	Rezultati kažejo, da je uporaba pogovornih strategij učinkovita za izboljšanje komunikacije med osebami z demenco in socialnim robotom (ti rezultati podpirajo izvedljivost uporabe pogovornih strategij za izboljšanje interakcije med osebo z demenco in robotom).
ASR	Kvalitativna	Arhanat et al., 2020	Zmanjšuje frustracije, stres in napetosti v odnosih s povečano socialno interakcijo. Spodbujajo različna smiselna preživljanja prostega časa. Podpora zagotavljanju varnosti, nujne pomoči in osnovni opomniki. Povečuje avtonomijo s pomočjo pri vsakodnevnih opravilih.
Pogovorni agent, klepetalni robot in sistem za dialog	Sistematični pregled literature	Russo et al., 2019	Pomembno je preučiti vlogo čustev pri socialnih robotih in ugotoviti, da je smiselno robotu zagotoviti sposobnost zaznavanja, interpretacije in izkazovanja čustev. Učinkovitost odvisna od ciljne skupine (prilagoditve za motnje govora pri osebah z demenco, npr. kratki in razumljivi stavki, počasen govor).
Komunikacijski roboti	Intervencijska nerandomizirana multicentrična	Obayashi et al., 2020	Olajšajo socialne aktivnosti starejših ne glede na stopnjo demence in starost. Delujejo učinkovito, zlasti pri bolnikih z zmerno demenco. Več koristi (večje izboljšanje) imajo starejši in tisti z zmerno/hudo demenco. Pozitivni učinki pri osebah z demenco na domu ali v institucijah, ne glede na spol. Izboljšanje kakovosti življenja pri oskrbovancih v socialnovarstvenih institucijah.
Inteligentna podporno tehnologija (IPT)	Sistematični pregled literature	Ienca et al., 2018	Pripomore k ohranjanju, obnavljanju, podpori, ponovni vzpostavitvi socialnih odnosov in zmožnost interakcije z zunanjim družbenim, digitalnim in naravnim okoljem. Spodbujanje avtonomije bolnikov in zmanjševanje bremena negovalcev. Izboljšuje varnost (tj. zaščita pred nevarnostjo poškodb ali zmanjšuje verjetnost zanjo). Izboljšuje samostojnost (sposobnost varnega, neodvisnega in udobnega življenja v lastnem domu in skupnosti, ne glede na starost, dohodek ali raven sposobnosti).
IPT	Kvalitativna	Wangmo et al., 2019	Dopolnjuje človeški stik in empatijo, ki sta ključnega pomena za zagotavljanje klinično učinkovite in moralno sprejemljive oskrbe. Izboljšajo bolnikovo avtonomijo s povečanjem njihove neodvisnosti in podaljšanjem njihovega samostojnega življenja na domu.

Na osnovi pregledanih člankov bi lahko, glede na namen uporabe, ASR razvrstili na RHL, humanoidne asistenčne socialne robote (HASR), pogovorne agente, klepetalne robote in sisteme za dialog ter inteligentno podporno tehnologijo.

RHL (Robopets) so namenjeni predvsem krepitvi družbenih interakcije osebam z demenco. Med njimi je najbolj poznan PARO, ki je napredni interaktivni robot v podobi mladiča tjulnja in je bil v osnovi namenjen za pomoč osebam z demenco. S pomočjo senzorjev (zvok, dotik, temperature, svetloba, drža) se odziva na vedenje uporabnikov, lahko odpira in zapira oči, premika plavuti in rep medtem, ko ga osebe božajo, reagira na udarce, se odziva na zvoke (npr. pozdrav) in kaže čustva (Fardeau et al., 2023; McGlynn et al., 2017). RHL predstavljajo alternativno rešitev za tiste, ki niso zmožni ustrezno skrbeti za žival (ne potrebujejo sprehodov, hranjenja, kopanja ipd.). Med najpogostejšimi robotskimi hišnimi ljubljenci so PARO, robotska mačka (JustoCat, NeCoRo), robotski pes (Aibo), robotski medvedek (CuDDler) (Abbott et al., 2019).

HASR se v glavnem uporabljajo kot podpora osebam z demenco pri vsakodnevni aktivnostih in izboljšujejo kakovost življenja. Ti robotski sistemi so opremljeni z različnimi nalogami, kot so socialne interakcija, gestikulacija, premikanje in prepoznavanje obrazne mimike (Zuschnegg et al., 2021; Law et al., 2019; Casey et al., 2020; Robaczewski et al., 2021). Med njimi je najbolj poznan Pepper, ki je optimiziran za interakcijo s človekom in je sposoben komunicirati prek govora in zaslona na dotik. Sposoben je prepoznati obraze in človeška čustva. Zdravstveno osebje lahko spremlja in nadzira stanje s pomočjo računalniškega programa (Softbank, 2023).

Silbot robot lahko izraža čustvena stanja, ima premičen vrat, roke in ramena, premika se na treh kolesih v vseh smereh, senzori preprečujejo trke, uporablja se tudi za kognitivno stimulacijo (Law et al., 2019).

MARIO ima različne aplikacije (npr. glasba, koledar, novice, igre), aktivirati ga je mogoče z glasom ali prek zaslona na dotik. Ima različne možnosti, namenjen je zabavi, druženju, kognitivni stimulaciji ali kot časovni opomnik pri osebah z demenco. Možno je tudi spremljanje zdravstvenega stanja v bolnišnici z aktiviranjem nujnih klicev (Casey et al., 2020).

NAO nima možnosti odziva z obrazno mimiko, hkrati ima številne senzore, kamere, mikrofone in tipala na nogah, kar mu omogoča zaznavanje okolice, zvokov in gibanja. Sam ima sposobnost prepoznavanja obrazov, govora in barv, lahko tudi

uporablja govor (posnete fraze). Je tudi izredno gibljiv in prožen pri premikanju. (Robaczewski et al., 2021; Fardeau et al., 2023).

Pogovorni agenti, klepetalni roboti in sistemi za dialog (Conversational Agents, Chatterbots and Dialogue Systems) predstavljajo pogovorno UI, ki je napredna oblika in omogoča strojem, da sodelujejo v interaktivnih dialogih z uporabniki. Ta tehnologija razume in interpretira človeški jezik za simulacijo pogovorov. Pogovorni sistemi UI se uporabljajo v aplikacijah, kot so klepetalni roboti, glasovni pomočniki (Russo et al., 2019).

Komunikacijski roboti (communication robots - com-robots) so zasnovani za interakcijo z ljudmi prek različnih komunikacijskih kanalov, kot so govor, kretnje in dotik. Ti roboti so programirani tako, da razumejo človeški jezik in se ustrezno odzovejo (Obayashi et al., 2020).

Inteligentna podpora tehnologija (IPT) (Intelligent Assistive Technology - IAT) ima pomembno vlogo pri opolnomočenju oseb z demenco. IPT vključuje UI, ki uporablja algoritme za prepoznavo okolja, za učenje vzorcev človeškega vedenja in sprejema racionalne odločitev o najboljših ukrepih. IPT zajema širok nabor tehnoloških naprav kot so sistemi pametnega doma, samostojne naprave (tablice, pametni telefoni, sledilniki - GPS) in humanoidni roboti (Ienca et al., 2018; Wangmo et al., 2019).

Večina avtorjev je med pozitivnimi učinki uporabe ASR izpostavljala tudi sicer njihove glavne namene, ki predstavljajo vir druženja, spodbujajo socialno angažiranost ter zmanjšujejo osamljenost (Moyle et al., 2018; Moyle et al., 2019a; Pu et al., 2020; Casey et al., 2020; Robaczewski et al., 2021; Law et al., 2019; Scoglio et al., 2019; Abbott et al., 2019). Nekateri uporabniki so robota ocenili kot prijatelja (Abbott et al., 2019; Pu et al., 2020). Pri interakciji z ASR je bil pri uporabnikih pogost verbalni odzivi, ki spodbuja pogovor tako z roboti kot drugimi ljudmi in izboljšuje socialne veščine uporabnika pri medosebnih odnosih. Tehnologija omogoča komunikacijo z robotom (Moyle et al., 2019b; Pu et al., 2020; Casey et al., 2020; Cruz-Sandoval et al., 2019), pri tem olajša in spodbuja komunikacijo tudi z drugimi osebami (Hung et al., 2019; Obayashi et al., 2020).

Večina avtorjev je ocenila, da ASR lahko pripomore k ohranjanju samostojnosti in pomaga pri vsakodnevnih aktivnostih, saj uporabniku lahko nudi podporo in pomoč pri opravljanju različnih nalog kot so prehranjevanje, vnos tekočin, pri kuhanju, z opominjanjem na aktivnosti (Góngora Alonso et al, 2019; Moyle et al, 2018; Law et al, 2019; Ienca et al, 2018; Wangmo et al, 2019; Arthanat et al, 2020). Ohranjanje samostojnosti pri demenci prispeva k temelju kakovostne oskrbe (Casey et al, 2020). ASR, prispeva k ohranjanje samostojnosti na način, da spremlja osebo z demenco čez dan in jim pri tem pomaga, da jih spomni kako naj delajo redne dnevne naloge in jih opolnomoči, da si pomagajo sami (Zuschnegg et al, 2021).

ASR lahko izboljša varnost in zmanjša tveganje poškodb (Ienca et al, 2018) ter opolnomoči uporabnika, da skrbi zase (Law et al, 2019). ASR lahko pripomore k preprečevanju tveganj za padce (Moyle et al, 2018; Casey et al; 2020; Law et al, 2019; Ienca et al, 2018; Arthanat et al, 2020). ASR tako lahko prispeva k varnosti in udobju za uporabnika (Moyle et al., 2018; Law et al., 2019; Ienca et al; Wangmo et al, 2019; Zuschnegg et al, 2021; Arthanat et al, 2020).

Interakcija z ASR pripomore k boljšemu počutju, izboljšuje duševno zdravje in lajša simptome demence (Demange et al, 2018; Góngora Alonso et al, 2019; Pu et al., 2020; Scoglio et al, 2019). Ugodno vpliva tudi na simptome depresije in kognitivno sposobnost (Abbott et al, 2019). Ob uporabi ASR so zaznali zmanjšanje negativnih vedenjskih odklonov, ugoden vpliv na tesnobo, žalost, vpitje, samoizolacijo, manj je bilo poročanj o bolečini in tavanja (Robaczewski et al, 2021). ASR pripomore k zmanjševanju vznemirjenosti (Moyle et al, 2018; Moyle et al, 2019a; Law et al., 2019; Robaczewski et al., 2021).

Nekateri avtorji navajajo, da ASR predstavlja vir veselja in skrb za druge (Moyle et al, 2018; Moyle et al., 2019a; Pu et al, 2020), lahko vpliva občutek odgovornosti (Moyle et al, 2019a) in omogoča bolj smiselno preživljanja prostega časa (Arthanat et al , 2020). Pozitivno prispeva k vzpostavljanju zaupanja, še posebej pri komunikaciji z drugimi ljudmi, kar pomaga pri socialnih veščinah (Moyle et al, 2019a; Abbott et al, 2019). V nekaterih primerih so uporabniki poročali, da so ob uporabi ASR pozabili, da imajo na demenco, zaradi česar so se počutili bolj samozavestne in podprte (Casey et al, 2020).

4 Razprava in zaključek

ASR se uporabljajo za podporo čustvene, kognitivne in fizične oskrbe ljudi z demenco, z namenom, da bi ohranili svojo samostojnost in kvaliteto življenja (Kachouie et al, 2017; Hirt, et al., 2021). Vse vključene raziskave v tem pregledu literature so med glavnimi ugotovitvami poročale o pozitivnih učinkih na počutje uporabnikov ASR, še posebej RHL, kar so predhodno ugotavljali tudi avtorji v doslej največjem pregledu literature na področju ASR (Kachouie et al, 2017). V večini pregledanih študij so avtorji navajali, da lahko ASR pri uporabnikih sproža pozitivna čustva, z izboljšanjem počutja in duševnega zdravja, lajša simptome demence in depresije, zmanjšuje vznemirjenost, ugodno deluje na kognitivno sposobnost, manj je bilo problematičnega vedenja, tavanja, ugodno je bil vpliv na tesnobo, žalost (Demange et al, 2018; Abbott et al, 2019; Góngora Alonso et al, 2019; Pu et al., 2020; Scoglio et al, 2019; Robaczewski et al, 2021; Moyle et al, 2018; Moyle et al, 2019a; Law et al., 2019; Robaczewski et al., 2021). Podobno so ugotavljali tudi drugi avtorji (Kachouie et al, 2017; Hirt, et al., 2021; Fardeau et al., 2023). Pri daljšem časovnem opazovanju vpliva ASR na depresijo, tesnobo, vznemirjenost ter vedenjske in psihične simptome demence so rezultati bolj heterogeni, nekateri avtorji ugotavljajo značilne razlike drugi ne (Hsieh et al, 2023), znanstveni izsledki metanalize drugih avtorjev kažejo, da ASR ne vplivajo na izboljšanje kognicije, nevropsihiatričnih simptomov in kakovosti življenja pri demenci (Yu et al., 2022). Nekateri avtorji so opozorili na možnost, da pri uporabi RHL in HASR ni učinkov na kvaliteto življenja in dobro počutje (Hirt et al., 2021).

Iz našega pregleda literature izhaja, da ASR in HASR lahko pripomorejo k boljši kakovosti življenja z nudenjem pomoči pri vsakodnevnih aktivnostih, s podporo in pomočjo pri opravljanju vsakodnevnih nalog se večja avtonomija. Podobno ugotavljajo tudi drugi avtorji (Kachouie et al, 2017; Hirt, et al., 2021). ASR so namenjeni socialni interakciji in vzpodbujajo komunikacijo z drugimi in socialne večšine ter zmanjšuje osamljenost (Fardeau et al., 2023; Kachouie et al, 2017).

Med pomisleki glede uporabe ASR je izstopal cenovni dostop tehnologije, še posebej pri socioekonomsko ranljivejših osebah z demenco (Hung et al., 2019; Ienca et al, 2018; Arthanat et al, 2020). V ospredju so še etika, privolitev, zbiranje podatkov, vstop v osebno sfero, ohranjanje dostojanstva (Ienca et al, 2018; Demange et al, 2018; Wangmo et al, 2019).

UI predstavlja velik potencial na področju intervencij in obravnave oseb z demenco. Ta pregled literature kaže, da je uporaba ASR pri demenci izvedljiva in sprejemljiva.

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ZELENI PREHOD IN JAVNO ZDRAVJE

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Prispevek analizira, ali so v zelenem in digitalnem prehodu trije stebri (okoljski, ekonomski in socialni) uravnoteženo obravnavani. Hkrati je država članica Evropske Unije zavezana k udejanjanju 17 ciljev trajnostnega razvoja. Med njimi je cilj zdravje, ki je hkrati gonilo proizvodnje, pa tudi razvoja. A dokumenti ukrepanja in njihovega spremljanja kažejo, da so socialni vidik, še zlasti javno zdravje in javno zdravstvo, premalo upoštevani tako v ukrepanju za razvoj kot v krepitvi odpornosti. Obstoječe stanje - več kot 140 000 ljudi brez zdravnika v primarnem varstvu, čakalne vrste, 1000 postelj v domovih za starejše nezasedenih zaradi pomanjkanje kadra (medicinskih sester, socialnih delavk, bolničarjev, itd.), več kot tri četrt zavarovancev ni deležnih zobozdravstvenih storitev javnega zdravstva – vse to so alarm nakopičenih državnih socialnih problemov. Pa vendar – premalo aktivnosti zelenega in digitalnega preboja, da bi ukrepanje proti klimatskim spremembam, onesnaženju voda in tal, povezali s krepitvijo zdravja državljanov in sistema javnega zdravstva.

Ključne besede:

javno
zdravstvo,
cilji
trajnostnega
razvoja,
Zelena
agenda,
vrednote
darilne
ekonomije,
sistemski
pristop
ukrepanja

GREEN TRANSITION AND PUBLIC HEALTHCARE

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public
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gift
economy
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system
management

The paper analyses if the three pillars of green and digital transition (environmental, economic and social) are balanced. The Republic of Slovenia is at the same time responsible to implement 17 sustainable development goals, SDGs. The third SDG is the health: it is the production driver and also the development driver. However, the policy development documents show that the social pillar is undervalued, most of it the health care and public health system. The situation is that more than 140 000 people do not have their primary health care doctor, there are waiting times, 1000 beds in long-term facilities are not occupied due to missing sisters and social workers, more than 75% of insured people do not have access to a dentist – all these are state social problems. However – there should be more activities for green and digital transition linked to climate changes, water and soil pollution as there is a need to empower citizens health care and the public healthcare system.

1 Uvod

Živimo v času, ko se soočamo s krizo javnega zdravja, klimatsko krizo, digitalno revolucijo, vojnami, finančnimi in ekonomskimi krizami ter izzivi migracij. Odgovor Evropske Unije (EU) na nakopičene probleme in izzive novih globalnih centrov moči je, da države EU delujejo skupaj in solidarno, da se ščiti vrednote in interese EU. Že skozi vso COVID-19 krizo je Evropski model kazal svojo moč. Je model demokratične svobode, solidarnosti, ekonomske rasti in socialnega varstva. Po COVID-19 je nujnost, da upoštevamo te pozive in odločno ukrepamo za ohranitev našega planeta in naše blaginje, očitna.

Namen socialnih storitev je socialna kohezija, v kateri se realizirata solidarnost in enakost. Socialna neenakost in prikrajšanost ljudi v družbi ogroža fizično in moralno celovitost človeka ter s tem človeškega in socialnega kapitala. V EU se solidarno ukrepa v primerih bolezni, starosti, nesposobnosti za delo, zagotavlja se socialno varstvo in varstvo pri delu, ukrepa proti revščini in socialni izključenosti. Zato se tudi v programih za zeleni prehod pričakuje ukrepanje za kakovostne zaposlitve, dostojno plačilo, za usklajevanje družinskega in službenega življenja in stanovanjskih problemov. Treba je razmišljati in ukrepati tudi glede problematičnih pogojev z vidika zdravja in dobro biti posameznika. A praksa kaže, da se posveča več pozornosti blaženju posledic kot odpravljanju vzrokov, kar pa je bistvenega pomena za dolgoročen in trajnosten učinek. Učinkovite so samo tiste politike ukrepanja, ki zmanjšujejo škodljive prakse komercialnih akterjev, ki jih v razne vrste škodovanja okolju, naravi in človeku žene želja po dobičku. Spoznan je politični paradox, da prav tisti akterji, ki najbolj onesnažujejo, tudi največ investirajo v sprejemanje takšnih ukrepov, ki ne bi ogrozili njihovega obstoja (Friel, 2023 [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(23\)02512-6/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(23)02512-6/fulltext)).

Koncept zdravja podpira pravo EU, podpirajo ga priporočila in metodologije institucij EU, Združeni narodi (United Nations, UN), Svetovna zdravstvena organizacija (World Health Organisation, WHO) in Organizacija za ekonomsko sodelovanje in nadzor (Organisation for Economic Cooperation and Development, OECD). Koncept in z njim povezana priporočila institucij temeljijo na temeljnih načelih kot so »zdravje v vseh politikah« in »osredotočenosti na pacienta« ter doprinašajo k izpeljavi 17 ciljev trajnostnega razvoja UN. Med njimi je tretji cilj

zdravje, ki zavezuje vlade »da zagotovijo zdravo življenje in spodbujajo dobrobit za vse in v vseh obdobjih« (<https://www.un.org/sustainabledevelopment/health/>, 2.12.2023). Pristop »Eno zdravje« napotuje, da zdravja ljudi, živali, rastlin in okolja ni mogoče obravnavati ločeno, ampak je treba ukrepati celostno za „eno zdravje“ (https://www.who.int/health-topics/one-health#tab=tab_1, 13.12.2023). Za zdravstvene politike so odgovorne države članice EU same.

Evropski zeleni dogovor želi do leta 2050 razviti trajnostno, podnebno nevtralnno in ekološko ozaveščeno gospodarstvo. Sestavni del dogovora je strategija od vil do vilic, ki predvideva pravičen, zdrav in zelen prehranski sistem, zavezanost trajnostnim praksam, nižjim emisijam toplogrednih plinov, izboljšanju biotske raznovrstnosti. Kljub zahtevam tisočem znanstvenikov in še več državljanov za zmanjšanje pesticidov zaradi zaščite zdravja in okolja, so 22. novembra 2023 evropski poslanci zavrnilo uredbo EK, ki je predvidevala 50% zmanjšanje pesticidov do leta 2030 in s tem ogrozili tudi strategijo »od vil do vilic« (https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en, 14.12.2023). Februarja 2024 Evropska Komisija organizira konferenco »Raziskovalne perspektive vpliva klimatskih sprememb na zdravje« z namenom, da se ozavesti pomen zdravja in njegova povezanost s klimatskimi spremembami. Pomembno pa je tudi opozorilo glede ekonomskega modela v katerem se odvija zeleni prehod: »Ne bomo uspešni, če ne bomo reformirali svetovne banke in Mednarodnega denarnega sklada, ki imata pomembno vlogo pri določanju norm in financiranja zelenega prehoda na svetovni ravni... Zto moramo pregledati upravljanje iz Bretton Woodsa in od držav v vzponu zahtevati, da prevzamejo svoj del odgovornosti pri financiranju svetovnih javnih dobrin« (Macron, F.; Stebri zelene modrosti, Project Syndicate, 2023, ww.project-syndicate.org, Delo, 9.1.2024, str.7).

Prikazan kontekst zakonodaje, ukrepanja in prakse izpostavlja vprašanja, na katere se osredotoča prispevek: Ali so identificirani dejavniki, zaradi katerih je nujen dostop do zdravstva v kontekstu zelenega dogovora in ali je zaradi novega konteksta že prišlo do sprememb? Kakšna je vloga vladanja - države? Kako tržna ekonomija vpliva na krepitev institucij in na darilno ekonomijo?

2 Kontekst zelenega dogovora in trajnostnega razvoja v okolju EU

Doseganje ciljev Evropskega zelenega dogovora ni ne enostaven in ne enosmeren proces. »Zdravstveni izzivi izhajajo iz podnebnih sprememb, onesnaževanja, zmanjšanja biotske raznovrstnosti in degradacije« je izpostavila Deklaracija iz 7. ministrske konference o okolju in zdravju v Budimpešti leta 2023 (<https://okolje-zdravje.si/ministrska-konferenca-o-okolju-in-zdravju> 12.12.2023). Države imajo različne zmogljivosti, pa tudi vse enako ne razumejo priložnosti ukrepanja za zeleno in digitalno, da bi v tem okviru ukrepanje povezali¹ z zdravjem in zdravstvom. Industrializacijo proizvodnje hrane, zaznamuje široka uporaba kemikalij, velikih strojev in intenzivna reja živali v zaprtih prostorih, kar prinaša okoljske in zdravstvene posledice. Medtem ko je okoljski davek intenzivnega kmetijstva splošno priznan, so njegovi škodljivi učinki na zdravje ljudi, tako neposredni kot posredni, manj priznani (Nyssens-James, C., 2023; <https://eeb.org/top-candidate-for-green-deal-chief-favours-industry-interests-over-major-commitments-on-food-animal-welfare-and-chemicals/>).

Evropski zeleni dogovor je strategija za preobrazbo držav članic EU v pravično in vključujočo družbo ter hkrati sodobno, konkurenčno in zeleno gospodarstvo. Gre tudi za spremembo in še zlasti okrepitev tudi socialnih vrednot. V dobi globalnega kapitalističnega neoliberalizma, velja Evropska Unija za področje kapitalizma s človeškim obrazom. Leta 2000 je bila v Lizboni sprejeta Socialna Agenda (in leta 2008 prenovljena Agenda

<https://ec.europa.eu/social/main.jsp?langId=en&catId=89&furtherEvents=yes&newsId=376>), ki je vpeljala na znanju zasnovano družbo. V korist trga dela in ščitenja socialnih pravic je EU sprejela 2017 EU socialni steber 20 vrednot.

¹ Še pred razglašenimi trajnimi cilji razvoja je leta 2008 Poročilo Komisije o merjenju gospodarske uspešnosti in družbenega napredka razkrilo številne razsežnosti, ki vplivajo in oblikujejo dobro počutje ljudi (The Stiglitz Commission, 2008, str. 10-11) kot so: materialni življenjski standard (dohodek, potrošnja in bogastvo), zdravje, izobraževanje, osebne dejavnosti, vključno z delom, politike ukrepanja, socialne povezave in odnosi, obstoječe in pričakovane razmere v okolju, ter negotovosti, tako ekonomske kot fizične narave. Vse te razsežnosti naj bi merili dobro počutje ljudi in ne le bruto družbeni produkt.

WHO je razdelal koncept zdravja, v katerem ni le prikazana povezanost zdravja s klimatskimi spremembami, ampak tudi okvir priporočene politike ukrepanja. Po definiciji WHO «je zdravje stanje, ki obsega fizično, mentalno in socialno dobro bit in ne zgolj odsotnost bolezni»

[https://\(www.who.int/about/accountability/governance/constitution](https://(www.who.int/about/accountability/governance/constitution),

12.12.2023). Posebej je izpostavljeno, da je zdravje odvisno od vedenjskih in kontekstualnih okoliščin, kjer se človek rodi, odrašča, živi, deluje in stara. Determinante zdravja so: globalni sistem (fizično in zgrajeno okolje, aktivnosti, lokalna ekonomija, skupnost, življenjski stil), bio diverziteteta (zrak, voda, zemljišča in prst). Klimatske spremembe uničujejo naravne habitate, drevesa, vplivajo na načine delovanja, mobilnost in prihodke, povečuje se revščina in socialne razlike. Vplivi globalnega segrevanja so suše in pomanjkanje vode: povprečno letno že 30 % Evropejcev prizadene pomanjkanje vode. Zato se stopnjujejo zdravstvena tveganja, slabšajo se sanitarni pogoji, več je podhranjenosti in slabi duševno zdravje. OECD in WHO sistematično na štirih področjih raziskujeta in dokumentirata povezavo med klimatskimi in zdravstvenimi problemi: prehranski sistem in agrikultura, proizvodnja in distribucija energije, dostopnost in učinkovitost, urbanizacija in krepitev zdravstvenih sistemov.

Zaradi dramatični napovedanih dogodkov v svetu (21 mio smrti in 161 mio ljudi skrajno obubožanih do leta 2050) je Svetovna banka razvila Program pomoči za zdravje zaradi klimatskih sprememb (World Bank Climate & Health Program). Korporacije in kapital si zatiskajo oči pred okoljskimi katastrofami, ki so posledica podnebnih sprememb. Tako lahko neustrezno ali neoptimalno ukrepanje za klimatske spremembe ogroža najbolj primarne človekove potrebe, ki so voda, hrana² in zrak, ki skupaj zagotavljajo varnost in dobrobit posameznika in družbe. Medtem ko so okoljske posledice industrializiranega kmetijstva dobro dokumentirane, njegovi neposredni in posredni (prek degradacije okolja) vplivi na zdravje ljudi ostajajo manj priznani. Prav neustrezen prehranski sistem, ki ogroža zdravje, celo povzroča smrti, je glavni v doprinosu klimatskih sprememb. Pri tem so najbolj prizadeti revni, ker je njihova kapaciteta prilagajanja nizka in imajo hkrati tudi manj dostopa do socialnih storitev, katerih glavni del je zdravje. Tudi EK napoveduje, da

² Industrializacijo proizvodnje hrane, zaznamuje široka uporaba kemikalij, velikih strojev in intenzivna reja živali v zaprtih prostorih, kar prinaša okoljske in zdravstvene posledice. Medtem ko je okoljski davek intenzivnega kmetijstva splošno priznan, so njegovi škodljivi učinki na zdravje ljudi, tako neposredni kot posredni, manj priznani (Nyssens-James, C., 2023; <https://ceb.org/top-candidate-for-green-deal-chief-favours-industry-interests-over-major-commitments-on-food-animal-welfare-and-chemicals/>).

bodo »za zeleni prehod v EU vsako leto do leta 2030 nujne naložbe v vrednosti 620 milijard evrov/.../kar bo zahtevalo vzpostavitev prave unije kapitalskih trgov, da bi mobilizirali zasebno financiranje« (Donohoe, P. et al., 2023).

3 Metodologija

Uporabljena metoda je razlagalno-raziskovalna. Ta metoda izpostavi pomembne dokumente, vzroke in posledice ukrepanja in z njimi povezane vsebine zato, da na osnovi njihove vsebine razkrije najpomembnejše probleme in izzive. Ker pa je metoda pojasnjevalnega značaja uvodoma obrazloži, zakaj je tematika pomembna, kdo in na kakšen način priporoča ukrepati. Nato so prikazani primeri, ugotovitve pristojnih organov in podatki, ki omogočajo odgovore na zastavljena tri vprašanja: Ali so v Sloveniji identificirani kritični izzivi? Ali politika ukrepanja postavlja v središče pozornosti zdravje in njegovo obvladovanje (ang. governance)? Ali delujeta vzporedno sistem tržne ekonomije in sistem darilne ekonomije?

Uporabljen pristop odgovarja na zastavljena bistvena tri vprašanja za državo Slovenijo, ki se sicer postavljajo v kontekstu povezanosti med zelenim in digitalnim prehodom v povezavi z zdravjem. Odgovori na tri vprašanja so zbrani na osnovi analiz in raziskovanj (Evropski semester, OECD, WHO), nadzorov Računskega sodišča R Slovenije in uradnih podatkov OECD, WHO, Statističnega urada Republike Slovenije, SURS.

4 Izzivi zdravstva v kontekstu zelenega dogovora in trajnostnega ukrepanja v Sloveniji

Evropski semester, ki intenzivno analizira realizacijo naštetih dokumentov, bdi nad kakovostjo ukrepanja in pripravljenostjo sistemov socialnega varnosti, vključno z zdravjem in dolgotrajno oskrbo, za Slovenijo vedno znova izpostavlja potrebo po reformah in večji intenzivnosti sprememb

(https://commission.europa.eu/system/files/2022-05/2022-european-semester-csr-slovenia_en.pdf). Načelo zdravje v vseh politika v slovenski praksi še ni zaživelo, niti ni sprejeta strategija, Nacionalni program pa spremlja Dvoletni sporazum WHO in Vlade (The Biennial Collaborative Agreement (BCA) between the World Health Organization (WHO) Regional Office for Europe and the Ministry of Health of Slovenia, on behalf of its Government, for 2022–2023.) Ni pripravljena strategija, ki

bi povezala zdravstvo in okrepitev sistemov, da bi se bili sposobni spopadati s klimatskimi spremembami, zagotavljati vsem zavarovancem (teh je 99% aktivnega prebivalstva) enak dostop do zdravstveni storitev, dostop do zdrave in pitne vode, higienske razmere, energijo in kakovostno hrano, ne nazadnje za ljudi ni pripravljen zdrav in trajnosten transport. Po podatkih SURS je tveganju revščine v Sloveniji izpostavljeno 251.000 ljudi, Slovenija je po inflaciji na povprečjem EU in nadaljuje se negativen naravni prirast (Delo, 28.12.2023, str.1).

»V javno finančno enačbo so v letu 2024vstopile tudi posledice podnebnih sprememb. Sanacija po poplavah je zvišala proračunske izdatke v letu 2024 za dobro milijardo evrov./...Vlada si je vzela tri mesece časa za pripravo davčnih reform./.../na mestu je ideja, da bi v Sloveniji pripravili in izpeljali nacionalni stresni test, da bi ugotovili, kako smo pripravljeni na podnebne spremembe. In da bi nanje odgovorili z ustreznim razvojnim modelom, ki ga zdaj po dobrih treh desetletjih lastne državnosti, še vedno nimamo« (Jenko, 2024, str. 19).

Ob velikih naložbah (največja med njimi so razvojna kohezijska sredstva), se od realizacije Evropskega zelenega dogovora in digitalne strategije EU pričakuje, da bodo prispevali k rasti, inovacijam in ustvarjanju novih zaposlitev. Ob strukturnih reformah in strategijah tranzicije je postalo pomembno tudi krepiti sisteme in odpornost. A ukrepa se vse preveč nepovezano. Za zdravje se ukrepa ločeno, brez povezanosti z ostalimi resorji in vključenostjo deležnikov³.

K ukrepanju zaradi okoljskih potreb se v Sloveniji pristopa tehnično-tehnološko: EU priporočilo nacionalnega načrta za okrevanje in odpornost 43% sredstev usmerja neposredno v tehnološko investiranje, ne glede na determinante ukrepanja za zdravje in brez predhodnega ugotavljanja potreb prebivalstva. Eno večjih tveganj za uspešnost zelenega prehoda je v Sloveniji zakon o vodah. Njegov 69. člen

³ Področje je zelo kompleksno, potekajo številne aktivnosti in ukrepi. V kontekstu zdravja je postalo pomembno tudi čezmejno obvladovanje zdravja (Uredba o resnih čezmejnih grožnjah, EU Regulation on serious crossborder health threats), Državni program obvladovanja raka se osredotoča zlasti na sekundarno preventivo. Čeprav je EK pripravila Evropsko strategijo nege (the EU Care Strategy) je v Sloveniji sicer sprejet Zakon o dolgotrajni oskrbi, ni pa pripravljena konkretna njena strategija ne izvedbeni akcijski ali operativni načrt. EK je leta 2021 uvedla nov ukrep, ki so misije, ki naj še posebej sistemsko in organizacijsko podpirajo nacionalne politike držav članic EU v kontekstu zdravja in trajnostnih ciljev razvoja. Pet misij je namreč osnovano za pet najbolj problematičnih področij zelenega prehoda: prilagajanje na klimatske spremembe, vključno z družbenimi spremembami, Rak, Zdrava zemlja in hrana, Klimatsko nevtralna in pametna mesta ter Zdravi oceani, morja, obale in notranje vode

onemogoča, da bi se podjetja modernizirala; 60 obratov je prisiljenih ostajati na stari, bolj umazani tehnologiji. Ni ne energetske ne prehranske samozadostnosti.

"Pri protipoplavni zaščiti v Sloveniji je bilo na voljo 300 mio evropskih sredstev, a je bila porabljena le dobra desetina/...glavni problem niso finance/.../ ampak resor za okolje in prostor, premalo strokovno podkovani in ambiciozni kadri/.../V preteklosti je bilo zato storjenih veliko napak, ki jih ni lahko popraviti. Pri projektih se pogosto zatakne na občinski ravni, saj občine nimajo podatkov ali zaradi različnih interesov ne prilagajajo svojih prostorskih načrtov in ukrepov..." (Jenko, *ibid.*)

Hrana je kot determinanta zdravja del zapletenih družbeno-ekonomskih odnosov: od kulture prehranjevanja in dejavnikov, ki vplivajo na to, kar jemo, do ekonomije, javnega naročanja, proizvodnje in trgovine. Industrializiran prehranjevalni sistem v Sloveniji z močnimi trgovskimi verigami podpira škodljiva umetna gnojila in pesticide, reja živali je pretežno v zaprtih prostorih. V Sloveniji se tranzicija k agroekologiji še zdaleč ni pričela, politika kmetijstva je v ukrepanju v resnem zaostanku, kot kažejo izsledki revizije Računskega sodišča. Sodišče je ugotovilo, da tako kot »ocena ranljivosti tudi strateški dokument za prilagajanje na področju kmetijstva ni bil pripravljen. Ravno tako niso bili določeni jasni cilji prilagajanja kmetijstva podnebnim spremembam« (Revizijsko poročilo: Učinkovitost Ministrstva za kmetijstvo, gozdarstvo in prehrano pri prilagajanju kmetijstva podnebnim spremembam, 2023).

Slovenija je sicer upoštevala priporočilo EK za Nacionalne programe za okrevanje in odpornost in za prehod v zeleno družbo namenila maksimalnih 42% ali 712 mio EUR, za digitalno transformacijo pa 20% ali 345 mio EUR (www.eu-skladi.si, 1.4.2021), vendar povezanosti z zdravjem ni. Nacionalni načrt za okrevanje in odpornost je od skupne vsote za obdobje 2021-2026 225 mio EUR načrtoval 9% za zdravje (in sicer za digitalizacijo, dostopnost sistemov in usposabljanje). EU kohezijska politika bo za obdobje 2021-2027 financirala zdravje z 103mio EUR, od tega z regionalnim skladom 28 mio za opremo. Ostalo bo Evropski socialni sklad (80% za dostopnost, uspešnost in pripravljenost zdravstvenega sistema, 20% za digitalizacijo).

Za učinkovito javno zdravstvo v kontekstu zelene agende so osrednjega pomena kapacitete – razpoložljiv in usposobljen strokoven kader. Zato se pričakuje, da je vzpostavljena in deluje strategija kadrovske politike. Računsko sodišče je v reviziji učinkovitosti vstopa zdravnikov na trg dela za obdobje od 1. 1. 2008 do 30. 9. 2019 podalo mnenje, da Ministrstvo za zdravje in Zdravniška zbornica Slovenije nista bila učinkovita pri skrbi za učinkovit vstop zdravnikov na trg dela, da nista poskrbela za ugotavljanje dejanskih potreb po zdravnikih niti za ugotavljanje razlogov za morebitno pomanjkanje zdravnikov v okviru posameznih specialnosti. Zaradi tega tudi nista mogla poskrbeti za to, da bi se razlogi za domnevno pomanjkanje zdravnikov uspešno odpravljali. Glavna razloga za neučinkovito skrb pri vstopu zdravnikov na trg dela sta predvsem v tem, da ni mogoče ugotoviti dejanskih obstoječih zdravniških kapacitet niti ni mogoče oceniti potreb po dodatnih zdravnikih. Noben deležnik namreč ne ugotavlja, koliko učinkovitih ur zdravniškega dela na mesec opravi posamezni zdravnik v okviru različnih oblik izvajanja zdravniške službe in pri različnih izvajalcih v mreži javne zdravstvene službe (kot na primer na podlagi pogodbe o zaposlitvi, podjetnih oziroma drugih pogodb civilnega prava ali na podlagi izstavljenih računov za opravljeno zdravstveno storitev). Podatki⁴ o tem, koliko je vsak posamezni zdravnik dejansko aktiviran v zdravniški službi, ne obstajajo.

5 Vladanje in sistemski pristop

Država in sistem zdravstva terjata vzpostavljen sistem javnih institucij in učinkovito vladanje, strokovno administracijo in javni management. Vladanje mora obvladovati politike ukrepanja in pripravo instrumentov (ang. Policy and policy-making), kar je več kot priprava zakonodaje. Je strategija, in na njej temelječi akcijski programi. Obvezen je sistemski pristop, ki vnaša odporne in trajne aktivnosti. Ne zakoni, strateški pristop v tveganem okolju za zdravje in z njim povezanim storitvam mora najti ustrezne rešitve za obvladovanje demografskih sprememb, ob digitalizaciji, novih načinih in pristopih dela.

⁴ 40% namenskih sredstev v svetu, po podatkih WHO, je v zdravstvo investiranih zmanj; številni poskusi propadejo, ker delovanje ni sistemsko osredotočeno.

Po mnenju računskega sodišča, Vlada, Ministrstvo za delo družino in socialne zadeve, MDDSZ in Ministrstvo za zdravje, MZ, niso bili uspešni pri »zagotavljanju dostopnosti in dosegljivosti storitev socialnega varstva vsem tistim, ki jih potrebujejo« ...«da so bile obravnave upravičencev do socialnega varstva nepravilne – v smislu zagotavljanje enake obravnave za vsakega posameznika, poleg tega pa je bil neustrežno zasnovan tudi načrt novega sistema dolgotrajne oskrbe» (Računsko sodišče, 2019, str. 4).

Dobro vladanje je pomembno za dostopnost do zdravnika kot za preventivne ukrepe, zlasti s promocijo zdravja in krepitvijo primarnega zdravstva kot skrb za ranljive ciljne skupine in osebe s kroničnimi boleznimi (na kar okoljski dejavniki močno vplivajo). Po podatkih EK v Poročilu o profilu zdravja (State of Health in the EU Slovenia Country Health Profile 2023) je v Sloveniji delež izdatkov za preventivo (5,3%) nižji kot v EU (6,0%) (ibid., str. 12). Ukrepanje pa bi lahko zmanjšalo obolevnost in stroške zdravljenja. Stroški sicer obsegajo 9,5% BDP, a so pod EU povprečjem in znašajo na prebivalca 2665 EUR (EU je poprečje 4028 EUR per capita v letu 2021) (ibid., str. 9).

Ko država naslavlja digitalne in zelene vrzeli, je treba krepiti institucionalne in zaposlitvene kapacitete; potrebno je veliko koordiniranja na nivoju države (governance). Misije so nov celostno holistični pristop politik ukrepanja, ki je lahko vladanju v pomembno strateško oporo, ker » misije in z njimi povezane usmeritve, tudi njihovo financiranje, terjajo poglobljanje na kakšen način naj javne organizacije dizajnirajo programe, izpeljujejo in vrednotijo politike ukrepanja« (Mazzucato, Governing Missions, str. 14).

Ker je zdravstvo pomemben strateški sektor, so v Sloveniji in EU sprožene aktivnosti pobud Evropskega načrta v boju proti *raku*, ne pa Misij, ki bi vzpostavile strateški portfolio pristop in hkrati nadgradile strategijo pametne specializacije, ki je bila tudi za zdravstvo zasnovana v pretekli finančni perspektivi. V kontekstu zdravja je tveganje, da bodo izgubljene priložnosti⁵, saj misija Rak prinaša potencial, ki ga

⁵ Na nivoju EU so v novembru 2023 zaključili prvo fazo trije projekti Horizon Europe: Uncan.EU, vozlišče za raziskavo raka in Evropski digitalni center za bolnike z rakom. V drugi fazi sledijo aktivnosti držav članic: aktivirajo se deležniki ekosistema zdravstva/raka po državah EU. Če se ne, bodo ostali izven sistema in možnosti črpanja dodatnih sredstev za R&I, krepitev sistemov, digitalizacijo, infrastrukturo, zaposlitve in dostopa do know-how-a. Po Uncan.EU konceptu digitalne platforme zajemajo množico podatkov (ne le o pacientih in njihovi družini, tudi o okolju, o socialnem, družbenem in ekonomskem statusu), ki jih nadgradi umetna inteligenca. Namen obdelave

gre izkoristiti (t.j. da se na novo redefinira pomen zdravja, sistem zdravstva. Ne nazadnje, da se Slovenija trdno postavi na zemljevid kot referenčni center. (Slovenija je imela leta 1950 prvi register raka, ki je vsa leta omogočal kakovostno delo in ugled).

6 Model tržne in darilne ekonomije v kontekstu trajnosti

V XXI. stoletju obstajata oba modela: tržne-denarne ekonomije in darilne ekonomije. Prvi ljudje so zemljo prejeli v dar, tržni model je na vrhuncu v današnjem obdobju liberalnega neokapitalizma. Trajnostni razvoj pa osvešča potrebo po vrednotah darilne ekonomije. Ekonomska modela se razlikujeta na treh točkah: dajanje, vračanje in reciprociteta izmenjevanja. Prav v vrednotah ali načelih in načinu organiziranja pa se daritvena in denarna ekonomija bistveno razlikujeta. Prevladujoči model ravnanja skozi uveljavljanje vrednot določa kulturo družbe.

Darilo je lahko ideja, usluga, orodje, tehnologija, ekspertiza, znanje, kontakti ali dostopi do mrež, itn. Po definiciji je darilna ekonomija tista, v kateri je dano darilo brez pričakovanja karkoli dobiti v zameno nazaj. Ker če bi se to pričakovalo, potem gre za transakcijo. Denarna menjava je namreč transakcijska: blago za blago oz. denar za denar, ker živimo v denarnem gospodarstvu in denar posreduje menjava. Nobelov nagrajenec Williamson je izpostavil »da zaupanje nadomesti pogodbe« (Thygesen, str. 11). Pri darilnem modelu se vzpostavijo trajni odnosi, pri drugem gre za enkratni akt menjave blago/denar za blago /denar.

Zakaj? »Ker darilna ekonomija kreira vrednote v skupnosti ali vrednost za družbo tako zaradi obveznosti do družbe kot želje nekaj narediti« Thygesen Gift economy, str. 10 Vrednost se namreč kaže v darilni ekonomiji kot tisti, ki mora biti na razpolago vsem (open access), zato da multiplicira vrednost. V tržni ekonomiji pa dobi vrednost obliko menjalne vrednosti, hranilna vrednosti, nato pa se lastnik odloči za menjava. Str. Thy.. Trajnost pomeni humani cilj in ravnovesje v ekosistemu, za človeka in naravo na prvem mestu. Zato je postala tako pomembna socialna (lahko prevajamo tudi – družbena) komponenta ali steber trajnosti (poleg okoljske in ekonomske). Njena bistvena značilnost je, da izboljšuje ekonomsko situacijo in generira vrednost za družbo.

Ob nobelovcu za ekonomijo Williamsonu še drugi avtorji, največ je antropologov, ki opozarjajo, da bi lahko razvoj trajnosti lahko veliko pridobil, ko bi se ob tržni ekonomiji bolj uporabljal potencial darilne ekonomije, še zlasti njena načela organiziranja (Thygesen, str. 18). Te koncepte že uporabljajo tudi institucije EU: odprta znanost, odprti podatki, aktiviranje networkinga, državljanska znanost so pomembne sestavine razvojnih dokumentov. Vendar pa ostaja sam razvoj trajnosti skozi pripravo predlogov projektov za financiranje konceptualiziran in organiziran po principih denarne tržne ekonomije.

V EU so priporočene »socialne inovacije, ki so za formalne sisteme gonilna sila, da lahko učinkoviteje rešujejo probleme« (SI-Drive, 2018, str. 19). Torej ne le tehnološke inovacije, ampak tudi socialne, so ključni gonilci (key drivers) produktivnosti in ekonomske rasti, dodana vrednost pa kreira nove in boljše zaposlitve. Socialna inovacija je postala izziv, ker »vključuje ponudbo in povpraševanje, pa tudi kreira širše okolje, v katerem se ukrepa«/.../»manjka pa jasen in celosten koncept in okvir za ukrepanje politike« (Reynolds, 2018, str. 5-6). V ekonomskem modelu je dodati vrednoti solidarnost in odgovornost, ker »so dobre za družbo in krepijo kapaciteto družbe, da družba odreagira« (Social innovation research, 2013). Številni so dokazi, da so socialne inovacije mehanizem, ki doprinaša ekonomskemu in družbeno-socialnemu razvoju,« (ibid., str. 3).

Ko se razpravlja in ukrepa o trajnosti so trajnosti dejansko treh vrst: okoljska, ekonomska in družbena (socialna), a se o njih ne razpravlja celostno. Socialne vrednote in dimenzija družbenih odnosov se zdijo manj pomembne. Ekonomski vidik pa v pogojih obstoječega denarnega gospodarstva vidi v denarju krati problem in hkrati rešitev. N.pr.: Poročilo EK o merjenju ekonomskih performans in napredka v družbi navaja v tem kontekstu številne pobude, zakonodajo, narejene so finančne kalkulacije in povezave s proračunom in managementom. Še pred razglašeni trajnimi cilji razvoja je leta 2008 Poročilo Komisije o merjenju gospodarske uspešnosti in družbenega napredka razkrilo številne razsežnosti, ki vplivajo in oblikujejo dobro počutje ljudi (The Stiglitz Commission, 2008, str. 10-11) kot so: materialni življenjski standard (dohodek, potrošnja in bogastvo), zdravje, izobraževanje, osebne dejavnosti, vključno z delom, politike ukrepanja, socialne povezave in odnosi, obstoječe in pričakovane razmere v okolju, ter negotovosti, tako ekonomske kot fizične narave. Vse te razsežnosti naj bi merili dobro počutje ljudi in ne le bruto družbeni produkt. Gre za izračune koliko stane trajnost in hkrati, koliko

trajnosti bodo prinesle investicije. Predvsem pa se gleda na denar kot na rešitev problema. Na ta način je koncept trajnosti ločen od aplikacije tistih vrednot kot jih sicer prinaša daritvena ekonomija – t. trajnostnih odnosov.

Vendar Agenda 2030 je jasna: do leta 2030 naj bi bilo 17 ciljev doseženih. Ne gre več za vprašanje ali trajnost ali ne, pač pa kako, na kakšen način. Številni podatki pričajo, da v velikem delu darilna ekonomija v Sloveniji deluje in to zelo dobro. Načinov je več: aktivnosti civilne družbe, številne enkratne akcije z namenom socialnih pomoči. Nega otrok in starejših, še zlasti s strani žensk, po vsebini sodi v model darilne ekonomije.

Seveda so tudi slabosti darilne ekonomije. Zato je vredno razmisliti, kako in v kolikšni meri darilna ekonomija in druge oblike socialne ekonomije, lahko spodkopala ali spremenila⁶ načela urejanja, organiziranja in upravljanja družbe? Prav zato so izredno pomembna vprašanja, ko darilna ekonomija nadgrajuje ali zamenjuje aktivnosti ekonomskega denarno-tržnega modela, kot n.pr.: »Kako lahko politiki izvajajo demokratični nadzor in urejajo družbo, kakšni so tudi neformalni načini organiziranja in ustvarjanja vrednosti? Česa bi se morali ljudje zavedati, kdaj se zavzemati za vzajemne ureditve v družbi in lokalnih skupnostih« (Thygesen, 2019, str. 18). S temi vsebinami so povezane razprave, kako spodbujati aktivno državljanstvo. EK v dokumentu sporoča: »Nadaljnje izvajanje evropskega stebra socialnih pravic ostaja prednostna naloga politike za spodbujanje navzgor usmerjene socialne konvergence v EU. Da bi zagotovili bolj sistematično analizo razvoja na področju zaposlovanja in socialnih zadev v državah članicah, je predlog Komisije za skupno poročilo o zaposlovanju za leto 2024 bolj osredotočen na posamezne države, saj vsebuje analizo po državah, ki temelji na načelih okvira socialne konvergence EK Vlaganje v konkurenčno prihodnost EU: Letni pregled trajnostne rasti za leto 2024, str. 9).

Številni primeri iz prakse potrjujejo, da se je treba za dolgoročne rešitve in trajnostnost vrniti k vrednotam darilne ekonomije. To pa so iste vrednote, ki so

⁶ N.pr. ob poplavah so številni individualni darovalci želeli in so darovali denar. Nekateri za najbolj ogrožene posameznike, drugi za občine, tretji namena daritve niso navajali. Vendar ne na nivoju države ne na nivoju občine ni bil vzpostavljen sistem ali mehanizem za takšno darilno ekonomijo, zaradi česar je prihajalo do zapletov, nesporazumov, pa tudi v občinah kot temeljnih skupnostih v katerih se razvijajo socialne vezi, niso bile informirane.

zapisane v primarnem Pravu EU, v Sloveniji⁷ pa še zlasti delujejo ob prilikah katastrof (n.pr. poplave, plazovi, pomoč bolnim, itd.). Ko je EU integrirala ekonomijo dobrobiti posameznika v njene družbeno-ekonomske politike takšen pristop zahteva, da mora vladanje ne le podpirati ekonomski steber in z njim povezane dobičke, ki jih prinaša razvoj tehnologije, ampak tudi socialni steber in z njim povezano naravo, potrebe ljudi in družbe. Koncept ekonomije dobrobiti naj spodbuja takšno ekonomijo, od katere imajo koristi planet Zemlja in njeni prebivalci, da se zagotavlja njihovo dostojanstvo in pravičnost.

7 Zaključki

Prispevek je odgovoril na zastavljena tri vprašanja. Za Slovenijo so identificirani dejavniki, zaradi katerih je treba povezovati dostop do zdravstva z aktivnostmi zelenega dogovora, saj nimajo vsi davkoplačevalci dostopa do sistema javnega zdravstva, so čakalne vrste, premalo je bolniških sester, itd. Da bi bilo zdravstvo učinkovito, možnosti, ki jih nudi digitalizacija ostajajo neizkoriščene. Zaradi novega konteksta razmišljanja in ukrepanja za trajnostni razvoj, strateških in sistemskih sprememb v kulturi razmišljanja in ukrepanja še ni. Razumevanje pomena vloge vladanja – države in odgovornosti za uveljavitev načela zdravja v vseh politikah ni. Pomembno je ločiti vzroke od posledic zato, da se postavlja prava vprašanja in da se skupaj išče relevantne rešitve. Tržna ekonomija slabi sistem javnega zdravstva, darilna ekonomija pa že uspešno in učinkovito sobiva s sistemom denarne ekonomije in vpliva na solidarnost in druge vrednote družbe.

Strategija zdravja in sistema zdravstva je v kontekstu trajnega razvoja potrebna zato ker so klimatske spremembe vezane na vprašanja zdravja, določajo kakovost okolja in so zaradi njihovega obsega postale fundamentalna grožnja človeku, hkrati pa determinante zdravja določajo družbeno-ekonomske pogoje in potrebe, kako naj funkcionira zdravstveni sistem, . Ker povečujejo smrti, povečujejo bolezni, širijo infekcije in respiratorne bolezni, v naravi pa je vse več požarov, neviht, prahu in peska, so slaba kakovost zraka, zemlje in vode največja grožnja naravi in ljudem. Zato morajo biti sistemi zdravstva javni, vladanje pa mora okrepiti politike ukrepanja

⁷ V 8. členu Zakona o preprečevanju dela in delo na črno je v 8. členu zapisano: »Za medsebojno sosedsko pomoč se šteje opravljanje dela med sosedi, kadar med njimi obstaja določena bližina v smislu prebivanja, če med njimi ni sklenjene pogodbe in je delo opravljeno brez plačila ter če ga ne opravi pravna oseba ali podjetnik, ki opravlja dejavnost, ki je neposredno vezana na opravljeno delo, kakor tudi druge oblike med sosedске pomoči, določene v zakonu«. Uradni list RS, št. 12/2007.

in zdravstveno infrastrukturo, da klimatske spremembe ne zmanjšujejo kakovosti življenja.

Številne raziskave, revizije, evalvacije in analize ostajajo neopažene, še bolj pa neuporabljene za krepitev sistema odgovornosti, izgradnjo sistema javnega zdravstva in krepitev politik ukrepanja. Lahko rečemo, da ima strategija prilagajanja zdravja in skrbi za zdravje in nego v klimatskih spremembah nizko prioriteto, kar se ne dogaja ne le v Sloveniji. So vrzeli med zakonodajo, opredelitvami politik in ukrepov ter dejanskim stanjem. Ob ukrepanju za dvojni zeleni in digitalni preboj se premalo obravnava možnosti in orodja, ki bi spravila v tek transformacijski potencial, ki ga ima promocija zdravja še zlasti v kontekstu trajnostnega razvoja. Podobno tudi manjka ob prioritetenih usmeritvah za zeleni in digitalni preboj usmeritev za spremembe življenjskega stila.

Neizkoriščeno je dejstvo, da zdravstvo ne deluje kot ekonomsko pomembna panoga. V zdravstvu namreč lahko raziskave in inovacije ob podpori digitalne transformacije povečujejo znanje in konkurenčnost, ki doprinaša konkurenčnosti države in ustvarjanju dodane vrednosti. Vse preveč energije se izgublja v teoretičnem razglabljanju, namesto bi ukrepi politik predstavljali izbrane strokovne predloge v prakso. Še zlasti je pomembna vloga visokega šolstva ali akademije, ki naj prevzame vlogo povezovanja različnih akterjev.

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SIMULATION AS A GAME-BASED EXPERIENTIAL TECHNIQUE IN ENGLISH FOR PROFESSIONAL PURPOSES: IMPLEMENTATION AND EVALUATION

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The goal of this paper was to explore how effective simulation as a game-based instructional method is in teaching English for Professional Purposes. It explains the creation, implementation, and assessment of the Company Simulation, a social epistemic simulation game in which students act out roles in a predetermined scenario and learn about the concepts and relationships of the business world while immersed in a classroom-created micro-world. Students complete tasks that mimic real-world professional tasks by navigating a complex web of interactions and transactions. A students' perceptions questionnaire has shown that the simulation was unequivocally thought to be relevant, enjoyable, and useful. It has also helped participants acquire specific language, social, and domain competences and skills in a collaborative environment offering abundant learning opportunities, thus bridging the academia and industry gap and helping students develop 21st century work-related skills in a meaningful, integrated, and purposeful way.

Keywords:
simulation,
English for
professional
purposes,
game-based
learning,
21st century
skills

1 Introduction

For successful professional communication and integration in the modern globalized and high-tech workplace arena future graduates need to possess an intricate set of skills and competences. In order to effectively prime students for the ever-increasingly sophisticated world of work, today's educators are faced with the challenge of creating not only meaningful and relevant learning environments, but also ones that are pertinent to the new generations of learners born into a digitally-wired world. The new protagonist of the 21st century educational scene, the new learner is a game player, experienced problem-solver and effective navigator in the world of networked information. The new learner has an exploratory and playful learning style and expects the learning space to be interactive, personalized, authentic and co-creative, as well as enjoyable and entertaining (Prensky, 2001; Veen & Staalduin, 2009; Veen, 2007).

These complex demands necessitate a critical approach to existing teaching practices and the re-tuning of the instruments of education in order to “sync up learning to the new rhythms of the 21st century” (Trilling et al., 2009, p. xxviii). Teachers should evolve into architects of learning experiences, game designers and game masters, able to design pedagogically and theoretically sound, yet enjoyable learning experiences.

This paper sets out to explore and test simulation as an instructional format in teaching English for Professional Purposes. Strongly rooted in the game-based learning paradigm, simulation lends itself easily to creating not only relevant and meaningful learning tasks, but also ones that have a strong game element, introducing excitement and challenge into the learning experience. Following the introduction providing the motivation and context for the implementation of this project, the most important theoretical and methodological tenets of play- and game-based learning and simulation as a technique are introduced. A brief description of the design and implementation of the Company Simulation in teaching English for Business Purposes is provided, followed by the discussion of the research study results, the challenges of game-based learning and concluding remarks.

2 Play- and game-based learning – an overview

Inspiration for 21st century teaching and learning challenges might be found in the world of play, tapping in its infinite potential and harnessing its captivating power. Play is a universal and primordial phenomenon accompanying human societies from times immemorial, regardless of their economic and cultural development level, age or gender, social class. In addition to its numerous other roles, play has always been an important pedagogical instrument, a powerful mediator for learning, for handing down the social heredity and tradition from generation to generation (Groos, 1901).

The idea of the potential of play in education goes a long way back. 25 centuries ago, Plato made the observation that early education ought to be a form of entertainment, as “knowledge which is acquired under compulsion obtains no hold on the mind” (Plato & Jowett, 1888, p. 218). Unfortunately, due to many misconceptions of play as being frivolous or even sinful, this line of thought has not been followed through until the end of the 18th century and the works of Enlightenment philosophers Friedrich Schiller and Jean-Jacques Rousseau, and later Dewey, Jean Piaget and Lev Vygotsky. Today, play is considered to be an infinite reservoir for learning and a lifelong portal to growth for all generations.

Although widely enjoyed for amusement and entertainment for thousands of years, the first records of games and simulations used for educational purposes are found rather late, in the 17th and 18th centuries in the field of military training (Wolfe & Crookall, 1998). It is the 1950s that mark the beginning of the contemporary era in simulation and gaming, and this is the period when a multitude of different games and simulations find their way into education and training in a range of diverse disciplines, management, healthcare, political sciences (Gredler, 2004; Klabbers, 2009). Play has been given (back) its legitimacy in education, as an approach, mindset, method and technique. A number of research studies (Connolly et al., 2012; Whitton & Baek, 2013) have shown the effectiveness of play- and game-based learning in the development of cognitive and affective skills. In higher education they have been found to be effective in the integration of content knowledge acquisition and the development of specific skills, such as collaboration, creative thinking decision-making, problem-solving and leadership, key 21st-century competences (Johnson et al., 2011).

Ever since the emergence of the communicative approach, games and simulations have found their way into the field of foreign language learning (FLL) as well, and their positive effects on raising students' engagement and motivation and levels of achievement have been well studied and documented (Crookall & Oxford, 1990; García-Carbonell et al., 2014; Hyland, 1993; Magge, 2006). However, although not a recent fad, they are still underutilized, particularly in the field of Languages for Professional Purposes.

3 Simulations

In the FL field, simulations are linked to a number of educational approaches and methods, such as experiential learning, task-based approaches, the socio-cultural theory. This paper's focus is on experiential social simulation games and their assets for learning and development. In a simulation game, players are immersed in a micro-world constructed to reflect and represent some complex social, economic, political or any other organizational system (de Freitas, 2006), be it a conference, enterprise, hospital, negotiations, etc. Participants play a defined role in a certain scenario and experience feelings and concerns of a particular role in a certain social context (ibid.). They navigate and explore an intricate web of interactions and transactions in this world, fulfilling tasks and solving problems, deepening their insights into this world and discovering its principles and relations (Rieber, 1996).

Simulation games take place in Huizinga's magic circle (Huizinga, 1955). The classroom becomes the playground, a virtual world, safe and sacred and dedicated to performance, where "people take risks and grow" (Heinrich, 2017, p. xiii). It is a risk-free environment, where the cost of mistakes and failures is low. The atmosphere is relaxed, reducing shyness and lowering the affective filter. Using role-play, students can freely experiment and try out different competences and skills in a world that is imaginary, yet with functions that are realistic (Jones, 1982). It allows reflections on new and unknown situations and practicing future events in a creative and stimulating ambience.

In line with the socio-cultural theory that perceives learning as a social process that emerges in a socio-cultural context, simulation games involve mutual and reciprocal peer learning, support and scaffolding, collaborative dialogue, negotiation and cooperation (Swain, 2000). It is through those nexuses of emergent interactions that

the zone of proximal development is created (Vygotsky, 1978), a space where progress, growth, and learning happen, where we bridge the gap between what we are and what we may become. It is an experiential approach, encouraging experimentation, self-discovery and exploration where play acts as the catalyst “for qualitative socio-cultural transformation” (Holzman, 2009, p. 115).

In Languages for Professional Purposes, simulation games offer the opportunities for creating communicative situations and tasks that are replicas of real-world situations, tasks or problems, with the possibility of transferring acquired experiences in future professional environments, thus priming students for future life and workplace experiences (Sturtridge, 1981). They offer a rich mixture of linguistic and domain-specific input, output and interactions and are conducive to inter-curricular integration, an integrated approach in acquiring not only linguistic skills but also specialist, domain-specific knowledge. Simulations have interactional authenticity and relevance for the future workplace. Tasks are contextualized, meaningful and purposeful, mirroring real life communicative challenges and embodying elements of real discourse.

4 The Company simulation – design, structure and implementation

The Company simulation, designed for first-year students in the English for Business Purposes course, was conceived in such a way as to meet the learning objectives of the curriculum and the workplace target needs of our future graduates, as identified by a previously conducted comprehensive needs analysis. These presume developing the linguistic, socio-linguistic, socio-cultural and socio-pragmatic communicative competences and skills for active participation in various business and life situations.

The Company simulation attempts at recreating and co-creating a micro-world, which is a representation of the settings of the business world reality, in line with Jones’ (1982) definition of simulation as “a reality of function in a simulated and structured environment” (p. 5).

It is meant to be a safe and interactive space for students to play out their chosen business roles and discover the business world’s principles and relations. As presented in Table 1 below, the Company simulation is built around missions and

tasks, situations and experiences characteristic of the potential target workplace and culture: establishing companies, recruitment and delegation of company roles, diverse business interactions and transactions in an imaginary business world.

Table 1: The Structure of the Company simulation

	Project tasks	Project subtasks	Organization
Mission 1	Building a Company Profile	A Setting up a company B Deciding on a business idea	Small groups
Mission 2	Building a Job Profile	A Delegating roles & responsibilities	Small groups and individual work
Mission 3	Preparing a CV and cover letter	B Job applications	Individual work
Mission 4		Presentation	Whole group work
Mission 5	Attending a Trade fair	A Making contacts at the trade fair B Wining and Dining	Small groups Whole group work
Mission 6	Conducting business transactions	E-mailing – inquiries, offers, placing an order, complaints	Small groups
Mission 7		Final Presentation	Whole group work
	Feedback and Evaluation	A Feedback and Comments B Evaluation & Discussion	

Source: Authors' design

The tasks are varied, involving individual, small-group and whole-group work and activating all four language macro-skills (reading, writing, listening and speaking) in an integrated way. They have tangible outcomes and clear and meaningful purposes instigating communication and information gathering and exchange, decision-making, knowledge sharing, negotiating of meaning and problem-solving. Students enact various spoken and written interactions accompanying business activities. They practice both formal business language and social interactions (company and personal business presentations, flight and hotel accommodation, establishing and developing contact with prospective business associates, formal business e-mails), as well as less formal interactions in building rapport and maintaining business contacts, working towards closing a business deal with another student company. Students are free to experiment with imaginary professional identities and behaviours, which contributes to a relaxing and enthusiastic atmosphere in the classroom. The final presentation encompasses presenting all the undertaken activities, as well as a portfolio containing the documents generated throughout the

Company simulation and the project closes with a comprehensive feedback and evaluation session.

Each mission in the Company simulation is introduced with a briefing and wrapped up with a debriefing session. The briefing session specifies the mission requirements, brings attention to specialist vocabulary and expressions (Bullard, 1990), sparks students' motivation and activates content, linguistic and socio-cultural background knowledge (Knutson, 2003). In the debriefing, reflection session, the learning experience is revisited and analysed, thus observing one of the main principles of experiential learning, namely, that "knowledge is created through the transformation of experience" (Kolb, 1984, p.38).

5 Evaluation

5.1 Research questions and method

As part of the reflection process on the pedagogic and linguistic effectiveness of the Company simulation project, a classroom-based study was carried out. The research questions addressed students' perceptions on the relevance of the Company simulation, its alignment with the course learning objectives and the students' need and interests as well as their perceptions on the enjoyability and usefulness of the Company simulation in general, and in terms of the acquisition of certain linguistic, social and professional skills.

RQ1: What are students' perceptions on the alignment of the Company simulation's content with the learning objectives of the English for Business Purposes 1 course?

RQ2: What are students' perceptions on the alignment of the Company simulation's content with their needs and interests?

RQ3: Do the students find the Company simulation tasks to be interesting and motivating?

RQ4: Do the students find the Company simulation tasks to be purposeful and relevant?

RQ5: What are students' perceptions on the enjoyability of the learning experience using the Company simulation?

RQ6: What are students' perceptions of the usefulness of the knowledge gained in the Company simulation in their further work?

RQ7: Do students find the Company simulation to have been effective in enriching their presentation skills?

RQ8: Do students find the Company simulation to have been effective in enriching their lexical skills?

RQ9: Do students find the Company simulation to have been effective in enriching their knowledge on business operations?

RQ10: Do students find the Company simulation to have been effective in enriching their teamwork skills?

The instrument used to gather data on students' learning experiences and attitudes was a students' perceptions questionnaire. The items were rated on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). It was administered on two occasions, with the 2014/2015 generation of students, upon the first implementation, and once again in the 2018/2019 academic year. A total of 57 and 67 participants, respectively, completed the evaluation questionnaire. The data were analyzed using the descriptive statistics method.

5.2 Results and Discussion

Mean scores and statement agreement percentages of students' perceptions on the relevance, enjoyability and usefulness of the Company simulation in general, as well as in terms of acquiring specific linguistic, social and professional skills are shown in Table 2.

Table 2: Mean scores and percentages on the students' perceptions questionnaire

Statements:	2014/2015 n=57		2018/2019 n=67	
	M	Agree & strongly agree %	M	Agree & strongly agree %
1. The Simulation content is aligned with the learning objectives.	4.31	87.8	4.70	95.5
2. The Simulation content is aligned with my needs and interests.	4.28	83.9	4.40	85.1
3. Tasks were interesting and motivating.	4.38	89.3	4.77	97
4. Tasks were purposeful and relevant.	4.33	91.2	4.74	95.5
5. Learning through simulation tasks was interesting and enjoyable.	4.50	92.6	4.74	98.5
6. The knowledge gained will be useful in my further work.	4.25	90.9	4.50	94.9
7. The Company simulation has been effective in enriching my:				
A Presentation skills	4.45	87.3	4.65	97
b Lexical skills	4.41	88.6	4.53	89.6
c Knowledge on business operations	4.21	84.3	4.46	86.6
d Teamwork skills	4.43	84.6	4.57	87.8

Source: Authors' calculations

The results show a significant degree of agreement with the given statements, with means exceeding 4.5 in a number of statements, especially for the 2018/2019 cohort, which might tentatively be attributed to introducing minor adjustments and the authors' greater confidence in directing and managing the simulation. Perceptions of usefulness and enjoyability coincide. The experience of learning using the simulation instruction format was found to be interesting and enjoyable by more than 92.6 % and 98.5% of the participants, respectively, an exceptionally high rate.

The Simulation was regarded as useful for future professional communication and found notably effective in developing presentation, lexical, teamwork skills as well as business-specific knowledge. In conclusion, we might say that the findings of our study aimed at exploring the effectiveness and viability of using simulation in teaching English for Professional Purposes are promising and encouraging and show that the instructional format was perceived as both enjoyable and relevant justifying our primary purpose and motivation for the implementation of this project. The simulation format has allowed for the creation of an exciting, collaborative and immersive learning environment abundant in learning opportunities for developing future work-related skills in a meaningful, integrated and purposeful way.

6 Concluding remarks

Play- and game-based learning are not without challenges. Navigating the tightrope between fun and purpose, finding ways “to get the correct balance between delightful play and fulfilling specified learning outcomes” (de Freitas, 2006, p.5) is never easy. Another important controversy related to learning using playful formats are assessment and evaluation, as the visible effects in terms of improved cognitive or social skills are not always immediate and the gap may be measured in months or even years (Bateson & Martin, 2013). Empirical studies’ results are often inconclusive and learning through play is still a black box raising important questions as to what learning is exactly and how learning outcomes should be specified and measured in a valid and reliable way.

However, although further research is still required as to the fine-tuning of instruments for measuring the direct influence of play- and game-based approaches on learning, we strongly believe that they deserve a highly prominent place in education. Combining language, content, and skill development in meaningful and purposeful replicas of target tasks using a game-based format enables: a) the creation of a learning experience that is more in line with the ways in which digital natives think and behave; b) the closer integration of teaching and learning with real-world professional experiences. Play is a driver of creativity and flexibility, preparing us for meeting future challenges and discovering new approaches for dealing with the world (Bateson & Martin, 2013). Learning through play, complex and sophisticated as it is, has learning outcomes that are far more wide-ranging and cross-disciplinary, deeper and longer-lasting and potentially more rich and applicable to real-world

experience. In education, it is the royal road to an ecological, holistic and humanistic approach to learning.

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THE DIGITAL OPERATIONAL RESILIENCE ACT – CHALLENGES FOR A SAFER FINANCIAL INSTITUTIONS

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The Digital Operational Resilience Act (DORA) is the latest regulation issued by the European Union to address the financial sector's growing reliance on technology and manage the associated cyber security risks. DORA sets the whole framework and extends the requirements for financial sector resilience not only to financial institutions themselves, but also extends the security requirements to suppliers of critical ICT services. This paper analyses the main issues of implementation starting with just determining whether a company is subject to DORA through to the actual implementation and the impact of DORA on internal processes, capabilities and more. The key problems associated with the implementation of DORA can be clearly considered to be the financial and time complexity of the implementation, the short timeframe for implementation, the degree of impact of DORA on the internal processes of companies and the need for significant changes within IT, IT process, IT Risk Management and especially the lack of experts with adequate knowledge and experience.

Keywords:

DORA,
implementation,
risks,
security,
challenges

1 Introduction

Digital transformation is a word that is bandied about in many ways in most companies and it could be argued that it is a phrase that is bandied about in all companies in the financial sector.

Digitisation affects many areas, including document processing, including the extraction of documents and their subsequent access to users, as well as the implementation of technologies that take over responsibility for routine tasks in which they replace living beings, and the implementation of various AI technologies to make companies more efficient. All of these areas are linked to one basic word - data - and it can be said that companies are collecting, storing and managing ever-increasing amounts of data to gain insight, make informed decisions and improve their operations.

At the same time, with the increasing use of digital technologies, businesses are becoming more and more dependent on data and are increasingly at risk of cyber-attacks, data breaches and other security threats. Therefore, it is essential to have a robust digital resilience strategy to protect data and maintain business continuity (EBA, 2019; EBA, 2019a).

The Digital Operational Resilience Act (DORA) is a regulation introduced by the European Union to address the financial sector's increasing reliance on technology and to manage the associated cyber security risks. This dependence is mainly driven by the drive to digitise companies mentioned above. In view of these efforts, attention is thus being paid at EU level to the cybersecurity aspect, which is closely linked to digitalisation.

DORA introduces specific and prescriptive requirements that are homogeneous across EU Member States, so companies have a simplified position as key parts of the regulation will be the same in all countries.

Compared to other regulations, the specific feature of DORA is that it does not only apply to the institution itself, but is binding on critical third-party ICT services that provide ICT-related services to financial institutions, such as cloud platforms, data analytics and auditing services, and of course the development and operation of companies' key information systems.

The first draft of DORA was published by the European Commission as part of the Digital Finance Package (DFP) on 24 September 2020. The law was approved by the European Parliament and entered into force on 16 January 2023. The European Supervisory Authorities (European Banking Authority (EBA), European Insurance and Occupational Pensions Authority (EIOPA) and European Securities and Markets Authority (ESMA)) are preparing a set of policy products to enable the application of DORA (EU, 2023; EBA, 2019).

In the context of the above, the main objective of DORA is to strengthen the resilience of the financial sector to ICT-related incidents and to standardise a set of criteria, templates and guidelines that will determine how financial organisations manage ICT and cyber risks (EU, 2023; KPMG 2023; Cybersecurity Exchange, 2023).

The aim of this paper is both to identify the key issues associated with DORA and, based on the authors' practical experience, to outline the critical steps that need to be implemented in financial institutions to successfully implement DORA.

2 Methodology

The article is based on an analysis of current information from a number of information sources describing and defining various aspects of the Digital Operational Resilience Act and the authors' experience in practical implementation of the DORA standard in the financial institutions in which they are involved.

The main sources of information are the directives issued by the European Union and other sources describing the requirements for companies under the DORA Regulation.

For the purpose of this paper, we analyzed more than 37 information sources and 12 of them were used and cited in this paper.

3 Dora and its implementation

3.1 Self Assessment and Critical Areas

The first and fundamental step that needs to be taken in a DORA implementation is to determine whether or not the company is a DORA subject of interest. Unfortunately, there is no specific list of entities or types of companies that are subject to the standard, so it is necessary to analyse the entire set of DORA requirements and then compare them with the company's focus, turnover, number of employees and many other parameters (BCI, 2023).

The initial DORA self-assessment contains over 30 questions that determine whether or not a company is obliged to implement DORA.

Examples of issues are (Bousaissi, 2023; EU, 2023):

- Is the entity a payment institution, including payment institutions exempted in accordance with Article 32 (1) of Directive (EU) 2015/2366?
- Is the entity an account information service providers?
- Is the entity an electronic money institution, including electronic money institutions exempted in accordance with Article 9 (1) of Directive 2009/110/EC?
- Is the entity a credit institution?
- Is the entity a trading venue?
- Is the entity an investment firm?
- Is the entity an administrator of critical benchmarks?
- Is the entity a crypto-asset service providers as authorized under MiCA and issuers of asset-referenced tokens ?
- Is the entity an insurance and reinsurance undertaking?
- Is the entity a central securities depository?
- Is the entity a trade repositories?
- Is the entity a manager of alternative investment funds?
- Is the entity a crowdfunding service provider?

- Is the entity an insurance intermediaries, reinsurance intermediaries and ancillary insurance intermediary?
- Is the entity an institution for occupational retirement provision?
- Is the entity a credit rating agency?
- Does the entity have more than 10 persons?
- Is the entity having annual turnover and/or annual balance sheet total > 2 million EUR
- Is the entity a payment system, other than referred to in the list above?
- Is the entity a card payment scheme?
- Is the entity a system operator, i.e. the entity or entities legally responsible for the operation of a system.?

It is clear from the above that almost all companies that touch the financial market in any way, have more than 10 employees, are affected by DORA implementation, thus it also applies to small financial organisations. The turnover does not need to be taken into account as 99% of the companies touching the financial market exceed the above-mentioned values.

If it is identified through self-assessment that a company is required to implement the DORA framework, it is advisable to be very structured and identify the key people and areas that need to be addressed within the company to implement DORA. In order to successfully implement DORA within a financial institution, a large number of steps and overall changes need to be implemented within the company and its processes. The critical areas that need to be implemented include (UK Finance, 2023; EU, 2023; ENISA, 2021; RSM, 2023):

- DORA can be considered a very large project, so a responsible project manager needs to be identified to deal with readiness and compliance within the organisation².
- Understand the five pillars of DORA: DORA divides digital operational resilience into five areas - risk management, incident reporting, digital operational resilience testing, third party ICT risk management and information sharing and intelligence².
- Significantly strengthen the area of ICT risk governance and management: the DORA places a strong emphasis on ensuring digital operational

resilience, and DORA is primarily the responsibility of risk management with compliance support with respect to the legal impact of impelment.

- Modify contracts with critical suppliers: DORA specifies requirements for contracts with third-party ICT providers that must be incorporated into financial institutions¹ contract management.
- ICT incident management and recording: the aim of DORA is to standardise the reporting obligations for serious ICT incidents across the European financial industry, i.e. companies must take this area into account in their internal processes.
- Control of third-party ICT risks: not only does the company oversee its own risks, but it must have processes and responses in place for third-party risks.
- Digital Operational Stability Testing: Regular testing of the operational stability and security of critical ICT systems is essential for the smooth operation of financial businesses¹.

A detailed analysis of the above critical elements is a prerequisite for the community to prepare for the full application of DORA and be able to meet all requirements. The above-mentioned critical areas are clearly linked to the problems associated with the implementation of DORA itself.

3.2 Key issues in DORA implementation

The implementation of the Digital Operational Resilience Regulation is quite a challenge for companies, especially compared to previous standards such as NIS2. The main reason for the challenge is the fact that a larger number of entities are subject to DORA - it is estimated that more than 6,000 companies in the Czech Republic will be affected by this regulation, mainly due to the transfer of DORA compliance responsibilities from financial institutions to suppliers of critical IT services. Of the many issues we have identified, we consider the following to be key issues (RSM, 2023; Norton Rose Fulbright, 2023; MorganFranklin Consulting, 2023):

- Preparedness, where smaller financial firms in particular may not be sufficiently prepared for the implementation of new requirements that are mandatory and failure to comply with them may be punishable by fines.
- Regular updating of ICT systems and elimination of threats.

- Process optimization of existing processes, the introduction of new processes and their description are key to meeting the requirements.
- Training of all relevant staff who must understand and comply with all new regulations.
- Timeframe: the planned timeframe for implementation is ambitious and requires organisations to take a more proactive approach to addressing these challenges.
- Design and implementation of complex security architecture.

All of the above points present challenges present a huge set of issues that are not only associated with the need for a significant knowledge base, but also funding, time etc. that companies do not have with respect to the launch date. The size of the company and its affiliation to a group of companies is an important aspect of the issue. If the company is part of a group of companies that use, for example, a group ICT service provider + other external suppliers, the implementation of DORA must also occur at the group level to ensure compliance.

While DORA is intended to strengthen the IT security of financial entities, its implementation may present many more challenges for smaller organizations, which have their own challenges of being subject to DORA compared to large corporations (MorganFranklin Consulting, 2023):

- Small businesses may face limited resources in terms of budget and staff to implement new requirements.
- They may lack the necessary technical knowledge to understand and implement complex DORA requirements.
- Small organisations often rely on third party ICT providers and managing relationships with third parties can be problematic.
- The regulatory burden of complying with DORA and other standards and regulations can be significant, and even small companies must meet defined requirements to augment staff with specific job functions.

3.3 EU norms related to IT security for financial institutions

With regard to the previous, let us give a brief overview of how many binding standards have been issued in recent years for the IT Security:

- Directive 2013/36/EU (CRD): this directive requires the EBA to further harmonise the internal governance arrangements, processes and mechanisms of financial institutions across the EU.
- Directive (EU) 2015/2366 (PSD2): this directive mandates the establishment, implementation and monitoring of security measures for operational and security risks.
- ICT and Security Risk Management Guidelines: these guidelines set out requirements for credit institutions, investment firms and payment service providers (PSPs) to mitigate and manage their information and communication technology (ICT) and security risks.
- EU Cybersecurity Law: the EU framework for cybersecurity certification for ICT products allows for the creation of tailored and risk-based EU certification schemes. The NIS2 Directive is the EU legislation on cybersecurity. It provides legal measures to strengthen the overall level of cybersecurity in the EU.
- DORA

In terms of content, these standards and directives seek to ensure a consistent and robust approach to IT security across the EU financial sector, but their number and range is significant and they impose a significant burden on companies.

4 Summary and conclusion

On the one hand, the implementation of dora represents a significant progress in setting rules and requirements for ICT security of various types of financial institutions, which can be considered a very positive factor, especially from the perspective of the clients of these companies. On the other hand, however, there are many problems associated with this regulation and its implementation, including in particular the lack of stability of the legislation, which is still under development, the volume of changes that companies have to implement even in their key processes.

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DOBRE PRAKSE POVEZOVANJA ERGONOMIJE IN TRAJNOSTI V SODOBNIH ORGANIZACIJAH

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V okvirih trajnostnega razvoja vse bolj pomembno vlogo predstavlja tudi ergonomija, kar se kaže predvsem v kontekstu sodobnega organizacijskega razvoja. S pomočjo SWOT analize je moč analizirati prednosti, slabosti, priložnosti ter nevarnosti vključevanja ergonomije v trajnostni razvoj organizacije. V raziskavi je poleg analize interdisciplinarnih povezav med omenjenima strokovnima vedama predstavljeno večje število dobrih praks, ki so skladne z ergonomskimi načeli za izboljšanje zdravja ter dobrega počutja zaposlenih na delovnem mestu. Te prakse so večplastne in zajemajo ergonomsko zasnovano delovnega prostora, uporabo energetske učinkovite pisarniške opreme, trajnostne postopke javnega naročanja, spoštovanje standardov zelene gradnje in izvajanje pobud, ki segajo od prizadevanj za zmanjšanje odpadkov do oblikovanja politik dela na daljavo. Implementacija strategij ohranjanja zdravja ter povečanja zadovoljstva zaposlenih dviga raven produktivnosti in prispeva k ohranjanju okolja. Predstavljen je model, ki ponuja možnost vključitve ergonomije v trajnostni proces, ki naj bi tekkel v vsaki organizaciji. Model poleg načrta za organizacije, ki si prizadevajo za bolj zdravo, učinkovitejšo in okoljsko ozaveščeno prihodnost, poudarja tudi pomen spodbujanja celostnega pristopa k organizacijski odličnosti.

Ključne besede:

ergonomija,
trajnost,
SWOT
analiza,
dobre
prakse,
model

GOOD PRACTICES FOR INTEGRATING ERGONOMICS AND SUSTAINABILITY IN MODERN ORGANIZATIONS

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Ergonomics is playing an increasingly important role in the context of sustainable development, particularly in the context of modern organizational development. A SWOT analysis can be used to analyse the strengths, weaknesses, opportunities, and threats of integrating ergonomics into sustainable organizational development. In addition to analysing the interdisciplinary links between the two disciplines, the study presents many good practices that are consistent with ergonomic principles to improve the health and well-being of employees in the workplace. These practices are multifaceted and include ergonomic workspace design, the use of energy-efficient office equipment, sustainable procurement practices, compliance with green building standards and the implementation of initiatives ranging from waste reduction efforts to the design of teleworking policies. Implementing strategies to maintain health and increase employee satisfaction raises productivity levels and contributes to preserving the environment. A model is presented that offers the possibility of integrating ergonomics into a sustainability process that should be ongoing in every organization. In addition to providing a roadmap for organizations striving for a healthier, more efficient, and environmentally conscious future, the model also highlights the importance of promoting an integrated approach to organizational excellence.

Keywords:
ergonomics,
sustainability,
SWOT
analysis,
good
practices,
model

1 Uvod

Koncept vključevanja ergonomije in trajnosti v organizacijski razvoj ima pomembno vlogo pri izboljšanju operativne učinkovitosti, spodbujanju zdravega delovnega okolja in obravnavanju vse večjega pomena trajnostnih praks. Dandanes sta koncepta tesno povezana, saj lahko ergonomska oblika delovnih mest pozitivno vpliva na trajnost. Ergonomska oprema lahko na primer pomaga zmanjšati porabo energije in virov ter lahko pomaga zmanjšati količino odpadkov in emisij. Vključevanje trajnostnih pristopov za izpolnjevanje potreb zainteresiranih strani z okolju prijaznimi in stroškovno učinkovitimi rešitvami poudarja pomen ergonomskih rešitev, ki upoštevajo človekovo dobro počutje (Amjad et al., 2023).

Sinergija med ergonomijo in trajnostnim razvojem organizacije je dobro dokumentirana in večplastna. Ergonomija kot v človeka usmerjena znanost je sestavni del trajnosti, saj se osredotoča na dobro počutje in zmožnosti posameznikov. Ergonomija je prav tako pomembna za razvoj okolju prijaznih in stroškovno učinkovitih rešitev na različnih organizacijskih področjih. Ta pristop je skladen s širšo opredelitvijo trajnosti, ki presega ohranjanje okolja in vključuje družbene in gospodarske razsežnosti, s ciljem zadovoljiti sedanje potrebe, ne da bi ogrozili zmožnost prihodnjih generacij (Gajšek et al., 2022).

Vključevanje ergonomskega znanja in trajnostnega managementa je prepoznano kot potencial za izboljšanje različnih organizacijskih področij. Ta sinergija lahko privede do izboljšav na podlagi več meril, pri čemer se priznava vloga ergonomije tako v neposrednem delovnem okolju kot v širšem družbenem vplivu. To nakazuje, da vključevanje ergonomije v trajnostne pobude prispeva k stalnemu razvoju in prilagajanju organizacij na način, ki podpira cilje družbene trajnosti (Gajšek et al., 2022).

Na področju oblikovanja delovnih mest ergonomija velja za strateški dejavnik inovacij, saj zagotavlja potrebno znanje in spretnosti o človeških značilnostih. Ta odnos je ključen pri trajnostnih projektih, pri čemer je ergonomija poudarjena kot ključni element trajnostnega oblikovanja in razvoja. Ker se organizacijska ergonomija osredotoča na načrtovanje delovnih sistemov in procesov za izboljšanje organizacijske uspešnosti in zmanjšanje tveganja poškodb in obremenitev ima s tem tudi velik vpliv na trajnostno politiko podjetja (Balantič et al., 2016; Tosi, 2012).

Tekom prispevka bomo raziskali interdisciplinarne povezave med ergonomijo in trajnostnim razvojem ter predstaviti vrsto dobrih praks v skladu z ergonomskimi načeli. S pomočjo SWOT analize bomo analizirali prednosti, slabosti, priložnosti in nevarnosti vključevanja ergonomije v trajnostni organizacijski razvoj. Predstavili bomo glavne dobre prakse povezovanja ergonomije in trajnostni. Prav tako bomo predstavili načrt za organizacije, ki si prizadevajo za bolj zdravo, učinkovito in okoljsko ozaveščeno prihodnost ter poudarili pomen celostnega pristopa za doseganje organizacijske odličnosti.

2 Vloga ergonomije pri trajnostnem organizacijskem razvoju

Današnje trajnostne organizacije si prizadevajo uravnorežiti t.i. »trojni vidik«, da bi dosegle dolgoročni uspeh in sposobnost preživetja. To pomeni, da organizacije ne morejo biti trajnostne, če ne skrbijo za varnost, zdravje in dobro počutje svojih najpomembnejših virov - delavcev. Ergonomija, ki se osredotoča na uravnoreženost med ljudmi in njihovimi dejavnostmi, orodji in okoljem, je pri tem ključna. Primerna ergonomija zagotavlja dobro počutje delavcev, kar je bistvenega pomena za vidik "ljudje", hkrati pa prispeva tudi k vidikoma "planet" in "dobiček", saj spodbuja učinkovito rabo virov in zmanjšuje količino odpadkov (OSHA, 2016).

Vključevanje ergonomije v trajnostne organizacijske odločitve pomembno vpliva na okoljsko učinkovitost, gospodarske prihranke in družbene koristi. Z **okoljskega vidika** ergonomija vključuje načrtovanje ali preoblikovanje sistemov, vključno s proizvodnimi podsistemi, komunikacijskimi sistemi, človeškimi viri in drugimi podpornimi podsistemi, kot sta zdravje in dobro počutje. Ta celostni pogled na življenjski cikel sistema lahko privede do bolj trajnostnih praks, kot sta učinkovitejša raba virov in manjša poraba energije, kar posledično lahko privede do manjšega ogljičnega odtisa organizacije (Sohrabi, 2021).

Z **ekonomskega vidika** ima ergonomija velik vpliv na zmanjšanje stroškov ter povečanje produktivnosti in kakovosti. Raziskave kažejo, da so ergonomsko ustrezna delovna okolja povezana s povprečno 66 % povečanjem produktivnosti, 44 % povečanjem kakovosti in 82 % povečanjem varnosti. To je ključnega pomena, saj ne zmanjšuje le stroškov, povezanih s poškodbami in boleznimi na delovnem mestu, temveč tudi povečuje splošno organizacijsko uspešnost (Maudgalya et al., 2008). Poleg tega lahko ergonomski posegi, bodisi na področju produkcije, bodisi na

področju oblikovanja izdelkov, prinesejo bolj realne in boljše rezultate, če so združeni z ustreznimi ekonomskimi modeli ali tehnikami. Ergonomija lahko pomembno zmanjša kostno-mišična obolenja, ki so pomemben vir stroškov odškodnin delavcev, kar predstavlja priložnost za prihranke podjetja (Naeini et al., 2018).

Vloga ergonomije je z **družbenega vidika** pomembna za izboljšanje kakovosti delovnih okolij delavcev. Posledice neustreznih delovnih pogojev lahko bistveno vplivajo na zdravje, uspešnost, zadovoljstvo, delovno učinkovitost in raven stresa delavcev. Z izboljšanjem teh področij, ergonomija prispeva k večjemu zadovoljstvu pri delu, manjši fluktuaciji in bolj zavzeti delovni sili. To ni koristno le za zaposlene, temveč tudi za organizacijo kot celoto, saj je zadovoljna in zdrava delovna sila bolj produktivna (Dombeková, 2016). Ergonomski posegi pomembno vplivajo tudi na produktivnost, saj izboljšajo učinkovitost delovnega mesta, zmanjšajo število poškodb, povezanih z delom, in povečajo zadovoljstvo zaposlenih (Tawfeek, 2023).

Koncept "trajnostnih delovnih sistemov" je nastajajoče področje, ki se prepleta z ergonomijo in zagovarja zasnove dela, ki lahko dolgoročno zagotavljajo in vzdržujejo človeške in družbene vire. Ta koncept poudarja ustvarjanje delovnih okolij, ki so varna, učinkovita in spodbujajo zdravje ter zadovoljstvo zaposlenih, kar je v skladu z načeli ergonomije. Tabela 1 predstavlja nekaj avtorskih vpogledov v ta pristop.

Vloga ergonomije pri trajnostnem organizacijskem razvoju je očitna, kar je razvidno tudi iz obsega literature o trajnostnih delovnih sistemih. Ti sistemi si z vključevanjem ergonomije prizadevajo za ustvarjanje delovnih okolij, ki podpirajo dolgoročno trajnost človeških in družbenih virov ter so tesno povezani z vsemi ergonomskimi načeli. Literatura izpostavlja multidisciplinarni pristop, pri katerem je ergonomsko znanje vključeno v širše okvire trajnosti in delovnih sistemov.

Tabela 1: Vpogled strokovnjakov v koncept trajnostnih delovnih sistemov

Vir	Pogled na koncept trajnostnih delovnih sistemov
(Zink, 2014)	Zanimanje za oblikovanje trajnostnih delovnih sistemov, ki so opredeljeni kot hkratno doseganje gospodarskih, ekoloških in socialnih ciljev, ne da bi pri tem ogrozili zmožnost prihodnjih generacij, da zadovoljijo svoje potrebe, je vedno večje. Ergonomija, ki se osredotoča na skladnost med ljudmi in njihovim okoljem, ima pri tem ključno vlogo, saj zagotavlja, da so zasnove dela usmerjene k človeku, varne in učinkovite.
(Gajšek et al., 2022)	Vključevanje ergonomskega znanja in trajnostnega upravljanja je prepoznano kot potencial za večkriterijske izboljšave na različnih organizacijskih področjih. To pomeni, da so ergonomska načela ključna pri razvoju delovnih sistemov, ki niso le učinkoviti in varni, temveč tudi okoljsko ozaveščeni in družbeno odgovorni.
(Brunoro et al., 2020)	Za trajnostno delo velja, da izboljšuje uspešnost organizacije in spodbuja strokovni razvoj, zdravje in dobro počutje delavcev ter presega odsotnost bolezni in gradi pozitivne zdravstvene rezultate. Ergonomija k temu prispeva z oblikovanjem delovnih okolij, ki zmanjšujejo zdravstvena tveganja in krepijo splošno dobro počutje.
(dos Santos et al., 2020)	Vloga strokovnjakov s področja ergonomije se pri trajnostnem razvoju vedno bolj priznava, saj se raziskave osredotočajo na razumevanje trajnostnih delovnih sistemov. To kaže na institucionalni premik v smeri prepoznavanja in izvajanja ergonomije v zasnovah trajnostnih delovnih sistemov.
(Balantič & Jarc Kovačič, 2022)	Ergonomija je za delodajalca sinonim za racionalizacijo in humanizacijo dela. Če pocenimo produkcijo in pri tem poskrbimo za boljše počutje delavcev, ki so manj obremenjeni, potem smo se uspešno vključili v trajnostni razvoj družbe. Gospodarski in socialni razvoj ter varstvo okolja so trije glavni stebri trajnostnega razvoja in praktično povsod najdemo elemente ergonomije, ki jih vgrajujemo v vse tri stebre.

3 SWOT analiza povezovanja ergonomije in trajnosti

Pregled literature nam je omogočil osnovo za oblikovanje SWOT matrike. V nadaljevanju so predstavljene prednosti, slabosti, priložnosti ter nevarnosti vključevanja ergonomije v trajnostni razvoj organizacije (Slika 1).

Prednosti ergonomije ne opazimo le pri izboljševanju varnosti in produktivnosti delavcev, temveč tudi pri spodbujanju splošne uspešnosti organizacije. Z

zmanjševanjem porabe virov in energije ter podpiranjem recikliranja in uporabe trajnostnih materialov odločno prispevamo k zmanjšanju ogljičnega odtisa. Ergonomske rešitve zmanjšujejo potrebo po prevozu, izboljšujejo kakovost zraka in naravno osvetlitev, kar vodi do boljšega delovnega okolja. Ergonomske rešitve so ključ do večje skladnosti z okoljskimi predpisi in imajo širše pozitivne učinke na gospodarstvo, okolje in javno zdravje, kar ustvarja bolj trajnostno in zdravo prihodnost za vse (Haslam & Waterson, 2013; Radjiyev et al., 2015).

Slabosti vključevanja ergonomije v trajnostne prakse se začnejo s pomanjkanjem ozaveščenosti, saj mnoge organizacije ne razumejo pomena ergonomije za trajnost. Visoki začetni stroški in naložbe marsikatero organizacijo odvrnejo od ergonomskih ukrepov, medtem ko časovne omejitve lahko povzročijo, da pobude zbledijo v ozadju drugih nujnih nalog. Odpor proti spremembam v organizacijah in določeni posamezniki otežujejo sprejetje novih praks, medtem ko pomanjkanje strokovnega znanja preprečuje učinkovito vključevanje in izvajanje ergonomskih načel v trajnostne strategije (Martin et al., 2013; Munguía Vega et al., 2019; Ryan & Wilson, 2013).

Priiložnosti vključevanja ergonomije v trajnostne prakse vključujejo interdisciplinarni pristop, ki združuje različna področja za širše učinkovite rešitve s poudarkom na dolgoročni trajnosti za prihodnje strategije in sodelovanje. Te sinergije spodbujajo inovacije, krepijo strateško usmeritev in izboljšujejo dolgoročno učinkovitost, kar ustvarja celostne rešitve za organizacije (Dul et al., 2012).

Grožnje za integracijo ergonomije v trajnost, zajemajo težave pri iskanju trajnostnih materialov, pomanjkanje razumevanja med zainteresiranimi stranmi, merilne izzive, nasprotujoče si cilje med učinkovitostjo in porabo virov ter razlike v osredotočenosti med takojšnjim in dolgoročnim učinkom. Te ovire zahtevajo premišljeno načrtovanje za uspešno izvedbo (Dekker et al., 2013; Lin et al., 2019).



Slika 1: SWOT analiza

Vir: lasten

4 Dobre prakse povezovanja ergonomije in trajnosti

Sprejemanje dobrih praks in večplastnih pristopov je ključno za uspešno vključevanje ergonomije in trajnosti v organizacije. Te prakse, ki temeljijo na raziskavah, ponujajo predloge za izboljšanje dobrega počutja zaposlenih ob hkratnem doseganju okoljskih in gospodarskih ciljev. V nadaljevanju je predstavljenih 10 dobrih praks vključevanja ergonomije v trajnostni razvoj:

1. **Ergonomsko oblikovanje delovnega prostora** je pomembno pri izboljšanju zdravja zaposlenih in učinkovitosti organizacije, hkrati pa prispeva k manjši porabi energetskega virov. Ergonomija vzpostavlja pogoje za ohranjanje in izboljšanje zdravja ter dobrega počutja zaposlenih z obravnavanjem okoljskih dejavnikov, ki so usmerjeni k človeku. Prav tako zmanjšuje število poškodb in bolezni na delovnem mestu. Poleg tega ergonomsko oblikovanje podpira ustvarjanje trajnostnih delovnih mest z

inovativnimi delovnimi strategijami z namenom izboljšanja energetske učinkovitosti podjetij (Afroz & Haque, 2021; Voordt & Jensen, 2023).

2. **Energetsko učinkovita pisarniška oprema** ter konstruktivno sodelovanje med ergonomijo in energetske učinkovitostjo pripomore k ustvarjanju optimalnega delovnega prostora. Ergonomsko oblikovanje se osredotoča na razporeditev pohištva, opreme in orodij, da bi spodbudili učinkovitost in zmanjšali fizično obremenitev. Cilj energetske učinkovitosti je zmanjšati porabo energije ob hkratnem ohranjanju produktivnosti in ravni udobja in ugodja, kar zagotavlja prihranke pri stroških, okoljsko trajnost in daljšo življenjsko dobo opreme. (Kozusznik et al., 2019).
3. **Trajnostne prakse javnega naročanja** so ena izmed strategij za obravnavanje številnih etičnih vprašanj in vprašanj družbene odgovornosti podjetij, vključno z vprašanji dela in človekovih pravic, varnosti na delovnem mestu in okoljske odgovornosti (Tiwari et al., 2019).
4. Upoštevanje **skladnosti z zelenimi gradbenimi standardi**, zlasti tistih, ki vključujejo ergonomijo, je v zadnjem času vse bolj aktualno. Zelena gradnja je pristop k oblikovanju, gradnji in upravljanju stavb, kar zmanjšuje vpliv na okolje in spodbuja trajnost. Standardi se osredotočajo na energetske učinkovitost, uporabo okolju prijaznih materialov, izboljšanje kakovosti notranjega zraka in maksimiranje izrabe naravne svetlobe (Hedge, 2013).
5. **Programi ergonomskega usposabljanja zaposlenih** pozitivno vplivajo na ustvarjanje in ohranjanje varnega delovnega okolja, izboljšanje varnosti na delovnem mestu ter zmanjšanje števila poškodb in motenj. Usposabljanja zaposlenim omogočajo varnejše in učinkovitejše delo, prepoznavanje simptomov kostno-mišičnih obolenj ter na splošno spodbujajo večjo produktivnost (Dul et al., 2012).
6. Spodbujanje zaposlenih k uporabi **trajnostnih načinov transporta**, kot so hoja, kolesarjenje, javni prevoz ali souporaba avtomobila, lahko znatno zmanjša celoten ogljični odtis organizacije. Trajnostni načini transporta lahko okrepijo zavezanost podjetja k trajnosti in spodbudijo zaposlene k bolj zdravemu načinu življenja (Shah et al., 2021).
7. Ergonomske rešitve v procesih **ravnanja z odpadki in recikliranja** lahko bistveno zmanjšajo ergonomska tveganja. Ključni ukrepi vključujejo uporabo ustrezne opreme za ravnanje z materialom, da se omejijo tveganja, kot so nepravilno dvigovanje ter nepravilna drža. S preprečevanjem nesreč, poškodb in bolezni na delovnem mestu zbiralcev odpadkov lahko poleg

- izboljšanege zdravja povečamo učinkovitost recikliranja (Emmatty & Panicker, 2019).
8. Vlaganje v **zelene ergonomske izdelke**, kot je pohištvo iz trajnostnih materialov ali oprema z energetsko varčnimi funkcijami, lahko izboljša tako dobro počutje zaposlenih kot okoljsko trajnost. Zeleni ergonomski izdelki so zasnovani tako, da optimirajo človekovo počutje in splošno zmogljivost proizvodnega sistema ter hkrati zmanjšujejo vplive na okolje. Cilj je ustvariti izdelke, ki so za uporabnike udobni in učinkoviti, hkrati pa so izdelani iz trajnostnih materialov, porabijo manj energije ter zmanjšajo količino odpadkov in onesnaženja (Hanson, 2013).
 9. Dobro zasnovane **politike dela na daljavo** lahko zmanjšajo potrebo po vožnji na delo, s tem pa zmanjšajo emisije in zaposlenim omogočijo, da si doma ustvarijo prilagojeno in ergonomsko ustrezno delovno okolje. Ta prilagodljivost lahko vodi k večjemu zadovoljstvu in manjšemu vplivu na okolje (Gomes, 2021).
 10. Uporaba **obnovljivih virov energije** v pisarniških prostorih je v skladu z ergonomskimi načeli, saj ustvarja bolj zdravo okolje in prispeva k širšim trajnostnim ciljem. To lahko zajema vse od namestitve sončnih kolektorjev do nakupa zelene energije pri dobaviteljih (Kozusznik et al., 2019).

Z vključevanjem teh večplastnih pristopov lahko organizacije ustvarijo trden okvir za izboljšanje dobrega počutja zaposlenih, zmanjšanje vpliva na okolje ter spodbujanje trajnostne in produktivne delovne kulture.

5 Model vključevanja ergonomije in trajnosti v organizacijo

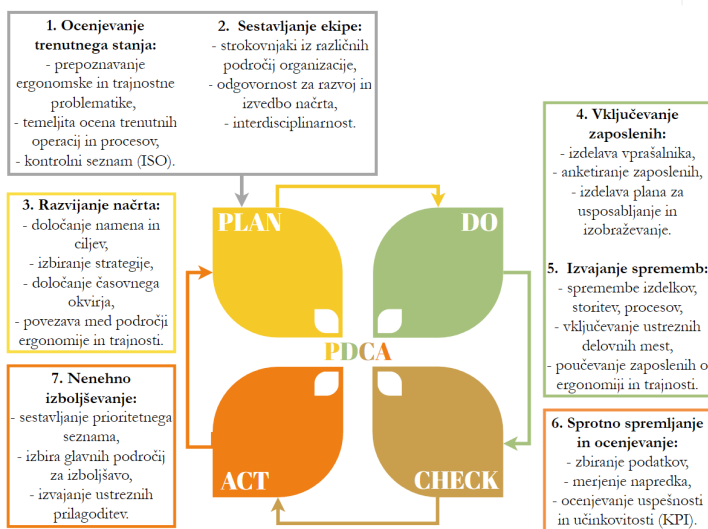
V nadaljevanju je predlagan strukturiran pristop k vključevanju ergonomije v pobude trajnostnega razvoja v organizacijah. Ta model spodbuja nenehne in stalne izboljšave s poudarkom na ergonomiji in trajnosti ter deluje v obliki cikla PDCA (Plan-Do-Check-Act). Večstopenjski proces vključuje naslednje korake (Medved & Balantič, 2024):

1. **Ocena trenutnega stanja:**
 - Prepoznavanje aktualnih ergonomskih in trajnostnih vprašanj, morebitnih tveganj in koristi izvajanja ergonomije v trajnostnem razvoju.

- Temeljita ocena trenutnih dejavnosti in procesov za opredelitev področij, na katerih je mogoče ergonomska načela vključiti v trajnostne pobude.
 - Pregled in ukrepanje v skladu s standardoma ISO 14001:2015 in ISO 6385:2016.
2. **Oblikovanje ekipe:**
- Vključevanje strokovnjakov z različnih področij organizacije, vključno z ergonomijo, trajnostnim razvojem, oblikovanjem in inženiringom, ki so odgovorni za razvoj in izvajanje ergonomskega in trajnostnega načrta.
 - Glede na organizacijske potrebe so vključene različne vloge, kot so inženirji za razvoj izdelkov, tehnologi, vodje proizvodnje, vodje projektov in finančni vodje.
3. **Razvoj načrta:**
- Določitev ciljev in posebnih ukrepov za reševanje ugotovljenih težav ter določitev časovnega okvira za izvedbo.
 - Načrt mora razkriti povezave med ergonomijo in trajnostnim razvojem ter upoštevati prej omenjene standarde ISO.
4. **Vključevanje zaposlenih:**
- Vključevanje zaposlenih, na katere spremembe najbolj vplivajo, ter zbiranje njihovih prispevkov in povratnih informacij.
 - Izvedba anket, da bi ugotovili, kakšna je njihova raven znanja in vključenosti v ergonomska in trajnostna načela, vrednote in smernice.
5. **Izvajanje sprememb:**
- Vključevanje ustreznih delovnih mest glede na panogo in dejavnost podjetja, kar lahko vključuje preoblikovanje opreme, uvajanje sodobnih tehnologij ali spreminjanje razporeditve delovnega mesta.
6. **Sprotno spremljanje in vrednotenje:**
- Spremljanje napredka sprememb in ocenjevanje njihove učinkovitosti.
 - Zbiranje podatkov o varnosti delavcev, produktivnosti, zadovoljstvu pri delu, uporabi virov, odpadkih in emisijah.
 - Stalno ocenjevanje in beleženje izvajanja ergonomskih načel v trajnostnih pobudah.

7. Nenehno izboljševanje:

- Uporaba zbranih podatkov za prepoznavanje področij za izboljšave in izvajanje potrebnih prilagoditev.
- Izobraževanje zaposlenih, strank in dobaviteljev o pomenu ergonomije za trajnostni razvoj.



Slika 2: Model vključevanja ergonomije v trajnostni razvoj organizacije

Vir: Vključevanje ergonomije v trajnostni razvoj organizacije (Medved & Balantič, 2024)

Model poudarja potrebo po izobraževanju o prednostih ergonomskih načel in o tem, kako jih je mogoče vključiti v vsakdanje trajnostne prakse in procese. Ta celovit pristop je namenjen organizacijam, ki želijo nenehno izboljševati uspešnost in učinkovitost na področju ergonomije in trajnosti.

6 Zaključek

Vključevanje ergonomije in trajnosti ni le trend, temveč strateški model za sodobne organizacije. Koristi te integracije so številne, med drugim boljše zdravje in produktivnost zaposlenih, prihranki pri stroških poslovanja, manjši vpliv na okolje in večji ugled podjetja. Vendar pa morajo organizacije obvladati s tem povezane izzive, kot so stroški začetnih naložb, odpor do sprememb, kompleksno izvedbo

ergonomske ocene ter potreba po nenehnem prilagajanju tehnološkim in regulativnim spremembam. V prihodnjih raziskavah je potrebno še naprej namenjati pozornost in raziskovati večje število področij:

1. **Tehnologija in inovacije:** Nenehni tehnološki napredek ponuja nove možnosti in orodja za izboljšanje ergonomskih in trajnostnih praks. Prihodnje raziskave lahko preučijo, kako lahko nove tehnologije, kot so umetna inteligenca, internet stvari in navidezna resničnost, dodatno podprejo te pobude.
2. **Globalni in kulturni vidiki:** Ker organizacije vse bolj delujejo na globalni ravni, je razumevanje vpliva kulturnih razlik na izvajanje ergonomskih in trajnostnih praks ključnega pomena. V prihodnjih študijah je potrebno preučiti strategije za prilagajanje dobrih praks različnim kulturnim kontekstom.
3. **Politični in regulativni okviri:** Z naraščajočim pomenom ergonomije in trajnosti se povečuje tudi vloga politike in regulativnih okvirov pri oblikovanju organizacijskih praks. Prihodnje raziskave bi lahko raziskovale vpliv obstoječih in potencialnih predpisov ter sistem organiziranja in upravljanja tega področja.
4. **Interdisciplinarno sodelovanje:** Spodbujanje sodelovanja med področji, kot so ergonomija, okoljska znanost, organizacijska psihologija in inženirstvo, lahko privede do bolj inovativnih in učinkovitih strategij vključevanja. Prihodnje pobude lahko spodbujajo interdisciplinarne raziskave in so bolj osredotočene na praktični vidik omenjenih področij.

Zaključujemo s tem, da ergonomija igra ključno vlogo pri oblikovanju trajnostnega razvoja v sodobnih organizacijah. SWOT analiza je razkrila, da medtem, ko obstajajo izzivi, kot so visoki začetni stroški in potreba po povečani ozaveščenosti, priložnosti za integracijo ergonomije v trajnostne prakse prinašajo mnoge koristi. Te vključujejo izboljšanje zdravja in dobrega počutja zaposlenih ter povečanje produktivnosti, ki neposredno vplivajo na okoljsko učinkovitost in gospodarsko uspešnost organizacij.

Predlagane dobre prakse kažejo na potencial ergonomije kot ključnega elementa organizacijske odličnosti in trajnosti. Spodbujanje celostnega pristopa pri povezovanju ergonomije in trajnosti, izpolnjuje zahteve trenutnih ergonomskih in okoljskih standardov, ob tem pa istočasno oblikuje temelje za inovativno in

trajnostno usmerjeno prihodnost. Vključitev ergonomije v trajnostni razvoj organizacije ni le koristno, ampak nujno za doseganje dolgoročne uspešnosti in blaginje.

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ZDRUŽEVANJE VARNOSTI IN ZDRAVJA PRI DELU TER TRAJNOSTNEGA RAZVOJA: PRIMER SLOVENIJE IN SRBIJE

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Varnost in zdravje pri delu sta ključna za uspešno delovanje organizacij v vseh državah. Prav tako sta ključna za trajnostni razvoj organizacij. V prispevku smo raziskali, kako povezati vidike varnosti in zdravja pri delu s spremembami, ki jih prinašata zeleni prehod in digitalna revolucija. Obe državi, Slovenija in Srbija, se soočata s temi spremembami, ki se odražajo v načinu dela in uvajanju novih tehnologij. V Sloveniji organizacije stremijo k zmanjšanju emisij, uporabi obnovljivih virov energije in učinkovitemu ravnanju z odpadki. V Srbiji pa posebno pozornost namenjajo ekološki obnovi industrijskih con. Pri teh spremembah je ključno povezati vidike varnosti in zdravja pri delu. Organizacije v obeh državah morajo zagotoviti varne delovne pogoje, ki upoštevajo nove tehnologije in njihov vpliv na zaposlene. To zmanjšuje verjetnost poškodb in bolezni ter izboljšuje delovno učinkovitost. V prispevku smo predstavili ukrepe za preprečevanje nevarnosti, ozaveščanje zaposlenih o novih tehnologijah ter izobraževanje o varnosti pri delu. Povezovanje vidikov varnosti in zdravja pri delu z zelenim prehodom in digitalno revolucijo lahko organizacijam v obeh državah prinese boljše rezultate, tako na gospodarskem kot tudi okoljskem področju.

Ključne besede:

varnost in
zdravje pri
delu,
trajnostni
razvoj,
digitalni
prehod,
zeleni
prehod,
Slovenija in
Srbija

COMBINING SAFETY AND HEALTH AT WORK AND SUSTAINABLE DEVELOPMENT: THE CASE OF SLOVENIA AND SERBIA

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Workplace safety and health are crucial aspects of successful organizational functioning in all countries. They are equally vital for organizations moving toward sustainable development. This article aims to demonstrate how to connect workplace safety and health with the changes brought about by both the green transition and the digital revolution. In both Slovenia and Serbia, these transitions manifest in changing work methods and the adoption of new technologies. In Slovenia, organizations focus on emission reduction, the use of renewable energy sources, and efficient waste management. In Serbia, special attention is given to ecological restoration of industrial zones. It is essential to integrate workplace safety and health considerations during these changes. Organizations in both countries must ensure safe working conditions that account for new technologies and their impact on employees. This reduces the likelihood of injuries and illnesses while enhancing work efficiency. The article will present measures for hazard prevention, employee awareness of new technologies, and safety education. Successfully linking workplace safety and health with the green transition and digital revolution can lead to improved outcomes for organizations in both economic and environmental domains.

Keywords:

health and
safety at
work,
sustainable
development,
digital
transition,
green
transition,
Slovenia and
Serbia

1 Uvod

Varnost in zdravje pri delu ter trajnostni razvoj so ključni vidiki uspešnega delovanja organizacij. V današnjem svetu, kjer se tehnologija hitro razvija in se pojavljajo novi izzivi, je združevanje teh vidikov postalo nujno. Varnost pri delu se nanaša na ukrepe in politike, ki jih organizacije izvajajo za zaščito svojih zaposlenih pred nevarnostmi, ki bi lahko ogrozile njihovo fizično dobro počutje. To vključuje preprečevanje nesreč, zagotavljanje varne opreme in usposabljanje zaposlenih za varno delo. Zdravje pri delu pa se nanaša na ohranjanje in izboljšanje fizičnega in duševnega zdravja zaposlenih. To vključuje zagotavljanje zdravih delovnih pogojev, spodbujanje zdravega življenjskega sloga in obravnavanje stresa na delovnem mestu (Zanko in Dawson, 2012). Zdravje in varnost pri delu sta bistveni vidik odgovornih in etičnih poslovnih praks, saj izkazujeta zavezanost zdravju in dobremu počutju zaposlenih, zmanjšujeta morebitno odgovornost in stroške, povezane z nezgodami na delovnem mestu, ter prispevata k splošnemu organizacijskemu uspehu (Vasconcelos idr., 2016). Trajnostni razvoj je koncept, ki poudarja potrebo po razvoju, ki zadovoljuje potrebe sedanjih generacij, ne da bi pri tem ogrozil sposobnost prihodnjih generacij, da zadovoljijo svoje potrebe. To vključuje uporabo obnovljivih virov, zmanjšanje emisij toplogrednih plinov in spodbujanje socialne pravičnosti (Bertoncelj idr., 2011). Združevanje varnosti, zdravja pri delu ter trajnostnega razvoja pomeni integracijo teh vidikov v strategijo in prakso organizacij. To ne le izboljšuje dobro počutje zaposlenih in zmanjšuje vpliv na okolje, ampak tudi povečuje učinkovitost in produktivnost organizacij, kar je ključno za dolgoročni uspeh organizacij.

Namen tega prispevka je prikazati, kako lahko organizacije v Sloveniji in Srbiji izkoristijo spremembe, ki jih prinašata zeleni in digitalni prehod, za učinkovito soočanje z izzivi okolja in izboljšanje varnosti ter zdravja pri delu v teh novih okoliščinah.

2 Varnost in zdravje pri delu

2.1 Definicija varnosti in zdravja pri delu

Varnost in zdravje pri delu sta ključna vidika, ki se nanašata na dobro počutje in zaščito zaposlenih na delovnem mestu. Varnost pri delu je disciplina, ki se osredotoča na zaščito varnosti, zdravja in blaginje ljudi, ki so zaposleni. To vključuje preprečevanje delovnih nesreč in bolezni, ki izhajajo iz delovnih pogojev. Varnost pri delu se nanaša na ukrepe, ki so namenjeni zmanjšanju tveganja poškodb ali bolezni na delovnem mestu. Zdravje pri delu pa se nanaša na ohranjanje in izboljšanje fizičnega in duševnega zdravja zaposlenih. To vključuje zagotavljanje zdravih delovnih pogojev, spodbujanje zdravega življenjskega sloga in obravnavanje stresa na delovnem mestu (Hughes in Ferrett, 2011).

Obe področji sta ključni za uspešno delovanje organizacij, saj zdravi in varni zaposleni prispevajo k večji produktivnosti in učinkovitosti. Poleg tega organizacije, ki skrbijo za varnost in zdravje svojih zaposlenih, izboljšujejo svoj ugled in zmanjšujejo tveganje za pravne težave, povezane z delovnimi nesrečami in boleznimi. Zato je skrb za varnost in zdravje pri delu ključnega pomena za vsako organizacijo.

2.1 Organizacija sistema varnosti in zdravja pri delu v Sloveniji in Srbiji

Organizacija sistema varnosti in zdravja pri delu je ključnega pomena za zagotavljanje varnega in zdravega delovnega okolja. Tako v Sloveniji kot v Srbiji so za to področje odgovorne različne institucije, ki igrajo pomembno vlogo pri uveljavljanju in zagotavljanju varnosti ter zdravja delavcev.

V Sloveniji je varnost in zdravje pri delu urejeno z Zakonom o varnosti in zdravju pri delu (ZVZD-1), ki ga je Državni zbor RS sprejel leta 2011. Ta zakon določa pravice in dolžnosti delodajalcev in delavcev glede zagotavljanja varnega in zdravega dela. Ministrstvo za delo, družino, socialne zadeve in enake možnosti nadzoruje prakso varnosti in zdravja pri delu v državi, medtem ko Inšpektorat RS za delo izvaja inšpekcijski nadzor ter nadzor nad spoštovanjem predpisov (Ministrstvo za delo, družino, socialne zadeve in enake možnosti, 2023).

Sistem varnosti in zdravja pri delu v Sloveniji temelji na preprečevanju nesreč, poškodb in poklicnih bolezni ter spodbujanju splošnega zdravja na delovnem mestu. Delodajalci so dolžni izvajati ocene tveganja in ukrepe za preprečevanje ali zmanjšanje nevarnosti na delovnem mestu, kar vključuje zagotavljanje ustreznega usposabljanja zaposlenih, vzdrževanje varnostne opreme in vzpostavitev postopkov za odzivanje v sili (Ministrstvo za delo, družino, socialne zadeve in enake možnosti, 2023).

Slovenija je vzpostavila tudi več ukrepov za preprečevanje nevarnosti pri delu in spodbujanje blaginje zaposlenih. Ti vključujejo redne zdravniške preglede zaposlenih, ergonomsko oblikovanje delovnega mesta in spodbujanje duševnega zdravja na delovnem mestu. Poudarek je na ozaveščanju in izobraževanju delodajalcev in delavcev o praksah varnosti in zdravja pri delu (Ministrstvo za delo, družino, socialne zadeve in enake možnosti, 2023).

V Srbiji ureja prakso varnosti in zdravja pri delu Zakon o varnosti in zdravju pri delu. Ministrstvo za delo in socialno politiko nadzira in izvaja te predpise, medtem ko ima Nacionalni inštitut za varnost in zdravje pri delu ključno vlogo pri zagotavljanju usposabljanja in podpore za ukrepe varnosti pri delu (Evropska agencija za varnost in zdravje pri delu, 2023).

Zakon v Srbiji določa splošne obveznosti za delodajalce in zaposlene, da ustvarijo varne in zdrave delovne pogoje. Delodajalci so dolžni oceniti tveganja na delovnem mestu in izvajati ustrezne preventivne ukrepe. Delavci imajo pravico do ustrezne obveščeniosti in usposabljanja o postopkih VZT. Zakon zajema tudi vidike, kot so vodenje evidenc, poročanje o nesrečah ali boleznih, zdravstveni nadzor in zagotavljanje osebne zaščitne opreme (Evropska agencija za varnost in zdravje pri delu, 2023).

3 Izzivi in priložnosti varnosti in zdravja pri delu v kontekstu zelenega in digitalnega prehoda

V kontekstu zelenega prehoda in digitalne revolucije se organizacije v obeh državah soočajo z novimi izzivi in priložnostmi.

Organizacije se morajo najprej seznaniti z novimi trendi zelenega in digitalnega prehoda ter prepoznati, kako te spremembe lahko vplivajo na varnost in zdravje pri delu. To vključuje razumevanje novih tehnologij, procesov dela in materialov ter njihove potencialne učinke na delavce (Peña-Casas, Ghailani in Coster, 2018).

Nato morajo organizacije opraviti celovito oceno tveganj, ki so povezana s temi spremembami. Ta ocena vključuje identifikacijo potencialnih nevarnosti, vrednotenje izpostavljenosti delavcev ter določitev potrebnih ukrepov za zmanjšanje tveganj (Marcilly, 2019).

Delavci morajo biti ustrezno izobraženi in usposobljeni glede novih tehnologij, procesov dela in varnostnih ukrepov, ki jih zahteva zeleni in digitalni prehod (Badri, Boudreau-Trudel in Souissi, 2018). Organizacije morajo zagotoviti potrebna izobraževanja, usposabljanja ter vključevanje delavcev v procese odločanja in oblikovanja politik varnosti in zdravja pri delu.

Organizacije morajo izvajati tehnične ukrepe, s katerimi se zmanjšujejo tveganja pri delu v okviru zelenega in digitalnega prehoda. To vključuje zagotavljanje ustrezne zaščitne opreme, oblikovanje ergonomskih delovnih mest in uporabo naprednih tehnologij za nadzor in varovanje delovnega okolja (Marcilly, 2019).

Poleg tega morajo organizacije sprejeti organizacijske ukrepe, s katerimi se povečuje varnost in zdravje pri delu v okoljih, ki temeljijo na zelenem in digitalnem prehodu (Peña-Casas, Ghailani in Coster, 2018). To vključuje vzpostavitev jasnih politik, postopkov in odgovornosti, redno spremljanje in revizijo varnostnih in zdravstvenih standardov ter spodbujanje kulture varnosti in zdravja pri delu.

Organizacije morajo spodbujati sodelovanje in komunikacijo med vsemi deležniki v zvezi z varnostjo in zdravjem pri delu v kontekstu zelenega in digitalnega prehoda. To vključuje delavske predstavnike, vodstvo organizacije, strokovnjake s področja varnosti in zdravja pri delu ter druge relevantne deležnike.

Nenazadnje morajo organizacije vzpostaviti sistematičen pristop k sledenju varnosti in zdravju pri delu ter izboljšavam, ki so povezane s spremembami zaradi zelenega in digitalnega prehoda. To vključuje beleženje in analizo podatkov o nesrečah,

incidentih ter zdravstvenih težavah, ki so povezane z delom, ter izvajanje potrebnih korektivnih ukrepov za preprečevanje ponovitve.

Skupno vsem tem točkam je, da organizacije v Sloveniji in Srbiji potrebujejo celovit pristop k zagotavljanju varnosti in zdravja pri delu v kontekstu zelenega in digitalnega prehoda. Spremembe v delovnem okolju zahtevajo proaktivno in celovito strategijo, ki upošteva tako zelene kot digitalne trende.

4 Soočanje z izzivi okolja ter varnosti in zdravja pri delu

Organizacije v Sloveniji in Srbiji imajo priložnost izkoristiti spremembe, ki jih prinašajo zeleni in digitalni prehod, za učinkovito soočanje z izzivi okolja. Zeleni prehod vključuje prehod na trajnostne in okolju prijazne prakse, ki omogočajo organizacijam, da zmanjšajo svoj okoljski odtis in prispevajo k varovanju okolja. To lahko dosežejo z uporabo obnovljivih virov energije, zmanjšanjem porabe vode in energije, recikliranjem odpadkov in izboljšanjem upravljanja z odpadki (Bertoncelj idr., 2011).

Digitalni prehod prinaša napredne tehnologije, ki omogočajo boljše upravljanje in nadzor nad energijo ter boljše spremljanje porabe energije. Organizacije lahko izkoristijo te tehnologije za povečanje energetske učinkovitosti, kar bo zmanjšalo porabo energije, stroške in negativni vpliv na okolje (Blažič in Starc, 2023). Zeleni prehod omogoča organizacijam, da razvijajo inovativne izdelke in storitve, ki so okolju prijazni. To vključuje uporabo recikliranih materialov, zmanjšanje embalaže in izboljšanje življenjske dobe izdelka. Organizacije lahko izkoristijo tudi digitalni prehod za razvoj novih digitalnih platform in rešitev, ki omogočajo trajnostno upravljanje virov. S preходом na okolju prijazne prakse in razvojem trajnostnih izdelkov ali storitev organizacije lahko krepijo svojo blagovno znamko. Slednje vodi do večjega zaupanja odjemalcev in potrošnikov ter lahko privede do povečanja prodaje ter prepoznavnosti organizacije kot okolju prijazne (Bavec idr., 2019).

Za učinkovito soočanje z izzivi okolja je ključno sodelovanje z drugimi organizacijami, vlado, akademsko sfero in nevladnimi organizacijami. Skupna prizadevanja lahko vodijo k razvoju skupnih strategij, izmenjavi znanja in virov ter pospešitvi učinkov prehoda na okolju prijazne in trajnostne prakse. Tako imajo organizacije v Sloveniji in Srbiji priložnost izkoristiti spremembe, ki jih prinašajo

zeleni in digitalni prehod, za izboljšanje svoje uspešnosti v okolju ter prispevanje k trajnostnemu razvoju.

5 Zaključek

V zaključku poudarjamo, da je uspešno povezovanje vidikov varnosti in zdravja pri delu z zelenim prehodom in digitalno revolucijo ključno za doseganje boljših rezultatov v organizacijah v Sloveniji in Srbiji, tako na gospodarskem kot tudi okoljskem področju. Zeleni prehod in digitalna revolucija prinašata številne spremembe, ki se odražajo v spreminjanju načina dela in uvajanju novih tehnologij. Organizacije se morajo prilagoditi tem spremembam in zagotoviti varne delovne pogoje, ki upoštevajo nove tehnologije in njihove vplive na zaposlene. To ne le zmanjšuje verjetnost poškodb in bolezni, ampak tudi izboljšuje delovno učinkovitost. V Sloveniji se organizacije osredotočajo na zmanjšanje emisij, uporabo obnovljivih virov energije in učinkovito ravnanje z odpadki, medtem ko se v Srbiji posebna pozornost namenja tudi ekološki obnovi industrijskih con. V obeh državah so predstavljeni ukrepi za preprečevanje nevarnosti, ozaveščanje zaposlenih o novih tehnologijah in izobraževanje o varnosti pri delu. S povezovanjem vidikov varnosti in zdravja pri delu z zelenim prehodom in digitalno revolucijo organizacije v Sloveniji in Srbiji lahko organizacije dosežejo trajnostni razvoj, ki je v skladu z globalnimi cilji in lokalnimi potrebami. Ta prispevek predstavlja korak k razumevanju, kako lahko organizacije izkoristijo te spremembe za soočanje z izzivi okolja in hkrati izboljšajo varnost in zdravje pri delu.

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ZELENI PREHOD OSKRBOVALNIH VERIG: IZZIVI, DIGITALIZACIJA IN EKONOMSKI VIDIKI

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Osnovni cilj tega članka je predstaviti in analizirati tveganja in priložnosti, ki jih prinaša zelena transformacija oskrbovalnih verig. Pri tem bo posebna pozornost namenjena ekonomski analizi s poudarkom na donosu naložb (ROI). Prvi sklop se nanaša na identifikacijo ključnih izzivov in nevarnosti pri prehodu na bolj trajnostne prakse v oskrbovalnih verigah s poudarkom na ekoloških, družbenih in ekonomskih tveganjih, ki so povezani z zelenim prehodom ter z analizo vpliva na stroške in dobičkonosnost podjetij. Drugi sklop predstavlja analizo korelacij med digitalizacijo in zelenim prehodom in sicer kako digitalizacija omogoča boljše upravljanje trajnostnih praks in procesov v oskrbovalnih verigah. Tretji sklop pa predstavi model za merjenje uspešnosti zelenega prehoda z metodo MFA. Gre za predstavitev metode matrične funkcionalne analize (MFA) kot orodja za merjenje in evalvacijo trajnostnih praks v oskrbovalnih verigah s praktičnimi smernicami za uporabo MFA pri oceni zelenega prehoda. Četrti sklop pa je diskusija o tem kako lahko podjetja dosežejo donosnost naložb (ROI) pri zelenem prehodu z uporabo digitalnih tehnologij.

Ključne besede:

zeleni prehod, digitalizacija, matrična funkcionalna analiza, trajnostni pristopi, oskrbovalne verige

GREEN TRANSFORMATION OF SUPPLY CHAINS: CHALLENGES, DIGITALIZATION AND ECONOMIC ASPECTS

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The main objective of this article is to present and analyze the risks and opportunities arising from the green transformation of supply chains. Particular attention is paid to the economic analysis with a focus on return on investment (ROI). The first part identifies the key challenges and threats in the transition to more sustainable practices in supply chains, focusing on the environmental, social and economic risks associated with the green transition and analyzing the impact on companies' costs and profitability. The second part analyzes the links between digitalization and the green transition, i.e. how digitalization enables better management of sustainable practices and processes in supply chains. The third part presents a model for measuring the success of the green transition using the MFA method. The aim is to introduce the Matrix Function Analysis (MFA) method as a tool for measuring and evaluating sustainable practices in supply chains and to provide practical guidelines for applying MFA to evaluate the green transition. The fourth part focuses how companies can achieve ROI in the green transition through the use of digital technologies.

Keywords:
green
transformation,
supply
chains,
sustainability,
matrix
function
analysis,
digitalization

1 Uvod

Pritisk na konkurenčnost podjetij ter nujnost digitalizacije poslovnih procesov sili podjetja, da se soočajo z izzivi spreminjanja načina upravljanja in optimizacije oskrbovalnih verig. Vzporedno pa se krepi tudi pritisk na podjetja, da zmanjšajo svoj vpliv na okolje in preidejo k bolj trajnostnim praksam. Dejstvo je, da lahko podjetja s premišljenimi in trajnostnimi pristopi, ne samo zmanjšajo svoj okoljski vpliv, temveč tudi izboljšajo svoje ekonomske izide in konkurenčnost. Ta nenehna dinamika med digitalizacijo in trajnostjo postavlja osnovo za raziskovanje, ki se osredotoča na vprašanje, kako digitalizacija vpliva na zeleni prehod oskrbovalnih verig ter kakšni so ekonomski izidi tega prehoda. Dosedanje raziskave so se fokusirale predvsem ekonomske vidike posameznih segmentov oskrbovalnih verig ne dajejo pa odgovora kakšni so medsebojne korelacije med med funkcijskimi področji oskrbovalnih verig ter dejavniki digitalizacije in dejavniki zelenega prehoda.

Osnovni namen tega članka je predstaviti in analizirati tveganja in priložnosti, ki jih prinaša zelena transformacija oskrbovalnih verig. Gre za predstavitev metode matrične funkcionalne analize (MFA) kot orodja za merjenje in evalvacijo trajnostnih praks v oskrbovalnih verigah s praktičnimi smernicami za uporabo MFA pri oceni zelenega prehoda z vidika donosnosti naložb (ROI) pri zelenem prehodu z uporabo digitalnih tehnologij.

2 Izzivi in nevarnosti pri zeleni transformaciji oskrbovalnih verig

Izzivi zelene transformacije oskrbovalnih verig so zelo kompleksni ter večplastni, saj vključujejo :

- ekološke izzive, ki so fokusirani na zmanjšanje negativnih vplivov na okolje,
- družbene izzive, ki se nanašajo na spodbujanje etičnih vrednot ter spoštovanje človeških pravic in ekonomske vidike ter
- ekonomske izzive, ki se nanašajo na ekonomske spremembe, kot posledico finančnih učinkov trajnostnih sprememb, saj se investiranje v zelene tehnologije in implementacijo trajnostnih praks dojema v smislu dodatnih finančnih obremenitev brez dodane vrednosti.

3 Korelacije med digitalizacijo in zelenim prehodom

Uspešna integracija digitalizacije v svoje trajnostne prakse je ključna rešitev kot odgovor na izzive zelenega prehoda v oskrbovalnih verigah, saj digitalizacija predstavlja ključno orodje za bolj učinkovito upravljanje trajnostnih praks in procesov. Omogoča boljše upravljanje trajnostnih praks in procesov v oskrbovalnih verigah. Transparentnost in sledljivost postajata ključna značilnost, ki ju digitalizacija prinaša, omogočajoč natančno sledenje proizvodnega procesa od začetka do konca. To ne le povečuje preglednost, temveč tudi olajša sledenje porabe virov ter izboljšav, kar je prikazano tudi na sliki 1.



Slika 1: Korelacije med digitalizacijo in zelenim prehodom

Vir: Lasten

4 Ekonomska analiza digitalne transformacije z vidika ROI

Pri prehodu na zeleno oskrbovalno verigo se pogosto pojavi vprašanje, ali so te spremembe ekonomsko upravičene. Donosnost naložb (ROI – Return On Investments) je ključen dejavnik za odločanje o tem, ali se investira v zeleni prehod.

Ekonomska analiza vključuje (Cousins, Lawson, Petersen, Fugate, 2019):

- **Oceno donosnosti:** potrebno je oceniti, ali bodo naložbe v zeleno transformacijo prinesle dovolj veliko donosnost naložb v primerjavi s tradicionalnimi pristopi.

- **Analizo razmerja med stroški in koristmi** : Tako imenovana »cost/benefit« analiza daje bistven odgovor na vprašanje : kdaj časovno in ali se bodo se investicije v zeleni prehod izplačale.
- **Trajnostni ekonomski razvoj**: Ekonomska analiza z vidika ROI mora upoštevati trajnostni ekonomski razvoj v smislu dolgoročne konkurenčnosti in in odgovornosti do okolja in družbe in koristi za družbo kot celoto in ne zgolj samo kratkoročnih finančnih dobičkov.

5 Faktorji uspešnosti digitalne in zelene transformacije oskrbovalnih verig

Na uspešnost digitalne in zelene transformacije oskrbovalnih verig predvsem vpliva aktivna podpora in vizija vodstva, ki moraj zelo jasno postaviti jasne cilje in smernice. Potrebna je prisotnost ustrezne organizacijske kulture in pripravljenost na spremembe, kar pa mora biti podprto z ustrezno izobraženimi zaposlenimi, ko so pripravljeni in usposobljeni za nove pristope in tehnologije ter ciljem da se vzpostavi trajnostni pristop poslovanja, ki temelji na zmanjšanju ogljičnega odtisa, uporabi obnovljivih virov ter daje poudarek na zmanjšanju odpadkov.

Predpogoj za izvedbo digitalne transformacije je ustrezna tehnološka infrastruktura. Ključen pri tem pa je izbor ustreznih digitalnih tehnologij, ustrezno podatkovna kakovost in razpoložljivost podatkov (IoT, umetna inteligenca, blockchain in napredna analitika)(Belhadi, Kamble, Gunasekaran, Mani, 2021). Le le s tovrstno kombinacijo lahko izboljšamo transparentost in učinkovitost oskrbovalnih verig. Poleg notranjih faktorjev je ključnega pomena tudi tesno sodelovanje s partnerji in ostalimi členi v oskrbovalni verigi, Vsekakor pa je bistveno vplivanje države v kontekstu njene okoljske politike in zakonodaje, ki sili podjetja v zeleni prehod in s tem posledično pripomore k delitvi stroškov in izmenjavi znanja.

Seveda se tu proces ne zaključí; za spremljanje napredka je potrebno vzpostaviti kazalnike uspešnosti in redno meriti rezultate. Z merjenjem uspešnosti digitalne transformacije se ugotavlja, ali so investicije v digitalno transformacijo smiselne in o tem, ali so cilji v skladu s pričakovanji (Almeida, Benitez, Kliemann , Frank, 2022).

6 Kazalniki za merjenje digitalne transformacije

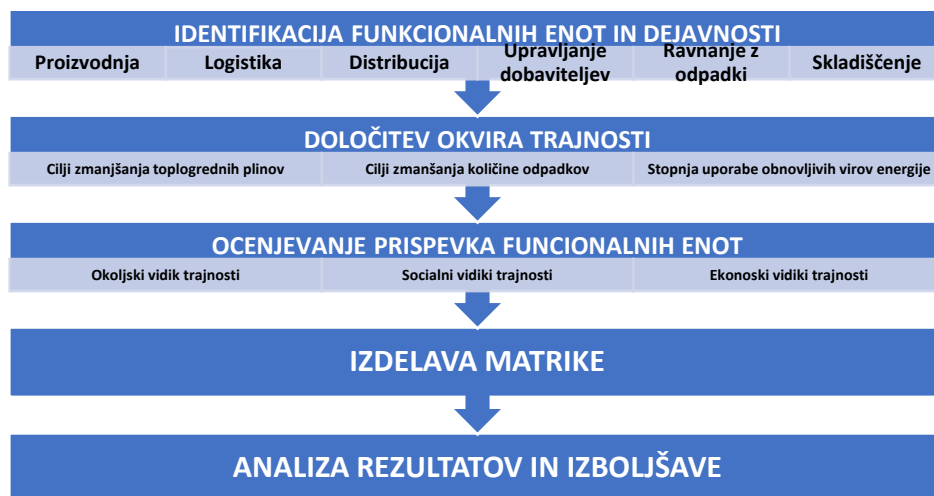
Ključni kazalniki, ki se uporabljajo za merjenje uspešnosti digitalne transformacije so (Aryal, A., Liao, Y., Nattuthurai, P in Li, B., 2018) :

- **Kazalniki poslovanja** (prihodek, dobiček, stroški in donos na investicijo (ROI - Return on Investment)). V kolikor s ti kazalniki izboljšujejo je to znak, da je digitalna transformacija prinesla pozitivne učinke.
- **Stopnja digitalizacije**, saj je število digitalizacije ključnih poslovnih procesov merilo za večjo uspešnost in je zato le ta kazalnik pomemben indikator stanja.
- **Povečanje produktivnosti** ; spremljanje posledic digitalne transformacije v kontekstu povečanja produktivnosti zaposlenih in izboljšanja procesov (manj napak, boljše izkoriščanje virov, povečanje hitrosti procesov).
- **Zmanjševanje stroškov** kot posledica povečanja produktivnosti in izboljšanja procesov zaradi digitalizacije.
- **Inovacije**
- **Stopnja uporabe novih tehnologij.**

7 Model za merjenje uspešnosti zelenega prehoda z metodo MFA

Matrična funkcionalna analiza (MFA) je analitična metoda, ki omogoča analizo različnih vidikov in funkcij v oskrbovalni verigi ter ocenjuje kakšen vpliv in delež prispevka imajo različne funkcionalne enote in dejavnosti v procesu zelene preobrazbe.

Za izvedbo uporabe matrične funkcionalne analize za merjenje uspešnosti zelenega prehoda oskrbovalnih verig so potrebni koraki prikazani na sliki 2.



Slika 2: Model MFA za merjenje zelenega prehoda

Vir: Lasten

8 Aplikacija matrične funkcionalne analize (MFA) na primeru zelenega prehoda oskrbovalnih verig

8.1 Izhodišča in robni pogoji

Predpostavimo, da imamo 6 funkcijskih področij (Proizvodnja, Logistika, Distribucija, Upravljanje Dobaviteljev, Ravnanje Z Odpadki, Skladiščenje), štiri dejavnike digitalizacije (IoT, Analitika podatkov, Sledljivost, Elektronsko poslovanje) ter tri dejavnike zelenega prehoda (Zmanjšanje emisij, Upravljanje Odpadkov in Obnovljivi Viri Energije).

8.2 Definicija izhodiščnih matrik

Na podlagi lastnih ocen, definiramo osnovni MFA matriki:

8.2.1 Matriko dejavnikov digitalizacije, kjer so so dejavniki digitalizacije ocenjeni za funkcijsko področje oskrbovalne verige glede na njihov vpliv na dejavnike zelenega prehoda. Upoštevajo se ocene od -5 (najbolj negativni vpliv) do 5 (najbolj pozitivni vpliv).

Tabela 1: Matrika dejavnikov digitalizacije

	IoT	Analitika podatkov	Sledljivost	Elektronsko poslovanje
Proizvodnja	4	3	2	1
Logistika	2	1	3	2
Distribucija	3	2	1	4
Upravljanje dob.	3	4	3	2
Ravnanje z odp.	4	3	2	1
Skladiščenje	1	2	3	4

Vir: Lasten

8.2.2 Matriko zelenega prehoda, kjer je ocenjen vpliv funkcijskih področij na zeleni prehod. Upoštevajo se ocene od -5 (najbolj negativni vpliv) do 5 (najbolj pozitivni vpliv).

Tabela 2: Matrika zelenega prehoda

	Zmanjšanje Emisij	Upravljanje Odpadkov	Obnovljivi Viri Energije
Proizvodnja	4	3	2
Logistika	2	3	4
Distribucija	3	2	1
Upravljanje dob.	3	4	3
Ravnanje z odp.	4	3	2
Skladiščenje	1	2	3

Vir: Lasten

8.3 Definicija pomembnosti (uteži) dejavnikov

V naslednjem koraku definiramo uteži pomembnosti za posamezne dejavnike (dejavnike digitalizacije, dejavnike zelenega prehoda), kar nam je osnova za izračun indeksih matrik.

Uteži za dejavnike digitalizacije:

IoT = 1, Analitika podatkov = 3, Sledljivost = 4, Elektronsko poslovanje = 5

Uteži za dejavnike zelenega prehoda:

Zmanjšanje emisij = 3, Upravljanje odpadkov = 5, Obnovljivi viri energije = 4

8.4 Izračun indeksnih matrik

8.4.1 Indeksna matrika dejavnikov digitalizacije

Za izračun indeksov dejavnikov digitalizacije in zelenega prehoda vsakega funkcijskega področja v oskrbovalni verigi uporabimo metodo uteženega seštevanja, pri čemer upoštevamo ocene dejavnikov in njihove uteži pomembnosti.

Za izračun MFA matrike indeksov dejavnikov digitalizacije (ID) uporabimo naslednjo formulo(1):

$$ID_{\text{funkcijsko področje}} = \sum_{i=0}^n Utež_{Dejavnika(i)} * Ocena_{Dejavnika(i)} \quad (1)$$

ter izračun ponovimo za vsako funkcijsko področje (Proizvodnja, Logistika, Distribucija, Upravljanje dobaviteljev, Ravnanje z odpadki, Skladiščenje) in nastane nasledna MFA matrika indeksov (Tabela 3):

Tabela 3: Indeksna matrika dejavnikov digitalizacije za posamezno funkcijsko področje

	IoT	Analitika podatkov	Sledljivost	Elektronsko poslovanje
Proizvodnja	26	27	33	37
Logistika	27	26	37	34
Distribucija	33	37	26	29
Upravljanje dob.	37	36	39	31
Ravnanje z odp.	26	34	29	28
Skladiščenje	39	32	31	29

Vir: Lasten

8.4.2 Indeks zelenega prehoda

Za izračun matrike indeksov zelenega prehoda (IZP) (Tabela 4) za posamezno funkcijsko področje uporabimo enačbo (2):

$$\text{IZPfunkcijskopodročje} = \sum_{i=0}^n \text{UtežDejavnika}(i) * \text{OcenaDejavnika}(i) \quad (2)$$

Tabela 4: Matrika indeksov zelenega prehoda

	Zmanjšanje Emisij	Upravljanje Odpadkov	Obnovljivi Viri Energije
Proizvodnja	35	41	37
Logistika	37	35	43
Distribucija	23	25	21
Upravljanje dob.	41	43	43
Ravnanje z odp.	35	41	37
Skladiščenje	25	29	30

Vir: Lasten

8.4.3 Izračun indeksa vpliva digitalizacije na zeleni prehod

Za izračun indeksov vpliva dejavnikov digitalizacije na zeleni prehod za vse poslovne funkcije uporabimo naslednjo formulo (3):

$$\text{Indeks vpliva (funkcijskopodročje)} = \frac{\text{IZPfunkcijskopodročje}}{\text{IDfunkcijskopodročje}} \quad (3)$$

Na podlagi tega kriterija kreiramo korelacijske matriko indeksov vpliva posameznih dejavnikov digitalizacije na zeleni prehod za vsako posamezno poslovno funkcijo (Primer Proizvodnja) (Tabela 5).

Tabela 5: Indeks vpliva digitalizacije na zeleni prehod

	IoT	Analitika Podatkov	Sledljivost	Elektronsko Poslovanje
Zmanjšanje emisij	1,34	1,29	1,06	0,94
Upravljanje odp.	1,57	1,52	1,24	1,11
Obnov.viri energ.	1,42	1,37	1,12	1,00

Vir: Lasten

Nato pa podatke iz te matrike povežemo povežemo z ekonomskim kriterijem ROI, ki opredeljuje donosnost naložbe za posamezen dejavnik digitalizacije in dobimo sliko o smiselnosti investiranja (4),(tabela 6).

$$\text{Indeks vpliva (funkcijskpodročje)} = \frac{\text{IZPfunkcijskpodročje}}{\text{IDfunkcijskpodročje}} \quad (4)$$

Pri tem je uporabljena osnovna formula(5) za izračun donosnosti, pri čemer se tako prihodek kot stroški nanašajo na posamezno funkcijsko področje.

$$\text{ROI(funkcijskpodročje)_(N)} = \frac{\text{Prihodek-Stroški}}{\text{Stroški}} \times 100 \quad (5)$$

Analiza se nato izvede za vsak dejavnik digitalizacije in nastane matrika, ki nam podaja informacijo o donosnosti naložbe v posamezno funkcijsko področje.

Tabela 6: Donosnost naložbe(ROI) za dejavnike digitalizacije

	IoT	Analitika Podatkov	Sledljivost	Elektronsko Poslovanje
Proizvodnja	ROI_1	ROI_2	ROI_3	ROI_4
Logistika	ROI_5	ROI_6	ROI_7	ROI_8
Distribucija	ROI_9	ROI_10	ROI_11	ROI_12
Upravljan.dob.	ROI_13	ROI_14	ROI_15	ROI_16
Ravnanje z odp.	ROI_17	ROI_18	ROI_19	ROI_20
Skladiščenje	ROI_21	ROI_22	ROI_23	ROI_24

Vir: Lasten

Uporaba MFA nam omogoča zelo hitro in enostavno identifikacijo delov zelenega prehoda. Kjer so indeksi vpliva večji od 1 in hkrati ROI pozitiven so ekonomsko upravičeni, hkrati pa je to tudi izvrstno orodje za korektivne ukrepe.

9 Zaključek

Referat se je osredotočil na pomembnost povezovanja digitalizacije in zelenega prehoda v oskrbovalnih verigah ter kako ta povezava vpliva na ekonomske izide. Poleg tega je bila predstavljena praktična uporabnost metode MFA pri merjenju uspešnosti trajnostnih praks. Vsekakor bo ta raziskava prinesla nove vpogled v to ključno področje in pomagala podjetjem pri boljšem razumevanju povezave med digitalizacijo in trajnostjo v oskrbovalnih verigah. S preišljenimi in trajnostnimi pristopi, lahko podjetja, ne samo zmanjšajo svoj okoljski vpliv, temveč tudi izboljšajo svoje ekonomske izide in konkurenčnost, kar je ključnega pomena za podjetja sama ter trajnostno prihodnost našega planeta.

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UNRAVELING THE ESG REPORTING LANDSCAPE: A COMPREHENSIVE ANALYSIS OF STANDARDS, FRAMEWORKS, AND IMPACT ON FIRMS

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In the constantly changing landscape of corporate sustainability, navigating the complex network of ESG reporting standards and frameworks has become a significant challenge for businesses worldwide. This research seeks to improve understanding of ESG reporting and shed light on the complexities of the ESG disclosure landscape by focusing on three aspects of ESG reporting: regulatory standards, ESG frameworks, and their impact on firms. It provides detailed comparisons of various themes of standards and frameworks, as well as a comprehensive examination of the diverse methodologies used by ESG data providers to determine and quantify ESG scores or rankings. By clarifying the intricacies of these methodologies, our research aims to provide stakeholders with a deeper understanding of the underlying processes that drive the generation and dissemination of ESG data within the financial ecosystem. Ultimately, we highlight key findings from different regions, offering insights into the varying effects of ESG disclosure on firm characteristics.

Keywords:
ESG,
sustainability
reporting
regulation,
sustainability
reporting
standards,
ESG
frameworks,
ESG
impact

1 Introduction

In the ever-evolving landscape of corporate sustainability, navigating the intricate web of Environmental, Social, and Governance (ESG) reporting standards and frameworks has become a formidable challenge for businesses worldwide. This research endeavors to enhance the comprehension of ESG reporting and illuminate the intricacies of the ESG disclosure landscape by focusing on three dimensions of ESG reporting: regulatory standards, ESG frameworks, and impact on firms.

Reporting information on sustainability matters became inevitable for firms due to the increasing demand from stakeholders. Providing material information on sustainability matters enables stakeholders to assess the firms' exposure to sustainability-related risks and opportunities. Firms consider sustainability matters in their business activities to take advantage of the benefits of engaging stakeholders, accessing to cheaper funding, retaining supplier relationships, and exploiting the marketing power of sustainability, which can contribute to improving competitiveness. Due to the harmonization of the sustainability reporting regulation and standards, the IFRS Sustainability Disclosure Standards¹ and the European Sustainability Reporting Standards (ESRS)² will acquire a significant market share in sustainability reporting in the coming years.

Firms also recognized that aligning with ESG frameworks, especially ESG ratings and rankings, can effectively attract investors and help address broader stakeholder concerns. On the other hand, the diverse scope and methodology of ESG ratings and rankings lead to divergence in firms' ESG performance and require firms to collaborate with more third-party aggregators to disseminate ESG disclosures efficiently.

ESG disclosures provide valuable insight into the governance and the policies, but ongoing debate exists on whether ESG significantly influences the firm characteristics. Most of the firms align financial objectives behind improving ESG performance. Enhancing shareholder value, decreasing the cost of capital, or increasing profitability can strengthen firms' commitment toward ESG concerns. In this research, we summarize the existing literature concerning the impact of ESG on

¹ IFRS Sustainability Disclosure Standards

² European Sustainability Reporting Standards

firm characteristics with a focus on the different geographical locations and show the impacts firms can expect from engaging in the ESG reporting landscape.

2 Policy and regulatory drivers of ESG disclosures

After the Paris Agreement and the European Green Deal entered into force, sustainability reporting regulation took a different approach in the United States and the European Union. In the United States, sustainability reporting was voluntary and motivated by the market. At the same time, the European Commission created prudential rules in the form of directives, guidelines, and regulations to incentivize disclosures on sustainability matters. Both legislation relied heavily on sustainability reporting standards like standards of the Global Reporting Initiative (GRI)³, the Sustainability Accounting Standards Board (SASB)⁴, and the recommendations of the Task Force on Climate Change Disclosures (TCFD)⁵, and introduced regulations that required the financial market participants to disclose information on the climate-related risks and opportunities related to financial products.

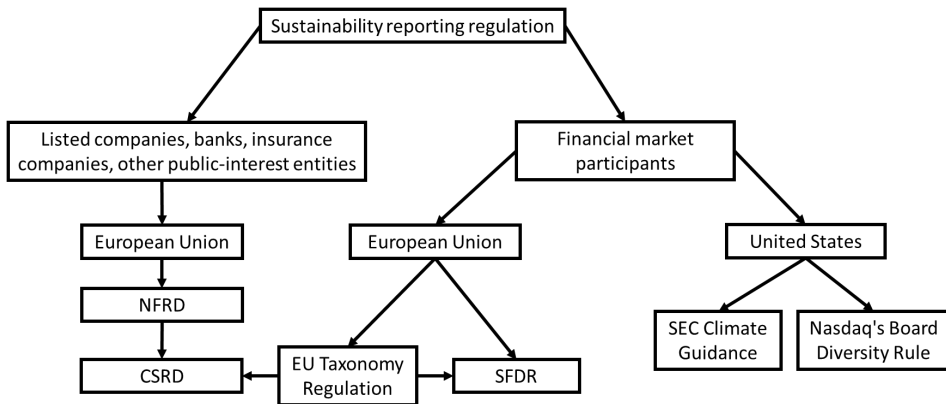


Figure 1: Sustainability reporting regulation

Source: Own

³ Global Reporting Initiative

⁴ Sustainability Accounting Standards Board

⁵ Task Force on Climate Change Disclosures

Considering the legislation in the United States, the Security Exchange Commission (SEC) introduced guidance on climate change-related disclosures⁶ in 2010 in which they required issuers to disclose material information on climate-related risks and opportunities in the business description, legal proceedings, risk factors, and Management Discussion and Analysis (MD&A). In 2021, the SEC accepted the new rules of the Nasdaq Stock Exchange listings⁷, which required firms to disclose material information on the diversity of the board. In March 2022, the SEC introduced the amendments to the climate guidance⁸, which requires domestic and foreign issuers to disclose climate-related information, including the governance, strategy, management processes, metrics, and targets concerning climate-related risks and opportunities from the financial year 2023.

Considering the legislation in the European Union, listed companies, banks, insurance companies and other large public-interest entities were obliged to publish non-financial statements from the financial year 2017 in accordance with Non-Financial Reporting Directive⁹ (NFRD). On 5th of January 2023, the Corporate Sustainability Reporting Directive¹⁰ (CSRD) entered into force, and large, public-interest entities have to apply the European Sustainability Reporting Standards (ESRS) drafted by the European Financial Reporting Advisory Group (EFRAG) starting from January 2024. CSRD incorporated sustainability reports, governance matters, double materiality, and sustainability due diligence in the context of the sustainability reporting policy. Firms have to disclose capital expenditure (CapEx) and operating expenditure (OpEx) associated with taxonomy-aligned activities and targets for 2030 and 2050 in accordance with the European Green Deal. CSRD also requires auditing for the sustainability reports.

In March 2021, the European Union introduced the Sustainable Finance Disclosure Regulation¹¹ (SFDR), which required financial market participants to disclose information on sustainability matters related to financial products. Financial market participants have to disclose 14 adverse impact indicators and can choose additional ones that can indicate the sustainability of their investments. In June 2020, the EU

⁶ SEC Climate Guidance

⁷ Nasdaq's Board Diversity Rule

⁸ The Enhancement and Standardization of Climate-Related Disclosures for Investors

⁹ NFRD, Directive 2014/95/EU

¹⁰ CSRD, Directive (EU) 2022/2464

¹¹ SFDR, Regulation (EU) 2019/2088

Taxonomy Regulation¹² amended SFDR by introducing criteria enabling investors to assess the sustainability of economic activities. Due to this regulation, firms can disclose data about their sustainable revenue, capital expenditures, and operating expenditures related to the six environmental objectives, including climate change mitigation, climate change adaptation, the sustainable use and protection of water and marine resources, the transition to a circular economy, pollution prevention and control, the protection and restoration of biodiversity and ecosystems, defined in the EU Taxonomy Regulation. Firms subject to CSRD have to report to what extent the EU Taxonomy Regulation covers their activity (taxonomy-eligibility) and to what extent they comply with the delegated acts (taxonomy-alignment), including the activities' screening criteria.

3 Sustainability reporting standards

Till the harmonization of the sustainability reporting standards, a wide variety of standards were available for firms. However, firms mostly applied the standards of GRI, SASB, and the recommendations of TCFD. The IFRS Foundation acquired SASB and the Climate Disclosure Standards Board¹³ (CDSB) and drafted the IFRS Sustainability Standards, which were published in June 2023. IFRS sustainability standards involve the structure of TCFD recommendations and recommend the application of SASB industry-specific standards and the CDSB frameworks on water and biodiversity.

The European Commission mandated EFRAG to draft the European Sustainability Standards (ESRS), which were adopted in July 2023. Due to CSRD, large entities subject to the NFRD have to comply with ESRS starting from January 2024, listed SMEs have to apply ESRS from January 2026, and third-country companies with a European subsidiary have to report in accordance with ESRS starting from January 2028. Thus, ESRS will play a crucial role in sustainability reporting in the coming years.

¹² EU Taxonomy, Regulation (EU) 2020/852

¹³ Climate Disclosure Standards Board

Figure 2. presents the principles of sustainability reporting in accordance with ESRS. ESRS customizes the recommendations of the IFRS standards considering the European policy and incorporates the important topics from the GRI. Applying a double materiality approach, ESRS distinguishes financial and impact materiality. Firms have to report sustainability-related risks and opportunities concerning the whole value chain and have to consider the time horizon of the impact. Firms have to conduct a materiality assessment involving the thematic standards of ESRS according to these principles. The structure of the report has to follow the recommendations of TCFD.

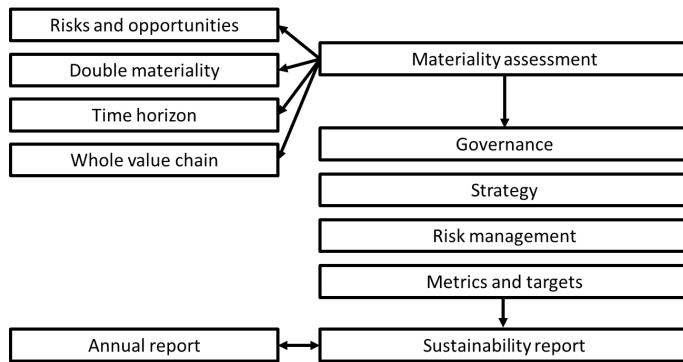


Figure 2: Principles of sustainability reporting

Source: Own

Before CSRD entered into force, firms usually reported on the material topics of GRI and SASB standards and the TCFD recommendations. Firms will focus on the ESRS and IFRS standards in the coming years.

4 ESG frameworks: investor expectations and stakeholder engagement

Unlike ESG reporting standards, which are more technical and focus on specific requirements, ESG frameworks are oriented towards principles. Their primary focus revolves around broader inquiries, such as the structuring of information and the collection of relevant data. ESG frameworks can be broadly categorized into three key sections. Firstly, voluntary disclosure frameworks such as the Carbon Disclosure

Project¹⁴ (CDP), the Global Real Estate Sustainability Benchmark¹⁵ (GRESB), and the Dow Jones Sustainability Indices¹⁶ (DJSI) operate on a voluntary basis, emphasizing proactive information disclosure by organizations. Secondly, guidance frameworks, including TCFD, CDSB, and the International Integrated Reporting Council¹⁷ (IIRC), provide structured guidance and principles to assist organizations in integrating ESG considerations into their reporting practices. Lastly, the landscape encompasses third-party aggregators represented by ESG data providers, playing a pivotal role in collecting, analyzing, and disseminating ESG data, thereby contributing to the broader ecosystem of ESG reporting. This classification illuminates the diverse roles of frameworks, whether voluntary, guidance-oriented, or aggregative, within the contemporary framework of corporate reporting.

Beyond regulatory compliance, firms are increasingly recognizing the importance of aligning with ESG frameworks, specifically the third category, to attract investors and address broader stakeholder concerns. These objectives are primarily achieved through the attainment of a favorable ESG score or ranking and through receiving positive evaluations from the prominent "Big Four" accounting firms. Table 1 demonstrates a comparative analysis of the diverse objectives, scopes, and methodologies pursued by prominent ESG data providers and the Big Four. Such an examination allows for an understanding of the overarching goals and strategic orientations inherent to each of these entities within the ESG data landscape. In addition, it offers firms invaluable insights into the specific dimensions around which they can tailor their ESG disclosure practices to convey their commitment and performance in alignment with these metrics.

The scope and the methodology of the ESG data providers can diverge significantly, which leads to diverse measurements of the firm's ESG performance. Metrics can be categorized mainly as materiality-based metrics or risks and opportunity-based metrics. However, some thematic scopes like carbon emission, supply chain sustainability, and hidden costs of unsustainable resource use appear among the scopes of the metrics. Across methodology, comprehensive, fundamental, and thematic metrics can be distinguished. Comprehensive metrics use public domain and privately collected data to construct the ESG metrics. Fundamental metrics use

¹⁴ Carbon Disclosure Project

¹⁵ Global Real Estate Sustainability Benchmark

¹⁶ Dow Jones Sustainability Indices

¹⁷ International Integrated Reporting Council

only public domain data, while thematic ESG data providers construct metrics for a specific use case.

Table 1: ESG frameworks: objectives, scope, methodology

Framework	Objective	Scope	Methodology
MSCI	To measure financially material ESG risks and opportunities	Risks and opportunities	Comprehensive
Sustainalytics	To measure financially material ESG risks	Risks	Comprehensive
S&P Global	To measure companies performance on and management of material ESG risks, opportunities and impacts	Risks, opportunities, and impacts	Comprehensive
ISS ESG	To measure the ability to manage material ESG risks, mitigate negative and generate positive social and environmental impacts	ESG risks, enviromental and social impacts	Comprehensive
FTSE Russel	To measure a company’s exposure to and management of ESG issues in multiple dimensions	Materiality	Comprehensive
LSEG	To measure the ESG performance considering industry-specific materiality	Materiality	Fundamental
Bloomberg	To measure the ESG performance considering industry-specific materiality	Materiality	Fundamental
Ecovadis	To measure the sustainability of procurement programs within global value chains	Sustainability of supply chains	Thematic
Trucost	To assess risks relating to climate change and natural resource constraints	Hidden costs of using unsustainable resources	Thematic
CDP	To measure carbon emissions of companies and cities	Carbon emissions	Thematic
Big Four	To identify common ESG metrics and recommend consitent ESG disclosure	Common ESG metrics	Thematic

Source: MSCI, Sustainalytics, S&P Global, ISS ESG, FTSE Russel, LSEG, Bloomberg, Ecovadis, Trucost, CDP, WEF

Alignment with different data providers can benefit the firms and enable them to disseminate ESG disclosure efficiently. Most investors follow more than one

metrics, which allows them to assess the sustainability of their investments from different angles according to the strengths and weaknesses of the metrics.

5 Impact of ESG disclosure on firm characteristics

ESG holds the potential to bolster companies' competitive positions (Barron et al., 2022). While ESG scores offer valuable insights into a company's policies and governance, an ongoing debate surrounds the question of whether ESG exerts an influence on firm characteristics. The subsections below present prior studies divided by the geographical locations of the samples used in their studies. This classification allows us to explore possible geographical differences in the outcomes of ESG disclosure on firm characteristics.

5.1 Africa

Agyemang and Ansong (2017) analyze 423 SMEs in Ghana for 2013 and show a positive link between CSR scores and firm financial performance. Similarly, Aboud and Diab (2019) find a statistically significantly positive relationship between ESG scores and profitability for their sample composed of 100 most active Egyptian companies in the Egyptian Stock Exchange from 2012 to 2016.

Johnson (2020) analyzes 68 firms from six Johannesburg Stock Exchange sectors over the period 2011–2018 and finds a statistically significantly negative relationship between ESG disclosure scores and weighted average cost of capital (WACC). Yet, a significant positive relationship is obtained between composite ESG disclosure scores and WACC for firms from the industrials sector. Similarly, Maama and Marimuthu (2021) examine 147 listed firms in 10 sub-Saharan African countries and demonstrate that there exists a negative relationship between ESG disclosure and cost of capital. The results of Maama and Marimuthu (2021) further show that social, governance and environmental disclosures all have negative relationships with the cost of capital.

5.2 Asia

Chelawat and Trivedi (2016) demonstrate that there is a statistically significant relationship between ESG scores and profitability for Indian companies in NSE

CNX Nifty 100 from 2008 to 2013. Likewise, Yoon et al. (2018) study 705 South Korean companies from 2010 to 2015 and show a considerable relationship between ESG scores and profitability. Similar results are achieved by Zhao et al. (2018) when considering 20 Chinese power generation companies from 2007 to 2016. Atan et al. (2018), on the other hand, analyze 54 Malaysian companies from 2010 to 2013 and find no statistically significant link between ESG scores and profitability, while Behl et al. (2021) find mixed results for their sample composed of 62 Indian energy companies from 2016 to 2019.

Tanjung (2023) examines all Indonesian companies present in SRI-KEHATI and IDX30 (Indonesia) from 2012 to 2021 and demonstrates that there is a positive relationship between ESG scores and the cost of capital. Tanjung (2023) also affirms that their results indicate that the adoption of green or sustainable finance in Asia is still in its infancy and that the sector requires more time to establish an enabling environment. Nevertheless, Ellili (2020) considers 30 companies listed on the Abu Dhabi Stock Exchange and Dubai Financial Market from 2010 to 2019 and finds a statistically significant negative relationship between ESG disclosure and the cost of capital. Likewise, Chen et al. (2023) analyze Chinese A-share companies from 2010 to 2020 and show a statistically significantly negative relationship between ESG scores and the cost of capital, which is robust even when heteroscedasticity, sequence correlation, and cross-section correlation are controlled, respectively, or simultaneously. Additionally, Chen et al. (2023) demonstrate that ESG can indirectly reduce the cost of equity capital by reducing the market risk of enterprises and increasing their equity diversification. Similarly, Kumawat and Patel (2022) explore listed Indian companies on NSE 500 from 2011 to 2020 and find a negative relationship between ESG disclosure and the cost of capital.

5.3 Europe

Ahmad et al. (2021) analyzed 350 firms from the FTSE350 from 2002 to 2018 and found a positive and significant impact of ESG scores on firms' financial performance. Yet, when considering individual ESG performance scores, the results are ambiguous. Additionally, Ahmad et al. (2021) demonstrate that firm size moderates the relationship between ESG scores and firms' financial performance. Nonetheless, Velte (2019) analyzed German companies on the German Prime Standard (DAX30, TecDAX, and MDAX) from 2011 to 2017 and found a negative

relationship between ESG scores and accruals-based earnings management, but no significant relationship between ESG scores and real earnings management (REM). Similarly, Cerciello et al. (2022) demonstrate a negative relationship for companies of Euro Stoxx 300 between the implementation and disclosure of sustainability in business practices and profitability. On the other hand, La Torre et al. (2020) show that there is no statistically significant relationship between stock returns of the companies in the Eurostoxx50 and ESG scores.

Khanchel and Lassoued (2022) analyze the largest firms in the STOXX Europe 600 index from 2002 to 2018 and find a statistically significant negative relationship between ESG scores and the cost of equity, but a positive relationship between ESG scores and the cost of debt. Gjergji (2020), on the other hand, examine 132 Italian SMEs in 2019 and show that in contrast to large companies, there exists a statistically significant positive relationship between ESG performance and the cost of capital; however, this pattern is capsized when the company is a family SME, as it benefits from environmental disclosure, like large companies do.

La Rosa and Bernini (2022) examine 2,599 time observations of European companies and show that there exists a negative relationship between the ESG controversy score and the cost of equity, albeit this impact is mitigated when associated with company efforts to improve environmental performance.

5.4 Latin America

Bahadori (2019) demonstrates a statistically significant positive relationship between ESG scores and profitability of 58 Brazilian listed companies from 2014 to 2018. Similarly, Järvinen (2022) shows a positive relationship between stock returns and ESG scores using a sample composed of the 50 largest Brazilian listed companies from 2015 to 2020.

Ramirez et al. (2022) examine 202 Latin American companies from 2017 to 2019 and show that there is a statistically significantly negative relationship between ESG scores and the cost of capital. Ramirez et al. (2022) also find no significant relationship between the cost of capital and Social and Environmental scores. This indicates that the increase in transparency about internal processes and governance entities can be an essential driver of value creation for firms and higher financing

confidence in Latin American firms. Similarly, Balassiano et al. (2023) consider 96 Brazilian non-financial companies from 2016 to 2020 and find a negative relationship between ESG scores and the cost of capital.

5.5 North America

Brogi and Lagasio (2018) analyse 3,476 companies from the USA and show a positive association between ESG and ROA and that banks engaged in ESG matters achieve a higher ROA. On the other hand, Ersoy et al. (2022) analyse 151 US commercial banks and show an inverted U-shaped relationship between market value and ESG scores and a U-shaped relationship between market value and the Environmental Pillar Score (EPS).

Alfalih (2022) analyses S&P500 non-financial companies from 2010 to 2019 and shows a significantly positive relationship between ESG information disclosure and corporate financial performance (proxied by ROA and Tobin's Q). Likewise, Ademi and Klungseth (2022), Borghesi et al. (2014), Gao and Zhang (2015) and Fatemi et al. (2018) also show a statistically considerably positive relationship between ESG performance and financial performance (proxied by Return-on-capital-employed (ROCE)). However, it is worth mentioning that some studies also show a statistically significantly negative relationship between ESG and financial performance (Buchanan et al., 2018; Di Giuli and Kostovetsky, 2014; Masulis and Reza, 2014). As a further consideration, Csapi and Balogh (2020) show that financial performance can proxy firm-level competitiveness in the case of small and medium-sized enterprises in the United States.

Khanchel and Lassoued (2022) examine a sample of 430 S&P 500 US firms from 2011 to 2019 and show different dynamic relationships between cost of capital and ESG scores. While Governance disclosure has a negative relationship in the first years and in later years it becomes positive, while Social disclosure has a positive relationship. Environmental disclosure, on the other hand, shows a negative relationship with cost of capital in the first years and no significant relationship in later years. Similarly, Piechocka-Kaluźna (2021) considers 6,393 US companies from 2016 to 2020 and finds a statistically significantly negative relationship between ESG scores and WACC. Additionally, Piechocka-Kaluźna (2021) shows an insignificant relationship between ESG scores and cost of debt.

Piechocka-Kaluźna et al. (2021) examines 1,263 US healthcare companies from 2016 to 2020 and also show a statistically significantly negative relationship between ESG scores and WACC.

5.6 Oceania

Siew et al. (2013) analyse 44 construction companies from ASX and find no statistically significant relationship between ESG disclosure and profitability. Similar results are found by Limkriangkrai et al. (2016) who analyse 329 Australia-based companies from 2009-2014.

Gholami et al. (2022) examine an extensive sample composed of Australian companies from 2007 to 2017 found on the Bloomberg database and find a statistically significantly negative relationship between ESG performance and both cost of equity and debt. Their findings also support the mitigating impact of corporate ESG performance disclosure score on the company's idiosyncratic risk as a strong complement for access to a cheaper source of funds.

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PREGLED MOBILNIH APLIKACIJ S PODROČJA ONESNAŽEVANJA OKOLJA

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Onesnaževanje okolja je težava, ki ne vpliva samo na okolje ampak tudi na zdravje ljudi. Za zmanjšanje negativnih vplivov je pomembno okoljsko ozaveščanje ljudi, tudi z uporabo široko dostopnih mobilnih aplikacij. Mobilne aplikacije smo pregledali v mobilnih trgovinah Google Play in iOS app z uporabo ključne besede »pollution«. Pri pregledu smo sledili priporočilom PRISMA. Aplikacije smo ocenili z uporabo vprašalnika Mobile Application Ration Scale (user version). Mobilne aplikacije so obsegale različne tipe onesnaževanja. Po pregledu smo izbrali 8 aplikacij, ki so se nanašale na onesnaževanje okolja. Ugotovili smo, da je splošna kakovost aplikacij dobra, pri čemer so bile dosežene ocene med 3.06 (± 0.23) in 4.35 (± 0.08). Najbolje ocenjena aplikacija je bila Earth Hero: Climate Change. Zaradi razširjenosti uporabe mobilnih aplikacij, jih je smiselno uporabljati za vzpodbujanje okoljske ozaveščenosti prebivalcev. V prihodnjih raziskavah bi se bilo smiselno osredotočiti na posamezne tipe onesnaževanja in oceniti kakovost pri uporabnikih.

Ključne besede:

onesnaževanje
okolja,
mobilne
aplikacije,
zdravje
ljudi,
negativni
vplivi,
priporočila

REVIEW OF MOBILE APPLICATIONS IN THE FIELD OF ENVIRONMENTAL POLLUTION

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Environmental pollution is a problem that affects not only the environment but also human health. To reduce the negative impacts, it is important to raise people's environmental awareness, including using widely available mobile applications. Mobile apps were reviewed in the Google Play and iOS app stores using the keyword "pollution". The review followed PRISMA recommendations. The apps were evaluated using the Mobile Application Rating Scale questionnaire (user version). Mobile applications encompassed different types of pollution. After screening, we selected 8 apps that were relevant to environmental pollution. We found the overall quality of the apps to be good, with scores ranging between 3.06 (± 0.23) and 4.35 (± 0.08). The top-rated app was Earth Hero: Climate Change. Given the widespread use of mobile apps, it makes sense to use them to promote environmental awareness among the population. Future research should narrow its focus to specific pollution types and assess user experience quality.

Keywords:
environmental
pollution,
mobile
applications,
human
health,
negative
impacts,
recommendations

1 Introduction

Environmental pollution is not new, but it is still the most serious problem and the most important environmental cause of morbidity and mortality (Ukaogo, et al., 2020). Pollution means the introduction of substances into the environment by humans, which may represent a danger to human health. Pollution can be classified in many ways, e.g. water pollution, air pollution, land pollution, food pollution, noise pollution and others (Appannagari, 2017). Many diseases are associated with environmental pollution. For some, the problem is the spread of diseases such as typhoid, while others are noncommunicable diseases such as asthma and cancer (Siddiqua, et al., 2022). Advances in mobile technologies could help users learn about the connections between pollution and health. Mobile applications are designed to be used on mobile devices that users often have with them and can reach (Delmas & Kohli, 2020). Mobile applications are important for raising awareness among the wider population, mainly because they are affordable, accessible, and easy to use. They are helpful not only to the general population, but also to researchers and policy makers in awareness and adaptation to climate change resulting from environmental pollution (Chakraborty & Chakravarty, 2017). Mobile applications often provide a feedback system and information regarding user behavior. They enable, for example, control of energy consumption or feedback on ecological driving and display of results or consequences of certain behavior (Brauer, et al., 2016). The authors of several papers evaluated mobile apps and suggested that there is a need for evaluation with reliable tools, as this can also promote the quality of information within mobile apps (Adam, et al., 2018; Bardus, et al., 2019). Evaluating mobile applications is also important, because the large number of applications makes it difficult to identify quality ones. Application popularity ratings and user reviews can often be subjective and do not provide enough information about the actual quality, so there is a need for evaluation with reliable tools (Stoyanov, et al., 2015). There are several mobile applications that are widely available and provide information on the topic of pollution. Our aim was to review the mobile applications in the Google Play and iOs app stores, select those that relate to different types of pollution and are freely available, and evaluate them using a questionnaire.

2 Methods

We conducted a review of mobile apps in the Google Play and iOS app stores using the keyword "pollution". During the review, we followed the PRISMA recommendations (Page, et al., 2021). We included mobile applications that related to the topic of pollution, were in Slovenian or English language and were freely available. We excluded paid applications, games and those that were technically or content inadequate.

In total, we found 783 applications that are related to pollution in general in mobile stores. We acquired 441 applications in the Google Play (227 on the phone and 214 on the tablet) and 342 applications in iOS app store (171 on the phone and 171 on the tablet). We removed 196 duplicates, leaving 587 apps that we reviewed by name and icon. This left 403 applications, the suitability of which was checked based on the description and assessed for eligibility. Based on the exclusion criteria (games, other foreign language, inappropriate content, and paid applications), we excluded 395 applications and included 8 in the final review (Figure 1).

Application evaluation was performed by three authors independently. We evaluated each item of each section. We calculated the average of the grades and the standard deviation for all of them. Based on the total evaluations, we determined the highest and lowest ranked mobile applications. To evaluate mobile applications, we used Mobile Application Rating Scale (user version). It contains engagement, functionality, aesthetics, and information mean score. The items are evaluated on a 5-point Likert scale from inadequate to excellent. Based on the mentioned scores, it is calculated app quality mean score. Section A (engagement) assesses entertainment, interest, customisation, interactivity, and target group. Section B (functionality) assesses performance, ease of use, navigation, and gestural design. Section C (aesthetics) includes layout, graphics, and visual appeal. Section D (information) contains quality of information, quantity of information, visual information, and credibility of source. Section E assesses app subjective quality, while section F contains the perceived impact items. We evaluated the application sections in Excel by calculating mean values.

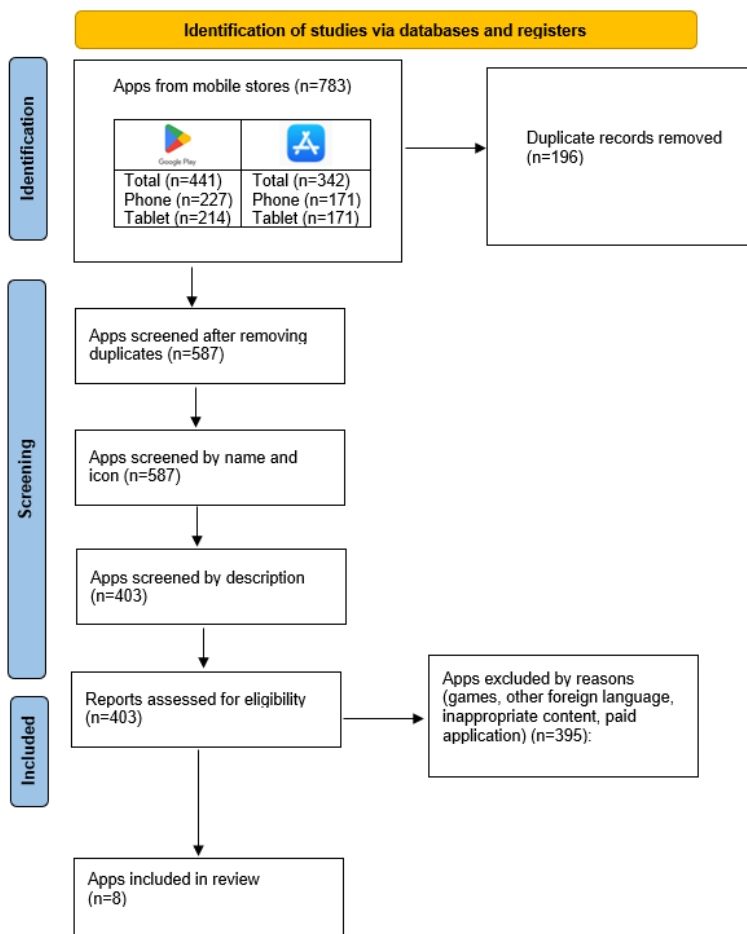


Figure 1: PRISMA flow diagram

Source: Page, et al., 2021



3 Results and discussion

The included applications were generally related to environmental pollution or to several aspects and not only to one type of pollution. Each application was evaluated by three reviewers using the Mobile Application Ration Scale questionnaire (user version). All included apps can be found in Google Play Store, while three of them (Environment Challenge, Environmental pollution, and Environmental Ecology)

are not in the iOS app store. Data on applications name and icon, first published, update, downloads, and user rating are shown in Table 1.

Table 1: Basic information about applications

Application name and icon	First published	Updated	Downloads	User rating
Earth Hero: Climate Change 	9 July 2019	9 December 2023	50.000+	4.8
Earth5R - The Environmental App 	27 January 2023	5 January 2024	10.000+	4.7
Environment Challenge 	4 July 2018	6 December 2023	100.000+	4.5
Environmental pollution 	19 September 2022	19 September 2022	500+	/
Climate Campaigners 	8 November 2022	9 February 2023	1.000+	3.6
Environmental Ecology 	14 December 2019	23 September 2022	10.000+	4.2
Pollution Reporter	9 September 2019	10 April 2022	100+	4.8

Application name and icon	First published	Updated	Downloads	User rating
				
Greenly - Carbon Footprint 	16 April 2020	20 August 2021	10.000+	3.7

Source: Own

Data on the mean scores of each section of the questionnaire by all three reviewers are shown in Table 2. The overall uMARS scores for the applications ranged from 3.06 (± 0.23) to 4.35 (± 0.08). Only one application achieved overall app quality above 4 (Earth Hero: Climate Change). Most applications received the highest score for functionality section, while most of them received the lowest score in engagement section.

Table 2: uMARS scores of the applications

Application name	uMARS section				
	Engagement mean score (SD)	Functionality mean score (SD)	Aesthetics mean score (SD)	Information mean score (SD)	Overall app quality (SD)
Earth Hero: Climate Change	4.47 (±0.31)	4.50 (±0.25)	4.44 (±0.38)	4.00 (±0.25)	4.35 (±0.08)
Earth5R - The Environmental App	3.53 (±0.31)	4.08 (±0.14)	3.67 (±0.00)	4.00 (±0.00)	3.82 (±0.09)
Environment Challenge	2.93 (±0.31)	3.92 (±0.38)	3.22 (±0.19)	2.83 (±0.38)	3.23 (±0.16)
Environmental pollution	2.40 (±0.53)	4.00 (±0.25)	3.33 (±0.58)	3.08 (±0.38)	3.20 (±0.28)
Climate Campaigners	3.53 (±0.12)	4.17 (±0.29)	4.00 (±0.00)	3.67 (±0.14)	3.84 (±0.07)
Environmental Ecology	2.27 (±0.70)	3.83 (±0.29)	3.22 (±0.19)	2.92 (±0.29)	3.06 (±0.23)
Pollution Reporter	3.87 (±0.42)	4.25 (±0.25)	3.33 (±0.00)	4.25 (±0.50)	3.93 (±0.17)
Greenly - Carbon Footprint	2.80 (±0.28)	3.63 (±0.18)	3.83 (±0.24)	3.38 (±0.18)	3.41 (±0.13)

Source: Own

Mobile applications have many options with which users can obtain reliable and fast information about pollution. In addition to mobile applications, there is already a mobile phone equipped with air pollution sensors that provides direct information from the environment (Nyarku, et al., 2018). More and more applications offer maps that show polluted areas and bring them closer to users. During the review of the applications, we noticed that many of them offer photos, graphic displays, and descriptions of the positive and negative impacts of environmental management. This is also noted by Wong, et al. (2021), who add that the active role and cooperation of users and the appropriate quality of information and photos are very

important for changes. As mobile applications develop rapidly, it is important to assess their quality (Agarwal, et al., 2021). Mobile Application Ration Scale questionnaire (user version) is often used, it was used e.g. to evaluate mobile applications for rheumatic patients (Lambrecht, et al., 2021), mobile applications to teach children basic life support (Fijačko, et al., 2021), mobile applications for calculating prostate cancer risk (Adam, et al., 2018), and mobile applications for weight management (Bardus, et al., 2019). Mobile applications that refer to environmental pollution and related content in articles are often not evaluated in terms of quality. We are, for example, found a review of applications relating to mobile phone data for the purpose of adapting cities to climate change (Dujardin, et al., 2020), a systematic review of mobile applications for sustainable waste management (Suruliraj, Nkwo & Orji, 2020), and monitoring ambient air pollution in asthmatic children by mobile applications (Lin, et al., 2023). Mobile applications are practical to use in everyday life and facilitate the monitoring and analysis of data relating to the environment and pollution (Akhmetov & Aitimov, 2015).

4 Conclusion

Due to their accessibility and increasingly widespread use, mobile applications are an effective tool for raising awareness about environmental pollution. Through the review of the applications, we found that they are generally of good quality and in most cases provide users with information related to environmental pollution. We believe that mobile applications are important for raising awareness, but at the same time it is important to continue to develop new ones that are equipped with quality sources of information. They should be evaluated with appropriate tools and questionnaires, because in this way suggestions for improvements are made. We also propose a review and assessment of mobile applications by individual types of environmental pollution, as this would make it easier and more transparent to provide information for users who are interested in more specific areas.

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TRADICIONALNE VREDNOTE V DIGITALNI DOBI: ŠTUDIJA PRIMERA DRUŽINSKEGA PODJETJA

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Družinska podjetja, kot posebna oblika podjetij, se pogosto soočajo s konfliktom med tradicijo in potrebo po digitalizaciji. Analiziramo konkreten primer družinskega podjetja, ki se ukvarja z mednarodnim poslovanjem, in raziskujemo konflikt med starejšo generacijo, ki poudarja osebni stik, in mlajšo generacijo, ki favorizira digitalno komunikacijo. V okviru raziskave so predstavljeni vidiki digitalizacije, ki kažejo na prednosti sedanje komunikacije, vključno z elektronsko pošto, video konferencami in družbenimi mediji. Tradicionalne vrednote, kot so osebni stik in zaupanje, so prav tako podrobno analizirane in poudarjene kot ključne v poslovanju družinskih podjetij. S študijo primera prikazujemo konkreten primer generacijskega konflikta v družinskem podjetju in raziskujemo, kako so z združevanjem tradicionalnih vrednot in digitalnih orodij dosegli uspešno mednarodno sodelovanje. Razprava poudarja pomembnost ravnotežja med tradicijo in tehnologijo, medtem ko zaključek izpostavlja potrebo po dialogu in izobraževanju med generacijami za doseganje harmonične kombinacije tradicije in sodobnih tehnologij.

Ključne besede:

družinsko
podjetje,
tradicionalne
vrednote,
digitalizacija,
poslovno
sodelovanje,
podjetništvo

TRADITIONAL VALUES IN THE DIGITAL ERA: CASE STUDY OF A FAMILY BUSINESS

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Family businesses, as a distinct form of businesses, often face a conflict between tradition and the need for digitization. By analysing a specific case of a family business engaged in international operations, we explore the conflict between the older generation, which emphasizes personal contact, and the younger generation, which favours digital communication. Within the research, aspects of digitization are presented, highlighting the advantages of current communication, including email, video conferences, and social media. Traditional values, such as personal contact and trust, are also thoroughly analysed and emphasized as crucial in the operations of family businesses. Through a case study, we illustrate a concrete example of generational conflict in a family business and investigate how the successful international collaboration was achieved by combining traditional values and digital tools. The discussion underscores the importance of balancing tradition and technology, while the conclusion points to the need for dialogue and education between generations to achieve a harmonious blend of tradition and modern technologies.

Keywords:

family
business,
traditional
values,
digitalization,
business
collaboration,
entrepreneurship

1 Introduction

A family business is a venture established and run by members of a single family. It is not just a business owned by a family; it is a business or even an enterprise in which the family significantly influences management, decision-making, and relationships within the company (Duh, 2003). It is emphasized that family businesses have specificities in organizational structure, culture, and decision-making compared to other enterprises.

The dynamics of family businesses often involve conflicts between traditional values and the necessity of digital transformation. There is a clash of opinions between older and younger generations when it comes to business practices, a consequence of the times we live in and the technology that surrounds and complements us.

Traditional values in business encompass certain principles and practices that have evolved over time and are often associated with older generations. In the context of family businesses, some classic elements of traditional values include personal contact and building trust through personal relationships. The traditional approach to business negotiations involves the physical presence of all parties during the negotiation process. This may stem from the belief that trust and mutual understanding are best developed through direct contact. Family businesses often strive to build long-term relationships based on mutual trust and loyalty (Howorth and Robinson, 2021).

Digitalization brings a variety of changes to the operations of family businesses in today's contemporary business world. Digitalization facilitates remote work and virtual collaboration (Klungseth and Tønsberg, 2023). Family members and employees can communicate and collaborate regardless of physical distance, improving team efficiency and enabling work from different locations.

The implementation of digital tools while respecting tradition can create a foundation for the successful operation of family businesses in the modern business environment.

2 Literature Review

2.1 Digitalization

Digitalization involves transitioning from traditional analogue methods to digital methods in order to optimize and enhance processes, services, and communication. It represents the adoption of technology, implying a change in the way things are done, with the aim of being better, faster, and more efficient (Zhang and Duan, 2023).

Digital transformation is a comprehensive process of applying digital technologies to change business models, processes, activities, and organizational culture to achieve greater efficiency, competitive advantage, and improved customer experience. In simple terms, digital transformation is the process of incorporating digital technology into an organization and its individual components (Ferreira, 2023). Different companies react differently to digital transformation, employing various steps and achieving different levels of success.

Digital technologies, such as email, instant messaging, and social media, enable instant communication regardless of geographical distance. This contributes to the rapid exchange of information and facilitates real-time collaboration. E-mails and various messaging apps have become key means of communication in both business and personal environments. The swift delivery of messages allows for efficient information exchange among individuals, teams, and organizations. Video conferencing technologies, like Zoom, Skype, or Microsoft Teams, provide the opportunity for virtual meetings in real-time.

They are particularly useful in business environments as they allow people to collaborate without the need for physical presence. Businesses worldwide continue to undergo digital transformation to adapt to rapid changes in technology. This involves the implementation of digital technologies in various aspects of operations, including data management, process automation, cloud technologies, and other innovations (Klungseth and Tonsberg, 2023).

2.2 Traditional Values

Traditional values often play a crucial role in shaping the identity of family businesses and influence their approach to business management. In addition to implied loyalty, mutual support, heritage preservation, ethics, and innovation within tradition, family businesses typically base their operations on personal contact, through which trust and security are established. Personal contact, also known as "face-to-face" communication, allows for direct interaction and the creation of personal connections between business partners (Somboonvechakarn, Taiphapoon, Anuntavoranich and Sinthupinyo, 2022).

Face-to-face communication enables the building of trust, which is crucial for successful business operations. It aids in understanding the needs and expectations of business partners, facilitating the transmission of the company's values, mission, and vision. In this way, it contributes to preserving the legacy and long-term identity of the business.

Personal contact facilitates communication, reduces the possibility of misunderstandings and conflicts. Communication is a two-way process in which individuals exchange information, with words constituting only 7 percent, intonation and voice tone making up 38 percent, and body language accounting for a significant 55 percent (Blauet, 2012). Body language is the most crucial aspect of communication because it provides a complete picture and confirmation of whether words align with nonverbal communication (Blauet, 2012). Eyes, for instance, indicate discomfort or insecurity during a conversation. Direct eye contact signifies interest in the conversation and the topic, indicating trust and honesty. Avoiding eye contact, on the other hand, may suggest discomfort, an unpleasant feeling, or a desire to hide feelings or the truth (Ule and Ule, 2005).

Nervousness and discomfort can be expressed through mouth or hand movements. Gesturing, such as waving hands while explaining something, emphasizes verbal communication and adds an emotional dimension. Facial expressions are powerful indicators of emotions and attitudes. Nodding one's head may denote agreement, while shaking it may indicate disagreement. An open body posture suggests confidence and readiness for communication, while crossed arms or a hunched posture may indicate insecurity or closedness (Blauet, 2012).

Voice tone can convey the emotional tone and meaning of a message. High tones may indicate excitement, while monotone delivery may seem dull or disinterested. Facial expressions directly express emotions, with a smile indicating joy or kindness, and a frown expressing dissatisfaction or disapproval. Touch can convey support, friendship, or encouragement. A handshake typically signifies welcome or agreement, while a pat on the shoulder may be a sign of support (Ule and Ule, 2005).

Through the mentioned nonverbal communication, a person expresses their feelings, which are often impossible to conceal with words. It actually provides the interlocutor with feedback and instils (dis)trust (Ule and Ule, 2005). We will agree that when forming international collaborations, there is a lower possibility of organizing personal contacts, and this is what can pose a challenge in family businesses. Because that small difference, which in this case is trust, is sometimes crucial for the decision to collaborate.

Basic traditional values such as respect, integrity, and honesty are certainly mandatory when making agreements and can be expressed even through digital collaboration (Howorth and Robinson, 2021). However, what is missing in that situation is the personal contact, which conveys a sense of trust. Attention to the client, care for the partner, and dedication to product quality contribute to adapting business operations to the specifics of each client.

3 Case Study

Situations where conflicts arise between the traditional values of a family business and the demands of the digital age often stem from a generational gap in technological acceptance. The generational gap in technological acceptance poses a significant challenge that can lead to conflicts between the traditional values of a family business and the needs of the digital age. Older generation members, often rooted in traditional values, may encounter resistance to the adoption of digital technologies or changes in work processes that these technologies bring about. On the other hand, younger family members, who have grown up in the era of digitization, may have a different approach and greater openness to new technologies.

In a specific example of a family business engaged in selling its products beyond the borders of its home country, we have identified a generational conflict regarding the approach to potential international collaborations. The older generation, who are also the founders of the company and its operations, insists on traditional values and personal contact when negotiating potential partnerships, while the younger generation is more adaptable to digital communication but lacks sufficient experience in deal-making.

International collaboration involves establishing business relationships between organizations or individuals from different countries to achieve common goals or exchange resources. Once the family business identifies its own goals, in this case, entering a new market, the process involves finding a suitable buyer. In family businesses, such as the one in our example, there is familiarity with competitors, existing collaborators, and acquaintances in the same line of business. Often, there is an exchange of experiences related to collaborations with customers. Information about experiences with a specific customer is shared, leading to an assessment of reputation, reliability, compatibility, and then a decision is made about whether the customer is a suitable candidate for collaboration.

After identifying potential partners, negotiations on the terms of collaboration follow. This includes defining roles, responsibilities, the scope of collaboration, as well as rules and conditions under which business will take place. Therefore, the manner in which these negotiations take place is crucial.

Introducing a company to a new market and unfamiliar potential partners or customers is one of the more challenging aspects of business, but at the same time, it can be a crucial phase in expanding business horizons. Understanding local needs and market specificities is essential for a successful company introduction. Products and services should be adapted to meet the needs of the target audience in the new market. Each market has its own peculiarities and cultural contexts. Different languages, values, business norms, and customer expectations can be obstacles that require careful adjustment to create a positive impression.

Due to all these challenges, the approach to potential customers is of utmost importance. In the conflict of generations in our example family business, the idea emerged to try both methods when introducing themselves to a new potential customer – digital communication and personal contact based on traditional values.

The foreign potential buyer of the product or potential collaborator had never worked with the mentioned family business before and had not had the opportunity to hear about it. Our family business wanted to enter a new market, introduce itself to a potential collaborator, explain its business history, and offer products. The younger generation of the family business insisted on digital communication, explaining that digitization has become increasingly widespread and implicit in business over the years. They emphasized that it accelerates communication and the collaboration negotiation process by eliminating the challenges of business travel, overnight stays, meetings, hiring translators, and numerous demanding activities associated with personal contact.

In the French business market, there was one potential buyer and two different approaches. The first approach was through email, utilizing a very comprehensive, complex, and clear text. In this text, they briefly explained the origin, history, and what the family business had to offer. They also sent a link to the website as proof that they were not a scam, mentioned common collaborators as a guarantee that the family business had already had points of contact with people known to them. They received a response via email shortly after, indicating uncertainty and posing questions about what they could offer and at what prices. After the offer was sent, along with additional explanations and clarifications of certain points, there was no further response.

The second approach, involving a more complex process, was, unlike the first, very successful. The older generation insisted on oral communication with them. They hired an interpreter who conducted a phone call directly with the company that was a potential collaborator. The family business introduced itself on behalf of the company, briefly explained what they do, without offering products and prices, but with the question of whether they were interested in scheduling a meeting in their country, at their address, to discuss potential collaboration.

Without hesitation, they agreed and scheduled a meeting. Then followed the organization of a business trip, transportation, accommodation, an agreement with the interpreter to be present via video call during the scheduled meeting, so that English as a universal language would not pose a barrier during the conversation.

The meeting went very successfully with the presence of a representative of the family business, who was a younger generation member, along with an interpreter on a video call. The potential collaborator had a personal interaction with the representative of the family business, during which he had the opportunity to gauge the level of seriousness, gain confidence, a sense of connection, and a pleasant atmosphere.

Besides the main business-related topic and collaboration, there were also casual conversations about everyday things, contributing to a relaxed atmosphere. When discussing prices and terms, there was room for negotiations and proposals, with both sides providing adequate arguments.

The additional involvement of an interpreter via video call eliminated the language barrier and potential discomfort due to misunderstandings. Engaging an interpreter via video call represents digital communication. Without technology, the company representative would have faced a language barrier, hindering smooth communication and clear understanding on both sides. The blend of traditional values with a touch of digitization facilitated the beginning of a successful collaboration.

Unknown collaborators or buyers can be cautious when establishing relationships with a new partner. Building trust takes time and consistency in fulfilling promises, providing quality services or products, and transparent communication. However, there is a need to gain at least a minimum level of trust during the first contact for any collaboration to take place and for the possibility of further fulfilling obligations, promises, and delivering quality.

3 Discussion

Implementing technological solutions that are intuitive, easy to use, and tailored to the specific needs of the family business can facilitate the acceptance of digitization. This includes adapting work processes to reflect the values of the family business, allowing family members to see direct benefits from the introduction of new technologies. Special attention should also be given to inclusive participation of all family members in the digital transformation processes (Somboonvechakarn, Taiphapoon, Anuntavoranich and Sinthupinyo, 2022). Distributing responsibilities, providing training for new technologies, and involving all members in the decision-making process can contribute to creating a shared understanding and direction.

Although digital collaboration can successfully convey fundamental traditional values through virtual interactions, the undeniable fact is that personal contact adds an additional layer of trust in business relationships. Personal contact allows partners to build emotional connections, creating stronger foundations for collaboration and long-term relationships (Ule and Ule, 2005). Despite the apparent challenges that come with physical distance, there are strategies that family businesses can employ to strengthen trust and a sense of closeness in the digital environment.

One approach is to organize periodic face-to-face meetings or business trips that enable team members to meet in person. These moments allow for a more informal approach to communication, strengthen team cohesion, and enable the sharing of ideas in a way that virtual platforms cannot fully replicate. Sometimes, it is necessary to invest a bit more in the process of establishing potential collaborations, which in this case would involve investing in a business trip to facilitate an in-person meeting with a potential partner. Business trips, in addition to financial investment, require a certain amount of time dedicated to organizing and conducting the meeting, especially if there is a significant geographical distance between two potential partners, but such an investment is often worthwhile and provides long-term results (Faas, 2023).

In new markets, there are often existing players who have already established their position. Finding a unique value proposition and strategies to stand out from the crowd can be challenging (Klaczak, 2023), which is why personal contact and oral communication provide an advantage.

When negotiating prices, disagreements often arise, opening up opportunities for negotiations that are easier to conduct in person. Presenting arguments and negotiating with a smile and a pleasant tone offer much more room for calculations and negotiations than a formal email, through which few would dare to ask for a lower price or better conditions. However, oral communication and the presence of both interested parties make reaching an agreement easier (Ule and Ule, 2005).

The older generation of the family business, advocating for a traditional approach, was guided by experience and, with its help, achieved a more successful outcome resulting in a successful collaboration. The collaboration continues from that point onwards through digital platforms, specifically via emails. Trust is further gained by fulfilling promises, conditions, regularity, fairness, and, of course, the quality of products. In addition, it is important to encourage open communication through digital means.

Regularly sharing information, achieving a clear understanding of expectations, and transparency in business can significantly contribute to building trust (Zhang and Duan, 2023). Although personal contact may be limited in the digital environment, family businesses have various strategies to preserve and strengthen trust in business relationships.

A combination of digital tools and carefully designed initiatives can result in efficient, connected, and confidential international collaboration. It is essential to show your collaborator that you appreciate and care about their business needs, while also respecting them as a person. Occasional interest in them, a kind word or compliment, greetings on religious holidays indicate deep respect and culture, further increasing the level of trust and appreciation, which is crucial in solid partnership relations.

Nurturing traditional values in a business environment shaped by digital technologies can bring significant advantages and contribute to creating a competitive edge. Traditional values such as integrity, responsibility, and transparency in communication play a crucial role in building trust among clients, partners, and employees (Howorth and Robinson, 2021). In the digital age, where information is easily shared and tracked, having a reputation for ethical and responsible business practices can be key to attracting and retaining clients.

Traditional values often form the core identity of a company. Companies that remain consistent with their values can attract consumers who share the same values, creating an authentic brand that stands out from the crowd. Traditional values do not necessarily have to be obstacles to innovation. On the contrary, when integrated into the innovation process, they can serve as guidelines for developing products and services that reflect ethical and social standards. This can attract clients who appreciate responsibility and sustainability.

4 Conclusion

To overcome the generation gap, it is crucial to establish dialogue and understanding between generations. Discussions about the benefits of digitization and ways in which traditional values can be preserved within new technological frameworks can be of paramount importance. Educating the older generation about the potential of digital tools and their application in business can help reduce the fear of change, while also conveying facts related to the significance of traditional values to the younger generations.

In essence, the generation gap in technological acceptance presents an opportunity for growth, innovation, and bridging the gap between the past and the future. Establishing dialogue, education, and collaborative efforts to implement digital solutions can result in a harmonious blend of traditional values and modern technologies within a family business.

Communication through digital platforms undoubtedly facilitates collaboration and enables faster and simpler access, which should be leveraged to ensure smooth business progress regardless of the geographical distance between partners. It is suggested that the initial discussion about potential collaboration should be a personal meeting to establish a sense of security and trust between the two partnering parties.

It is important to emphasize that the goal is not to abandon traditional values but to align them with the demands of the digital age. This allows the family business to retain its identity and heritage while adapting to new market conditions.

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ANALYSIS OF THE INCREASE IN LEARNING SUCCESS THROUGH THE USE OF DIGITAL TOOLS IN REPETITIVE TEACHING ENTRY IN ECONOMICS LESSONS

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Vocational schools face the challenge of preparing learners for the digitalised world of work within the framework of media and digital education, which also includes advanced digital working methods. The focus of the present study is on the one hand on possible positive effects in relation to the learning success of the learners and on the other hand to differentiate between the male and female gender in this respect. The students come from business classes at the vocational college. In order to be able to record and illustrate the results of this study in a measurable way, a learning assessment was carried out at the end of the teaching sequence. The results show that the tool *Kahoot!* has a measurable and beneficial effect on the learners' performance. In addition, it could be measured that the positive effect mentioned has a stronger impact on the male students than on the female students.

Keywords:

vocational
education
didactics,
digital
tools,
learning
success,
teaching

1 Research question, state of research and research gap

Lesson starters are of central importance for successful teaching. In the first few minutes of the lesson, it is particularly important to arouse the students' attention and to transform this into a sustained interest in the subject matter (cf. Brühne, Sauerborn 2011:11). For the long-term activation of students as well as the safeguarding of the subject matter, an in-depth examination of the repetitive lesson introduction¹ can be informative. Greving and Paradies, for example, make the following demands on the repetitive introduction to lessons:

[...] the thematic introduction at the beginning of a lesson should tie in with the material of the previous lesson in as short and concentrated a form as possible and remind the pupils of the work results of the previous lesson, the problems that remained open, the proposed solution strategies or the opinions of individuals". (Greving, Paradies 2011:19, own translation)

In prior literature, on the other hand, it is often described as a homework check, an oral repetition of the last lesson by the students or a summary of the central learning content by the teacher (cf. Brühne, Sauerborn 2011:59; Greving, Paradies 2011:19; Meyer, Junghans 2021:252; Sutter 2015:28). Greving and Paradies (2011:19), however, criticise such a "ritualised control entry", as it can lead to increased tension and anxiety on the part of the students. The intention of the repetitive lesson introduction is not to discipline but to activate and motivate students (cf. Sutter 2015:28). Greving and Paradies (2011:19) as well as Meyer and Junghans (2021:252) therefore plead for new forms of repetitive entry, but they do not give practical examples. One way to comply with this could be the use of digital tools, more specifically digital audience response systems (ARS). ARS are electronic voting systems that can be used to make teaching more interactive and flexible. They make it possible to open up teaching structures towards user-determined teaching and learning (cf. Canto, Olesch 2015). Examples include the platforms *Mentimeter*, *slido* or *Kahoot!*

¹ In the literature, the repetitive teaching entry is also referred to as practising or thematic entry. In the course of this work, the term repetitive teaching entry or repetitive entry will be used.

The integration of such platforms into everyday school life could be useful because the use of digital tools is an elementary part of the current and future reality of pupils' lives (cf. Roß 2020:10). The situation at school should not contrast with this reality of life. Rather, it must help shape the development processes of a digitally shaped society. This is all the more true in the context of vocational schools, as they are supposed to prepare students for the labour market. In addition, digital media enable the design of new learning paths and experiences (cf. Heusinger 2020:11-12). Studies on student motivation and the efficiency of teaching processes have shown that students learn faster and better the more active the learning processes are designed (cf. Yildirim, Sadik 2021:12, 18; Syafitri, Pami Putri, Reflinda 2020:2). Digital ARS can enable the teacher to involve all students in the learning processes and make them more fun and active. Klinsmann et al. (2016:2, 6) attest to the possibility of ARS to activate learning potentials in students through their active problem solving. They state that the ARS eKaRuS has a positive effect on the interaction between students and lecturers and on students' test results. Fotaris et al. (2016:106) and Martínez-Jiménez et al. (2021:11) conclude in similar studies that a game-like learning environment can increase students' enjoyment and cooperation. In a practical approach, teachers attest that ARS provide teachers with a picture of students' individual performance, so that comprehension problems can often be addressed immediately (cf. Schmidt, Hinderer 2017:24). An exemplary study for the use of *Kahoot!* shows a high level of acceptance of the tool among students of engineering subjects at bachelor level. Participants were more motivated and came to their seminars better prepared because they knew that everyone had to participate in *Kahoots!* (cf. Chernov, Klas, Furman Shaharabani 2021:491). The study also proves that students who worked with *Kahoot!* had greater learning success on tests (cf. Chernov, Klas, Furman Shaharabani 2021:494-495). Other studies show similar positive influences on participants' learning outcomes (cf. Toma, Diaconu, Popescu 2021:13; Elkhamisy, Wassef 2021:218-219). Goshevski, Veljanoska and HatziaPOSTOLOU (2017:6) have identified the following *game mechanics* for the modes of action of such ARS: Challenges, Chance, Competition, Cooperation, Feedback, Resource Acquisition, Rewards, Transactions, Turns and Win States. These modes of action are mainly based on behaviourist approaches.

The studies listed here show that digital tools and their positive impact are receiving a lot of attention in research. There are studies from various countries and for different learning levels, from schools to universities. However, there is only little

evidence for positive effects on the learning level of students in business classes at vocational colleges. Moreover, the studies did not investigate in which teaching phases ARS can be used particularly effectively. However, due to its function, the repetitive lesson entry seems to offer good conditions. In order to counteract this research gap, this study analyses the effectiveness of a digital, repetitive lesson introduction on the learning success of students in business lessons at vocational colleges.

2 Generation of hypotheses

The repetitive practice and reactivation of learning content is a central element for the long-term anchoring of knowledge. Research from neuroscience confirms a causal connection between activation through repetition of knowledge and linkage in long-term memory (cf. Brühne, Sauerborn 2011:58-59). Even though research in learning psychology from the field of the "cognitive theory of learning" recommends continuous repetition of learning content, "practice and repetition phases", especially in the form of the repetitive start of lessons, are rarely used in practice. The main reasons given for this are the tightly knit educational plans and the associated time pressure (cf. Brühne, Sauerborn 2011:59). In the psychology of learning, however, even 5 to 10 minutes of continuous repetition of learning content is considered sufficient for the long-term retention of knowledge. Therefore, the repetitive lesson introduction is particularly suitable due to its simple implementation in the lesson sequence (cf. Brühne, Sauerborn 2011:59). In addition, the repetitive lesson entry combines various features for the sustainable safeguarding of learning content. Characteristics are the structuring and reconstruction of learning content, feedback as learning status control and self-reflection for teachers and learners, problem solving as well as the individualisation of learning (cf. Brühne, Sauerborn 2011:59; Greving, Paradies 2011:19-22).

The extent to which the repetitive entry into lessons could have an influence on the learning success of pupils can be guessed at by looking at the meta-study "Visible Learning" by Hattie (2009). Regarding Cohen's *d* effect size, a comparison of the characteristics shows that, according to Hattie, especially the self-assessment of one's own level of performance ($d= 1.44$), feedback ($d=0.73$), solving of problems ($d=0.61$), the learning techniques ($d=0.59$), motivation ($d=0.48$) and questioning ($d=0.46$) have a beneficial effect on learning success. The effect of homework

($d=0.29$) in contrast, Hattie attributes only a minor influence on learning success (cf. Lipowsky, Lotz 2015:103, 106). According to Lipowsky and Lotz (2015:104, 106), these characteristics are particularly important for the cognitive activation of students. Cognitive activation is one of the three basic dimensions for teaching quality and good teaching.

"The cognitive activation of students is described by Lipowsky (2015) as the stimulation of "deeper reflection and elaborate engagement with the subject matter" (p. 89 f.). Here, then, it is required that "all learners are encouraged to actively engage with the subject matter at a level appropriate to them" (Leuders & Holzäpfel 2011, p. 213), whereby the term activity refers to the thinking and not the behaviour of the learners." (Lipowsky, Lotz 2015:106)

At this point of cognitive activation, the digital tools come into play. They offer teachers varied and new access to the students in combination with the repetitive lesson entry. Digital ARS allow students to test their learning level anonymously. Due to the playful and ungraded character, the "fear of failure" (cf. Bernshausen 2010:54) and the shame of speaking in front of the class may also be taken away, as well as active participation in the repetition of the learning content of the previous lesson. The performance and social pressure that arises from showing and answering in class is probably often perceived negatively by the pupils and could lead to refusal and fear (cf. Bäuerle, Kury 1980:71; Bernshausen 2010:54-56, 58). The students are freed from this pressure to perform by the anonymous evaluation possibilities in the digital tools. The teacher can receive realistic feedback on the performance of the entire class, as all students are actively involved and can thus reveal their understanding of the topic.

The following hypothesis can therefore be derived from the preceding presentation:

Hypothesis 1: *A repetitive teaching approach in combination with digital tools has a positive effect on the learning success of the students.*

The use of digital media by pupils in Germany has been intensively studied for about 20 years, especially through the JIM studies. In the studies, young people between 12 and 19 years of age from all over Germany are surveyed. Based on the studies of the last few years, it can be stated that the differences between the genders in media use are small and have decreased in recent years. The JIM-Study 2021 (cf. mpfs

2021:8) shows that there are hardly any noticeable differences in device ownership between girls and boys. In terms of daily or several times a week use of the available media, girls and boys differ only minimally (96% to 94%²). A clear advantage of boys only exists in gaming (59% to 84%) (cf. mpfs 2021:15), which already stood out in the 2010 JIM study (cf. mpfs 2010:8). A recent study by Forsa on behalf of the DAK- Gesundheit (2020:6) also showed that the daily use of social media is at a high level (205 minutes to 182 minutes) for both girls and boys (same age group as JIM study). This means that young people, regardless of gender, are now very familiar with digital offerings.

The JIM Study 2021 also examined online learning in the context of the corona pandemic. In this study, 35% of girls and 34% of boys said that online learning worked very well to well, 50% of girls and 44% of boys rated it on average, while 11% of girls and 18% of boys rated online learning as poor to very poor (cf. mpfs 2021:18). Lampert and Thiel (2021:20, 21) provide diverse background and explanations for this finding in their study on 'Media use and school at the time of the first lockdown during the 2020 Covid 19 pandemic'. Boys were more likely to report being nervous (29% to 32%) and to feel anxious about their learning success in online classes (27% to 32%). Furthermore, they rated their motivation in online teaching lower (52 % to 44 %) and also rated their own performance less well than girls (50 % to 48 %). Finally, boys also asked the teacher questions or sought help more often than girls.

From these data, it is clear that there are only small but crucial differences between girls and boys specifically in online teaching. This suggests that the effects of repetitive teaching using digital tools are similar and that differences between girls and boys are measurable. For this reason, the second hypothesis can be derived as follows:

Hypothesis 2: *The successful use of digital tools at the beginning of a lesson depends on the gender of the students. Girls take up the offer better than boys and therefore achieve greater learning success.*

² For all percentages in this chapter, the data of the female respondents follow first, then the data of the male respondents.

3 Research design

The hypotheses that have been put forward will be tested through an empirical study with quantitative data collection. The aim is to transfer the assumptions derived from theory into practice at the vocational college and the business lessons there. For this research, data collection takes place at four vocational colleges in the Aachen city region. For this purpose, the effects of a repetitive introduction to lessons using digital tools on the learning success of students in business lessons at vocational colleges as well as the effect of gender³ on this will be examined. The sample consists of students from a DQR- level four course⁴. For each vocational college, two classes of the same educational level and year are considered. One of the classes in the sample acts as the experimental group and one as the control group. The classes are selected so that they are as homogeneous as possible in terms of learning level, age structure and gender distribution.

The repetitive lesson introduction with digital tools takes place in the classes of the experimental group, whereas a conventional repetitive introduction is used in the classes of the control group. In the experimental and control group, a comparison takes place per vocational college in the same learning situation (teaching sequence) to the extent of six teaching hours in the form of three double lessons. The digital repetitive lesson introduction for the experimental group consists of about five concise questions on the topic of the last lesson, each lasting between 5 and 10 minutes. These are asked in the form of a short digital question or quiz. Closed questions are used as the question type; semi-open and open questions are not asked for better comparability of the results. The learning and feedback platform *Kaboot!* is used in all classes for the implementation of the digital repetitive lesson introduction. *Kaboot!* was chosen as an example for ARS because it is known by the students. They do not have to register, it is free of charge and does not require any downloads (cf. Goshevski, Veljanoska, Hetziapostolou 2017:4). The questions are varied in order to achieve a high degree of student activation. The automatic evaluation functions of *Kaboot!*, which can be used especially well with closed questions, can also reveal

³ The survey of gender is based on the Doing Gender approach of West and Zimmerman (1987:131-135), where a categorisation into sex, sex categories and gender takes place. In the study, gender is determined on the basis of the category sex (biological sex), which is why it is limited to the sexes male and female. This is also done against the background of comparability with other studies.

⁴ DQR stands for German Qualifications Framework. An overview can be found at the Federal Ministry of Education and Research (2023).

difficulties in understanding on the part of the students. These are directly addressed during the implementation in order to actively prevent major comprehension problems from arising or remaining. The focus here is explicitly on constructive feedback, which should point out learning difficulties to the students and support them in self-reflection.

In order to test the hypotheses, the same learning assessment will be carried out at the end of the teaching series in the experimental and control groups of the respective vocational college. In the quantitative data collection, the gender of the students is recorded in addition to the percentage results achieved in the learning assessment and the form of the repeated lesson entry. The recording of the percentage result enables comparability among each other.

4 Results

4.1 Evaluation procedure

To test the hypotheses, the collected data is subjected to an inductive data analysis using statistical methods. Inductive statistics allows the results found for the sample to be assumed for the population as well. In this respect, the collected data are subjected to a one-sided significance test in order to verify the hypotheses that have been formulated. Here, the procedure is based on that of Schnell, Hill and Esser (2018:403-432) and Rasch et al. (2021). The analysis and processing of the data is carried out with the statistics program SPSS in version 29. Furthermore, a significance level of $\alpha=0.05$ was used for the study.

The variables are results of learning level control (dependent variable), lesson entry (independent variable) and gender (independent variable). The entry level has the characteristics experimental and control group (coding: experimental group=1, control group=2). Gender is divided into male and female (coding: male=1, female=2).

For the analysis of the data, they are first visualised in a marginal count and then subjected to a subgroup analysis. For this purpose, an exploratory data analysis is carried out in SPSS and the data is compared with each other with regard to the frequency distribution, outliers and other elements of descriptive statistics.

Furthermore, the samples are checked for their normal distribution during the explorative data analysis. This is done using visualised histograms and the Shapiro-Wilk test. The Shapiro-Wilk test is chosen here because, in contrast to the Kolmogorov-Smirnov test, which only indicates the lower limit for a true normal distribution, it has a statistically more precise significance with regard to normal distribution. Subsequently, the data are subjected to a significance test to verify the hypotheses.

In order to test the first hypothesis, the variables results learning level control in dependence on the start of teaching are examined for significance by means of an independent two-sample t-test. The parametric test procedures, such as the t-test, require normally distributed data and variance homogeneity. The variance homogeneity is checked with the Levene test; if this is not present, the Welch test is used as an alternative to the t-test. However, the certification of a significant result does not provide any conclusion about the significance, existence or strength of the effect (cf. Schnell, Hill, Esser 2018:413-414). In order to be able to make a statement about the effect size, Cohen's d is analysed. The effect size is classified as $d=0.2$ as a small effect, $d=0.5$ as a medium effect and $d=0.8$ as a strong effect (cf. Rasch et al. 2021:54).

The second hypothesis examines the variables results learning level control in dependence on gender and lesson entry. For this purpose, two independent two-sample t-tests are conducted. The t-test procedure is equivalent to the first hypothesis. The effect size of the start of the lesson on the results of the learning assessment of male subjects and the effect size of the start of the lesson on the results of the learning assessment of female subjects are examined. The effect sizes are then compared with each other if they are significant. Finally, a two-factor analysis of variance (ANOVA, 2x2 design) is used to check whether there are interaction effects between the two independent variables (Eid, Gollwitzer, Schmitt 2017:432-440). Significance is demonstrated by means of ANOVA for values $p < \alpha = 0.05$ values.

Finally, the results of the first and second hypothesis are subjected to a post-hoc test strength analysis with regard to possible limitations of statistical significance.

4.2 Results for hypothesis 1

The data basis for the first hypothesis consists of a sample $N=114$ divided into the experimental group $n=58$ and the control group $n=56$. No cases are excluded. A descriptive evaluation of the data as well as the observation of the box plots allow a visualisation of the data distribution and the results in the learning level control.

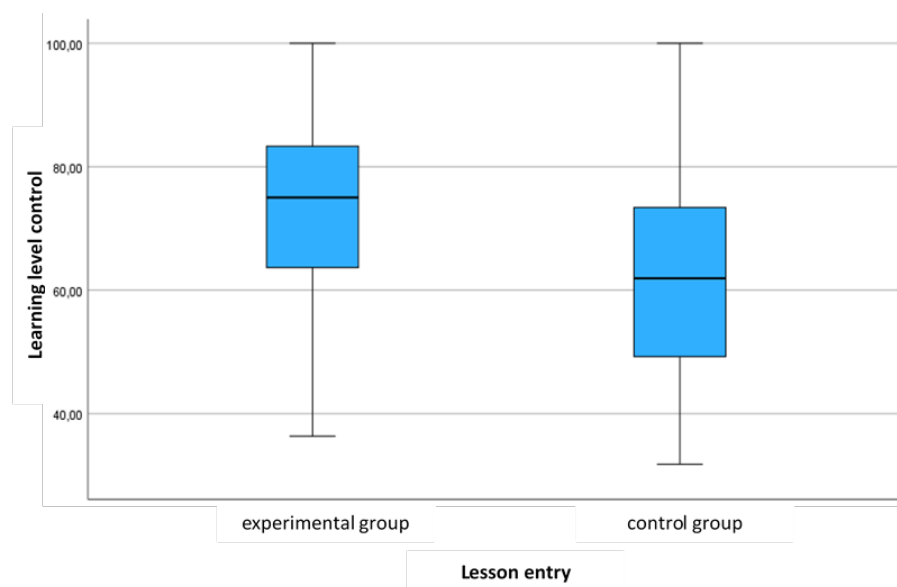


Figure 1: Box plot results of learning level control in the experimental and control group

Source: Own

The descriptive evaluation shows that the experimental group, which has undergone a repetitive introduction to teaching with *Kahoot!*, performs better than the control group, especially when looking at the interquartile range and median. Due to the smaller interquartile range in the experimental group, there is also greater homogeneity in the distribution of results compared to the control group. There are no outliers in the experimental and control groups.

The normal distribution of the experimental and control groups is tested by the Shapiro-Wilk test. Basically, in the case of significance, it can be $p > \alpha = 0.05$ it can be assumed that the null hypothesis for the normal distribution can be confirmed and the alternative hypothesis rejected. In the case of a value $p < \alpha = 0.05$ the alternative hypothesis for the normal distribution is confirmed and the null hypothesis rejected. In the Shapiro-Wilk test, the experimental group has a significance value of $p = 0.128 > \alpha = 0.05$ and the control group a value of $p = 0.477 > \alpha = 0.05$ for the control group. Through these results, the null hypothesis can be considered confirmed, resulting in a normal distribution according to the Shapiro-Wilk test.

In order to carry out the independent two-sample t-test, variance homogeneity is checked in advance. This is the case if the null hypothesis can be confirmed. $p > \alpha = 0.05$ can be confirmed. The alternative hypothesis is present if $p < \alpha = 0.05$. Variance homogeneity is then not present. This can be checked with the Levene test. Since this value has a magnitude of $p = 0.814 > \alpha = 0.05$ the null hypothesis can be confirmed. Variance homogeneity is therefore present and the t-test can be used.

Table 1: Independent two-sample t-test for hypothesis 1

	Levene-test of the equality of variance		t-Test for the equality of means							
	F	Sig.	T	df	Significance			95% confidence interval of the difference		
					one-sided P	Two-sided p	Mean difference	Differences for standard errors	Lower value	Upper value
Learning levelvariances are control equal	.055	.814	3.471	112	<.001	<.001	10.49344	3.02300	4.50375	16.48313
variances are not equal			3.469	111.442	<.001	<.001	10.49344	3.02490	4.49967	16.48721

For the evaluation of the two-sample t-test, the p-value of significance is necessary. Since there is a directed hypothesis and a positive effect can be expected from the theory, the one-sided p-value is used to test the hypothesis for significance. Since the one-sided significance $p < 0.001 < \alpha = 0.05$ the null hypothesis for hypothesis 1 can be rejected and thus hypothesis 1 can be accepted as an alternative hypothesis. Thus, a statistical significance of more than 95% is demonstrated for the two means compared. Consequently, the students in the experimental group achieved a

significantly better result than the students in the control group due to the repetitive introduction to teaching with digital tools.

For the significance of the observed significance for hypothesis 1, a consideration of the effect size is indispensable. According to Cohen's *d*, hypothesis 1 with a significance of $p < 0.001 < \alpha = 0.05$ an effect size of $d = 0.650$. According to Hattie, this results in a positive effect of medium strength on the learning success of students through digital tools. Furthermore, the statistical significance in the form of the test strength of the sample is relevant. With a test strength of 0.964 and a sample size of $\alpha = 0.05$ with a sample size of $n = 58$ for the experimental group and $n = 56$ for the control group, it has sufficient statistical significance to be able to apply it to the population. In sum, our results support Hypothesis 1.

4.3 Results for hypothesis 2

To examine the second hypothesis, the data of the experimental and control groups of both genders are compared with each other. The experimental groups consisted of 29 students each in both the female and male groups. The male control group consisted of 32 participants, the female control group of 24 participants. Exclusions or errors do not have to be taken into account at any point.

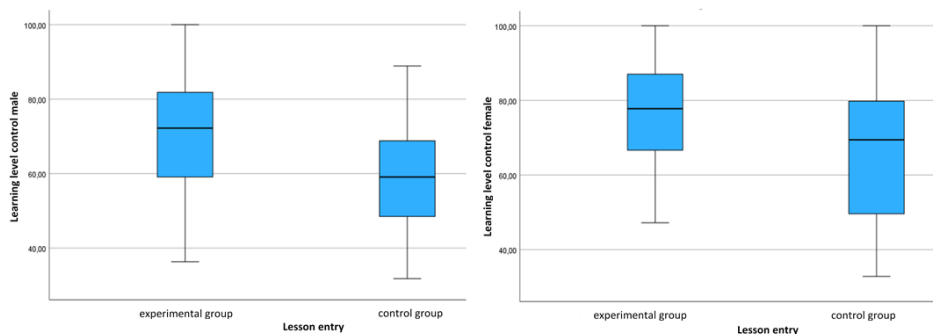


Figure 2: Box plot results learning level control by gender in the experimental and control group

Source: Own

When looking at the boxplots, it is noticeable that the medians of the results of the learning level checks of the female control and experimental groups are higher than those of the male groups. Furthermore, it can be seen that the interquartile range of the female control group is significantly larger compared to the male group. This indicates a more heterogeneous distribution of learning levels within the female control group. The interquartile range for the female experimental group is significantly smaller compared to the control group, which could indicate a homogenisation of learning levels. If, on the other hand, the boxplots of the male experimental and control groups are compared, it is noticeable that the position of the box for the control group shifts upwards, but both boxes show very similar ratios.

In the following, the data are analysed using inductive statistics. In order to apply the t-test, it must first be checked to what extent the data are normally distributed. In principle, the normal distribution of the sample is equal to the normal distribution of the overall distribution. The test according to Shapiro and Wilk is intended to prove the normal distribution of the samples. Its results show normal distribution for the experimental and control groups. As described above, $p > \alpha = 0.05$ for the null hypothesis and $p < \alpha = 0.05$ for the alternative hypothesis. In the present test, the results of the experimental groups of male participants are at $p = 0.557 > \alpha = 0.05$ and those of the female participants at $p = 0.350 > \alpha = 0.05$. The control groups, in turn, show a value of $p = 0.950 > \alpha = 0.05$ and for the female participants a value of $p = 0.545 > \alpha = 0.05$ for the female subjects. With these results, the null hypothesis can be considered confirmed, which means that a normal distribution exists according to the Shapiro-Wilk test.

An additional prerequisite for conducting the t-test is variance homogeneity. This is present if the null hypothesis can be $p > \alpha = 0.05$ can be confirmed. As already mentioned above, if this is not the case, the Welch ($p < \alpha = 0.05$) the Welch test would be used as an alternative. As explained above, the Levene test is used for testing. For the male experimental and control groups, this is $p = 0.182 > \alpha = 0.05$ and for the female groups $p = 0.131 > \alpha = 0.05$. Thus, the null hypothesis is confirmed and variance homogeneity is given. The t-test can be applied.

Table 2: Independent two-sample t-test for hypothesis 2 (male)

	Levene-test of the equality of variance		t-Test for the equality of means							
	F	Sig.	T	df	Significance		Mean difference	Differences for standard errors	95% confidence interval of the difference	
					one-sided P	Two- sided p			Lower value	Upper value
Learning levelvariances are control equal (male) variances are not equal	1.826	.182	2.629	59	.005	.011	10.34139	3.93373	2.47001	18.21277
			2.602	54.055	.006	.012	10.34139	3.97419	2.37380	18.30898

Table 3: Independent two-sample t-test for hypothesis 2 (female)

	Levene-test of the equality of variance		t-Test for the equality of means							
	F	Sig.	T	df	Significance		Mean difference	Differences for standard errors	95% confidence interval of the difference	
					one-sided P	Two- sided p			Lower value	Upper value
Learning levelvariances are control equal (female) variances are not equal	2.356	.131	2.106	51	.020	.040	9.57658	4.54748	.44714	18.70603
			2.050	42.008	.023	.047	9.57658	4.67060	.15098	19.00218

After the prerequisites for applying a t-test have been confirmed, the results of the male and female experimental groups are compared with the control groups. Since there is a directed hypothesis and a positive effect is assumed, the one-sided p-value is used to test the significance of the hypothesis. With equal variances, the one-sided significances are as follows in the case of the pupils $p=0.005 < \alpha=0.05$ and in the case of the female students $p=0.02 < \alpha=0.05$. It can be deduced from this that hypothesis 1 is not only true for both genders together, but also for the isolated consideration of female and male pupils and that one group does not equalise or reverse the result of the other.

Finally, the decisive test of hypothesis 2 is carried out by comparing the effect sizes using Cohen's d. The assumption that girls generate greater learning gains than boys through repetitive lesson introductions with *Kaboot!* Should be reflected in a higher d. However, for hypothesis 2, the male experimental group results in an $d=0.674$ and for the female group a $d=0.581$. Thus, both are in the range of a medium,

positive effect size ($0.4 < d < 0.8$), but the effect size is higher for the boys. Hypothesis 2 is therefore refuted, as boys benefit more than girls from the use of digital tools when starting lessons.

Finally, two checks were made to exclude errors regarding the refutation of hypothesis 2. Firstly, the test strength resulting from the sample size is relevant with regard to the statistical significance and effect strength of the sample. With the given sample sizes, the test strength for the pupils is $d = 0.674$ and for the female students for $d = 0.581$ respectively 0.830 and 0.667 . The significance level in both cases is, as before, at $\alpha = 0.05$.

Table 4: Two-factor ANOVA

dependent variable: results of learning level control					
Source	type III: sum of squares	df	Mean of the squares	F	sig.
corrected model	4559.373 ^a	3	1519.791	6.027	<.001
constant term	525967.424	1	525967.424	2085.734	<.001
lesson entry	2796.162	1	2796.162	11.088	.001
gender	1421.176	1	1421.176	5.636	.019
lesson entry gender	4.123	1	4.123	.016	.898
error	27739.113	110	252.174		
total	561280.259	114			
corrected total variation	32298.486	113			

R-square = .141 (corrected R-square = .118)

The check for evaluation errors using ANOVA revealed that there was a significant difference (independent of gender) between the results of the learning level check ($p < 0.001 < \alpha = 0.05$), depending on the type of instructional introduction that was carried out in the classes in the instructional sequence. It thus confirms the results of hypothesis 1. The ANOVA also showed a significant result ($p = 0.019 < \alpha = 0.05$) for gender (independent of the type of lesson introduction). It thus confirms that there is a gender difference in the results of the learning level control (hypothesis 2). However, there are no significant interaction effects of gender and type of lesson entry ($p = 0.898 > \alpha = 0.05$). Both final checks do not speak against the interpretation of the data. The test strength is discussed in more detail in the limitation in chapter

5. Thus, hypothesis 2 is considered refuted, the data suggesting instead the opposite of the original assumption.

5 Conclusion, limitations and need for research

In summary, two central findings can be noted on the basis of this analysis. Firstly, the data analysis showed that the use of digital tools in the repetitive introduction to lessons has a positive effect on the learning success of students in business lessons at vocational colleges. The use of digital, repetitive entry into lessons was shown to have an effect strength in the medium range ($d=0.650$) was demonstrated. There are demonstrable gender differences. Contrary to the hypothesis, pupils ($d=0.674$) benefit more than female pupils ($d=0.581$). Possible reasons for this positive effect could be the variety and the playful element of the quizzes. It also plays a major role that all students have to repeatedly deal with the lesson material of the previous lesson. With the classic repetitive lesson introduction, on the other hand, it can easily happen that only high-performing students participate and thus the weaker students in particular are already left behind at the beginning of a lesson. These assumptions are based on the literature mentioned in chapter 1 and the teachers' subjective impressions. However, a survey among the students of the control group was not conducted.

On the other hand, the data analysis showed that - contrary to the hypothesis stated at the beginning - pupils can increase their learning success more than female pupils if the teacher uses digital lesson introductions. In the sample considered, the slightly higher effect size for pupils could even lead to a homogeneity of performance between the sexes in the long term, since the female pupils also achieved better learning successes than the male pupils within the control group, which can also be assumed for the population (cf. Voyer, Voyer 2014:1189). However, both effect sizes lie in the middle range (female $d=0.581$; male $d=0.674$), so that no preferential treatment of the pupils is to be expected, especially if one takes into account the short period of time spent in educational programmes at the vocational college. The descriptive data analysis also suggests an improvement in the homogeneity of learning outcomes through the use of digital tools. Here it is noticeable that for the samples from hypothesis 1, the interquartile range of the control group is significantly greater than for the experimental group. However, a generalisation to the population was not tested for this effect in this study using inductive methods.

This could therefore be an approach for further hypotheses to be tested in potentially subsequent studies. In combination, these findings suggest that the learning success of a class can not only be increased through the use of digital tools, but that performance differences can also be reduced.

This study is subject to some limitations. For example, due to the short time span considered, no statements can be made about the long-term effect of the use of digital, repetitive lesson starters. It is not possible to predict from the data collected what the effect size will be when a class is confronted with digital entrances in several consecutive teaching sequences. In this context, a further study could examine whether the effect of variety is a one-off effect and whether the inclusion of all students in the repetition of lesson content using digital tools shows long-term learning success. Whether random influences had an impact on the better learning success of the experimental groups cannot be completely ruled out. However, since the lessons were conducted with the same materials and methods except for the introduction, it can be assumed that random influences had only minimal effects. Furthermore, the experimental groups worked exclusively with *Kahoot!* so that the experiment could be repeated with other ARS to confirm the study results. Another limitation is the influence of the teacher, which would be difficult to measure but could also have a significant impact on learning outcomes. At the same time, teachers are forced to further develop their digital competence and can thus also benefit from the use of digital tools to start teaching (cf. Wohlfart, Trumler, Wagner 2021:7360). There is also a limitation to the validity of hypothesis 2 with regard to sample sizes. Due to the smaller sample sizes, the strengths of the tests are 0.830 for men and 0.667 for women. A larger number of participants could thus significantly increase the test strength of the experiment and is therefore recommended.

However, since hypothesis 1 has a test strength of 0.964 with the present sample size, it can be concluded that repetitive digital lesson starters offer added value for teaching in the form of measurably increased learning success. In addition, they bring variety into the lesson introduction and can be easily integrated into the lesson.

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MODEL VEČKRITERIJSKE ANALIZE ZA POKLICNO IZOBRAŽEVANJE IN USPOSABLJANJE NA POLIGONIH MIC

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S študijo primera smo ugotovili stanje izobraževalnih poligonov na Biotehniškem centru Naklo, učinkovitost izobraževalnega okolja, uporabo digitalnih orodij in priložnosti za trajnostni razvoj. V raziskavi je bil uporabljen model Kepner-Tregoe in večkriterijska analiza DEXi za izobraževalne poligone Medpodjetniškega izobraževalnega centra (MIC). Z modelom Kepner-Tregoe, kjer smo prikazali numerične podatke z dodeljenimi utežmi, se je pokazal kot najboljši izobraževalni poligon »Živilstvo« pred »Hortikulturo«, »Prehrano« in »Kmetijstvo«. Z večkriterijsko analizo DEXi smo natančneje opredelili numerične in opisne lastnosti ter grafično prikazali rezultate. Z analizo smo opredelili tveganja posameznih izobraževalnih poligonov, ki omogočajo analizo stanja za nadaljnje odločanje. Digitalni sistemi so dobro razviti na področju živilstva in hortikulture, pokazale pa so se velike priložnosti na področju kmetijstva. Mlade generacije pričakujejo sodobne digitalne opremljene poligone, ki nudijo možnost usposabljanja za trajnostnost. Vpis deležnikov je povezan z opremljenostjo izobraževalnih poligonov z naprednimi tehnologijami, ki so potrebna tudi za strokovni razvoj kadrov in sistematično spremljanje načrtovanja in izvajanja politike zelenega prehoda.

Gljučne besede:

večkriterijska
analiza,
DEXi,
izobraževanje,
praktično
usposabljanje,
izobraževalni
poligoni

A MULTI-CRITERIA ANALYSIS MODEL FOR VOCATIONAL EDUCATION AND TRAINING POLYGONS IN ENTREPRENEURIAL TRAINING CENTRE

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The case study was used to determine the status of the educational polygons at the Naklo Biotechnical Centre, the effectiveness of the educational environment, the use of digital tools and opportunities for sustainable development. The study used the Kepner-Tregoe model and DEXi multicriteria analysis for the educational polygons of the Inter-enterprise Training Centre (MIC). Using the Kepner-Tregoe model, where numerical data with assigned weights were displayed, the best educational polygon was found to be "Food Science" over "Horticulture", "Nutrition" and "Agriculture". A DEXi multi-criteria analysis was used to refine the numerical and descriptive properties and to graphically display the results. The analysis has identified the risks of the individual educational polygons, allowing a situation analysis for further decision-making. Digital systems are well developed in the food and horticulture sectors but have shown great opportunities in the agricultural sector. Young generations expect modern digital equipped polygons that offer the possibility of training for sustainability. Stakeholders buy-in is linked to equipping training polygons with advanced technologies, which are also needed for professional staff development and systematic monitoring of the planning and implementation of the Green Transition policy.

Keywords:

multicriteria
analysis,
DEXi,
education,
practical
training,
training
polygons

1 Uvod

Za zeleni in digitalni prehod so potrebne spremembe v vedenju posameznikov, ki so mogoče le z nadgrajevanjem in razvijanjem znanja in spretnosti. Izobraževanje in usposabljanje ima pri prehodu na trajnostno, podnebno nevtralnno, digitalno in odporno gospodarstvo ključno vlogo.

Resolucija Sveta o strateškem okviru za evropsko sodelovanje v izobraževanju in usposabljanju pri uresničevanju evropskega izobraževalnega prostora in širše (2021–2030) za podporo izobraževalnim sistemom izmed petih prednostnih področij za zeleni in digitalni prehod poudarja povečanje razpoložljivosti, dostopnosti in kakovosti digitalne opreme in infrastrukture. V Sloveniji kakovostno poklicno izobraževanje in usposabljanje v višjem sekundarnem in krajšem terciarnem izobraževanju (ISCED 3 in 5) s svojo infrastrukturo omogočajo Medpodjetniški izobraževalni centri (MIC).

MIC Biotehniškega centra (BC) Naklo ponuja fleksibilne in praktično usmerjene programske vsebine in povezuje izobraževalne procese na področju kmetijstva, hortikulture, živilstva, naravovarstva in podjetništvo. Za svoje poslovanje pridobiva sredstva iz proračuna, s prispevki dijakov, študentov in udeležencev izobraževanja odraslih ter prodajo storitev in izdelkov ter drugih virov. Razvojna strategija MIC je usmerjena k prenosu znanj, projektnemu delu pri načrtovanju in izvajanju praktičnih vsebin na izobraževalnih poligonih, ter razvijanju strokovnih, podjetniških in raziskovalnih kompetenc.

2 Odločitveni problem

Sodobno izobraževanje naj bi spodbujalo učence in učitelje, da bi raziskovali, reševali probleme in uporabljali različna orodja in kognitivne veščine zato, da bi dosegli novo znanje (Licardo, 2021). MIC zaradi izobraževalnih poligonov omogoča poleg praktičnega učenja tudi projektno in problemsko učenje. Učenci in študenti lahko delajo v skupinah ali timih, kar omogoča socialno učenje. Učitelj ali mentor je tisti, ki proces usmerja in spremlja.

V raziskavi smo proučevali učinkovitost izobraževalnih poligonov MIC BC Naklo. Odločitveni proces je zahteval sistematično zbiranje, urejanje in grupiranje podatkov, postavitev kriterijev in njihovo vrednotenje ter postavitev uteži kriterijem. Rezultati, ki jih spremljamo, temeljijo na gospodarjenju z viri v šolskem in hkrati konkretnem podjetniškem okolju, torej učnih situacijah, v katerih se naši deležniki srečujejo v poslovnem in življenjskem okolju.

Cilj raziskave je oblikovati model za ocenjevanje izobraževalnih poligonov MIC BC Naklo, ki bo služil kot pripomoček pri načrtovanju nadaljnje strategije in razvoja praktičnega usposabljanja v poklicnem in strokovnem izobraževanju.

2.1 Identifikacija izobraževalnih poligonov

Določili smo štiri vzorčne izobraževalne poligone, ki pomenijo v sistemu poklicnega izobraževanja in usposabljanja dodano vrednost zaradi možnosti pridobivanja praktičnih veščin različnih deležnikov: Kmetijstvo predstavlja šolsko posestvo s kmetijskimi zemljišči namenjenimi pridelavi krme za živino in pridelavi poljščin in zajema infrastrukturo za rejo živali. Hortikultura združuje zunanje površine za pridelavo vrtnin in okrasnih rastlin, vključno z delavnicami za cvetličarstvo. Živilstvo zajema pekarsko, slaščičarsko, sadjarsko in mlekarsko delavnico. Prehrana zajema šolsko kuhinjo. V fazah odločitvenega procesa smo ovrednotili izobraževalne poligone, ki imajo različne karakteristike infrastrukture, izobraževalne možnosti in vire financiranja. Izobraževalne poligone smo ovrednotili v dveh korakih z oceno stanja in izkušenj pri vodenju posameznih procesov. Ocenjevanje je zajemalo tudi analizo tveganja posameznih izobraževalnih poligonov.

3 Metode dela

3.1 Vhodni podatki

Izhodišče je predstavljala razgradnja problema po nivojih strukture. Preko popisa ključnih faz procesov izobraževanja in usposabljanja smo opisali vhodne podatke, ki so predstavljali osnovo za razvoj simulacijskega modela s pomočjo katerega smo ocenili parametre (kriterije). Najpomembnejši parametri so predstavljali vhodne podatke za DEXi odločitveni model.

V prvi fazi smo za oceno izobraževalnih poligonov določili seznam kriterijev s pedagoškega in poslovnega vidika.

V drugi fazi smo kriterije hierarhično uredili z upoštevanjem medsebojne odvisnosti in vsebinskih povezav z različnimi utežmi in strukturirali v nivojih. Primarni nivo smo definirali s tremi atributi: infrastruktura, strokovni in pedagoški proces, trženje. Na končno oceno modela vplivajo poleg merske lestvice vseh primarnih in sekundarnih nivojev hierarhije večkriterijskega odločitvenega modela DEXi funkcije koristnosti in definirana odločitvena pravila.

3.2 Struktura modela

Problem smo razgradili na manjše podprobleme in izdelali spisek nabora kriterijev, ki pomembno vplivajo na dejavnost izobraževalnih poligonov. Sestavili smo drevo kriterijev in kriterijem definirali zaloge vrednosti. Z modelom smo ovrednotili alternative variant, ki smo jih primerjali med seboj in ocenili občutljivost. Z 9 kriteriji smo pojasnili vplivne infrastrukturne dejavnike izobraževalnih poligonov, 16 kriterijev je zajelo vplivne dejavnike strokovnih in pedagoških procesov, 12 kriterijev je opredeljevalo tržni vidik.

3.3 Vrednotenje, analiza in izbira izobraževalnega poligona

Za oceno tehnoloških dejavnikov, pedagoških in strokovnih procesov ter tržnega vidika smo izdelali hierarhično agregacijo obravnavanih spremenljivk. Pri vrednotenju posameznih poligonov iz zalog vrednosti smo uporabili program Excel. Za vrednotenje večparametrskega modela smo uporabili model utežne vsote, kjer smo vrednosti kriterijev preslikali v njihove koristnosti in jih pomnožili z upoštevanimi utežmi. S seštevkem vseh koristnosti smo dobili vrednost, ki smo jo primerjali s posameznimi poligoni. Izobraževalne poligone smo rangirali; najvišja uvrstitev po rangju je najboljša.

3.4 Izhodiščno vrednotenje z metodo Kepner-Tregoe

Izobraževalne poligone smo vrednotili po metodi Kepner-Tregoe, ki poleg opazovanja in primerjanja alternativ omogoča tudi njihovo vrednotenje. Za vsak parameter posameznega poligona smo določili numerično oceno od 0 (najslabša

vrednost) do 10 (idealna vrednost). S točkami od 1 do 10 smo določili tudi uteži za posamezne parametre. Posamezni poligon smo ovrednotili tako, da smo pomnožili oceno parametra z njegovo utežjo in seštelili utežne ocene posameznega poligona. Največjo utež (10) smo določili za parametre Tehnološka didaktična opremljenost, Vpis deležnikov, Zadovoljstvo deležnikov, Zadovoljstvo zaposlenih, Kompetenten kader, Financiranje poligona iz javnih sredstev in Zadovoljstvo kupcev.

3.5 Analiza tveganja »Kaj-če«

V analizi »Kaj-če« smo preverjali občutljivost sprememb pri tehnološko didaktični opremljenosti na področju infrastrukture, vpis deležnikov pri segmentu strokovni in pedagoški proces ter finančni učinek procesa/izdelka za finančno stabilnost poligona v strukturi trženja.

3.6 Večkriterijska analiza s programskim sistemom DEXi

DEXi je računalniški program, namenjen interaktivnem razvoju kvalitativnih večatributnih odločitvenih modelov in vrednotenju možnosti. Podpira kompleksne odločitvene naloge, hierarhična struktura predstavlja razčlenitev problema odločanja v podprobleme, ki so manjši, manj zapleteni in jih zato lažje rešujemo (Bohanec, 2023). DEXi programsko opremo je uporabila Francoska skupnost agronomov za ocenjevanje trajnosti kmetijskih sistemov in razvila 11 hierarhičnih in kvalitativnih modelov (Craheix idr., 2015). Za podporo analitike kakovosti je bilo ekspertno modeliranje s programom DEXi uporabljeno pri razvijanju predloga informacij za evalvacije v visokem šolstvu (Kovač, 2015). Na področju energetike je bilo modeliranje odločitvenih modelov s programom DEXi uporabljeno za naložbe v obnovljive vire (Papler, Bojnec, 2013a), bioplinarne (Papler, Bojnec, 2013b) in kogeneracije na lesno biomaso (Papler, Bojnec, 2016).

3.6.1 Struktura modela

Vhod v model MIC predstavljajo kriteriji: infrastruktura, strokovni in pedagoški proces ter trženje. To so spremenljivke, ki ponazarjajo podprobleme v strukturi modela z dejavniki. Vsem kriterijem smo določili mersko lestvico z zalogami vrednosti, ki jo lahko zavzamejo kriteriji pri vrednotenju (slika 1).



Slika 1: Zaloge vrednosti za MIC glede na strokovni in pedagoški proces ter trženje

Vir: lasten

Funkcije koristnosti definiramo od nižjih do višjih nivojev v drevesu kriterijev. Koren drevesa predstavlja končno oceno alternativ. V programu DEXi zapišemo pravila v tabelo z vsemi kombinacijami za katere definiramo vrednost, ki jo parameter zavzame (slika 2).

	Finančna stabilnost 33%	Zeleni produkti 33%	Večkanalna komunikacija 33%	Trženje
1	nizki	majhna	<=pomemben	slaba
2	nizki	<=primerana	nepomemben	slaba
3	<=srednji	majhna	nepomemben	slaba
4	nizki	majhna	srednje pomemben: <i>bolj pomemben</i>	sprejemljiva
5	nizki	<=primerana	srednje pomemben	sprejemljiva
6	<=srednji	majhna	srednje pomemben	sprejemljiva
7	nizki	primerna	pomemben: srednje pomemben	sprejemljiva
8	nizki	primerna: solidna	pomemben	sprejemljiva
9	<=srednji	primerna	pomemben	sprejemljiva
10	nizki	solidna	<=pomemben	sprejemljiva
11	nizki	solidna: <i>večja</i>	nepomemben	sprejemljiva
12	<=srednji	solidna	nepomemben	sprejemljiva
13	srednji	majhna	pomemben: srednje pomemben	sprejemljiva
14	srednji	<=primerana	pomemben	sprejemljiva
15	>=srednji	majhna	pomemben	sprejemljiva
16	srednji	primerna	<=pomemben	sprejemljiva
17	srednji	primerna: solidna	nepomemben	sprejemljiva
18	>=srednji	primerna	nepomemben	sprejemljiva
19	veliki	majhna	<=pomemben	sprejemljiva
20	veliki	<=primerana	nepomemben	sprejemljiva
21	nizki	<=solidna	<i>zelo pomemben</i>	dobra
22	<=srednji	<=primerana	<i>zelo pomemben</i>	dobra
23	*	majhna	<i>zelo pomemben</i>	dobra
24	nizki	primerna: solidna	<i>>=bolj pomemben</i>	dobra
25	nizki	primerna: <i>večja</i>	<i>bolj pomemben</i>	dobra
26	<=srednji	primerna	<i>>=bolj pomemben</i>	dobra
27	<=srednji	primerna: solidna	<i>bolj pomemben</i>	dobra
28	*	primerna	<i>bolj pomemben</i>	dobra
29	nizki	solidna	<i>>=srednje pomemben</i>	dobra
30	nizki	solidna: <i>večja</i>	srednje pomemben: <i>bolj pomemben</i>	dobra
31	nizki	<i>>=solidna</i>	srednje pomemben	dobra
32	<=srednji	solidna	srednje pomemben: <i>bolj pomemben</i>	dobra
33	<=srednji	solidna: <i>večja</i>	srednje pomemben	dobra
34	*	solidna	srednje pomemben	dobra
35	nizki	<i>večja</i>	pomemben: <i>bolj pomemben</i>	dobra

Slika 2: Odločitvena pravila za poddrevo Trženje

Vir: lasten

V posameznih vozliščih določimo uteži, kjer združujemo več kriterijev v poddrevo in jim z vidika vpliva določimo vrednost uteži. Vsota uteži kriterijev znotraj poddrevesa je 100. Pri MIC sta najbolj najbolj pomembna kakovost pedagoškega procesa (ustreznost) z utežjo 40 % in infrastruktura z utežjo 35 %. Finančna stabilnost poligona ima utež 25 %.

4 Rezultati

4.1 Rezultati z uporabo metode Kepner-Tregoe

Izobraževalni poligoni MIC Biotehniškega centra Naklo s svojo infrastrukturo omogočajo pridobivanje kompetenc v formalnih in neformalnih izobraževalnih programih. Med opazovanimi izobraževalnimi poligoni: »Kmetijstvo«, »Hortikultura«, »Prehrana« in »Živilstvo«, se na prvo mesto uvršča izobraževalni poligon »Živilstvo« s 1.417 točkami, na drugo »Hortikultura« s 1.344 točkami, na tretje »Prehrana« s 1.160 točkami in četrto mesto »Kmetijstvo« s 1.147 točkami. Z upoštevanjem sprememb z vidika občutljivosti (metoda »Kaj-čec«), kjer smo upoštevali spremembe ocen tehnološke didaktične opremljenosti tehnologije, vpisa deležnikov in finančnega učinka procesa/izdelka pri trženju, je prišlo do spremembe vrednosti ocen in vrstnega reda izobraževalnih poligonov, kjer sta se na 3. in 4. mestu poligona »Kmetijstvo« in »Prehrana« zamenjala. Rezultati so prikazani v tabeli 1.

Tabela 1: Rezultati ocen poligonov MIC z metodo Kepner-Tregoe in »Kaj-čec«

Poligon	Kmetijstvo	Hortikultura	Živilstvo	Prehrana
Ocena	1.147	1.344	1.417	1.160
Rang	4. mesto	2. mesto	1. mesto	3. mesto
Ocena »Kaj-čec«	1.103	1.324	1.389	1.098
Rang »Kaj-čec«	3. mesto	2. mesto	1. mesto	4. mesto
Sprememba s tveganji	-44	-20	-28	-62
Sprememba s tveganji (%)	4,0	1,5	2,0	5,6

Vir: lasten

Pri obravnavanih spremembah sta se kot najbolj občutljiva izobraževalna poligona pokazala poligon »Prehrana« in »Kmetijstvo«, manj pa »Živilstvo« in »Hortikultura«. Iz rezultatov sklepamo, da je zadovoljstvo s prehrano zelo pomemben element z vidika deležnikov v strokovnem in pedagoškem procesu ter finančnih učinkih na stabilnost poslovanja. Pomemben element je še tehnološka in didaktična opremljenost infrastrukture. Na področju kmetijstva se močno odraža uporaba sodobne tehnološke opreme, ki zagotavlja razvoj ekološko usmerjenega kmetijskega gospodarstva. Na področju živilstva je dosežen velik napredek na področju

mlekarstva, tveganja so predvsem pri menjavi kadrov in upravljanju tehnoloških procesov v mlekarški delavnici, manj pa v učnih živilskih delavnicah, kjer je poudarek na spoznavanju različnih tehnoloških procesov v manjših enotah. Najbolj stabilen sistem je izobraževalni poligon »Hortikultura«, kjer so zaznani vplivi podnebnih sprememb, vendar hkrati ponuja priložnosti pri uporabi digitalnih orodij za spremljanje pridelave vrtnin.

Tabela 2: Uporaba digitalnih orodij in zelenih kompetenc v strokovnem in pedagoškem procesu na poligonih MIC

Poligon	Kmetijstvo	Hortikultura	Živilstvo	Prehrana
Uporaba digitalnih orodij	<ul style="list-style-type: none"> - krmilni voz - avtomatsko pranje v mlekarnici - demonstracije nove opreme - simulator za navigacijo traktorja Trimble - simulator škropljenja AG-tronik - dron - državni portali (VOLOS, CPZ govedo...) - 3D tiskalnik - Teams, Zoom, Arnes učilnice - program Jana 	<ul style="list-style-type: none"> - avtomatsko zalivanje - senzorji (temperatura, vlaga, pH, prevodnost tal...) - digitalna vremenska postaja - avtomatsko namakanje - zelene stene - robotska kosilnica - Teams, Zoom, Arnes učilnice - program Jana 	<ul style="list-style-type: none"> - CIP, CNS v mlekarški delavnici - spletna trgovina - Teams, Zoom, Arnes učilnice - program Jana 	<ul style="list-style-type: none"> - proces naročanja malice - nabava materiala DNS, Vasco, Katalog živil - program Jana
Zelene kompetence	<ul style="list-style-type: none"> - senzorji CO₂, amonijak - zmanjševanje odpadkov in rabe papirja - ekološki certifikat, ISO 14001 - zeleni projekti - ARSO postaja 	<ul style="list-style-type: none"> - zmanjševanje odpadkov in rabe papirja - ekološki certifikat, ISO 14001 - terapevtski vrt - učna pot VODA - zeleni projekti 	<ul style="list-style-type: none"> - zmanjševanje odpadkov in rabe papirja - ekološki certifikat, ISO 14001, Izbrana kakovost - spremljaje porabe embalaže - zeleni projekti 	<ul style="list-style-type: none"> - zmanjševanje odpadkov - ISO 14001

Poligon	Kmetijstvo	Hortikultura	Živilstvo	Prehrana
	- laboratorijske analize - vodenje materialnega knjigovodstva (SLEDAT, Pantheon) - mobilnosti - projekti - predmeti: Trajnostni razvoj z izbranimi poglavji iz biologije (VŠŠ), Trajnostni razvoj (SSI), Varovanje okolja z osnovami trajnostnega razvoja (SPI)	- digitalna vremenska postaja - mobilnosti - predmeti: Trajnostni razvoj z izbranimi poglavji iz biologije (VŠŠ), Trajnostni razvoj (SSI), Varovanje okolja z osnovami trajnostnega razvoja (SPI)	- laboratorijske analize - povratna embalaža - predmeti: Trajnostni razvoj z izbranimi poglavji iz biologije (VŠŠ), Trajnostni razvoj (SSI), Varovanje okolja z osnovami trajnostnega razvoja (SPI)	

Vir: lasten

4.2 Rezultati z uporabo programa DEXi

Pri vrednotenju izobraževanja in usposabljanja na poligonih MIC s programom DEXi je bil najbolje ocenjen »Strokovni in pedagoški proces«, dobro »Trženje« in najslabše »Infrastruktura«.

Varianta	Kmetijstvo	Hortikultura	Živilstvo	Prehrana
. MIC	dober	prav dober	prav dober	dober
.. Infrastruktura	slaba	sprejemljiva	primerna	primerna
... Tehnologija	zadovoljivo	primerno	zadovoljivo	primerno
.... Velikost poligona glede na možnost vključenih deležnikov	solidna	primerna	majhna	majhna
.... Tehnološka praktična opremljenost	majhna	primerna	primerna	primerna
.... Starost tehnološke opremljenosti	zastarela	zadovoljiva	zadovoljiva	zadovoljiva
.... Vzdrževanje poligona	slabo	primerno	slabo	primerno
... Zeleni prehod	majhna	majhna	solidna	solidna
.... Okoljska sprejemljivost	pogojno zadovolji	pogojno zadovolji	slaba	pogojno zadovolji
.... Izboljšave procesov	slabo	slabo	primerno	zadovoljivo
.... Vpliv podnebnih sprememb na učno enoto	zelo velik	zelo velik	srednji	manjši
... Digitalizacija	nepomemben	nepomemben	srednje pomembna	pomembna
.... Razpoložljivost digitalnih tehnologij v procesih	zadovoljiva	zadovoljiva	primerna	slaba
.... Avtomatizacija procesov	slaba	slaba	sprejemljiva	primerna

Slika 3: Infrastruktura za štiri variante

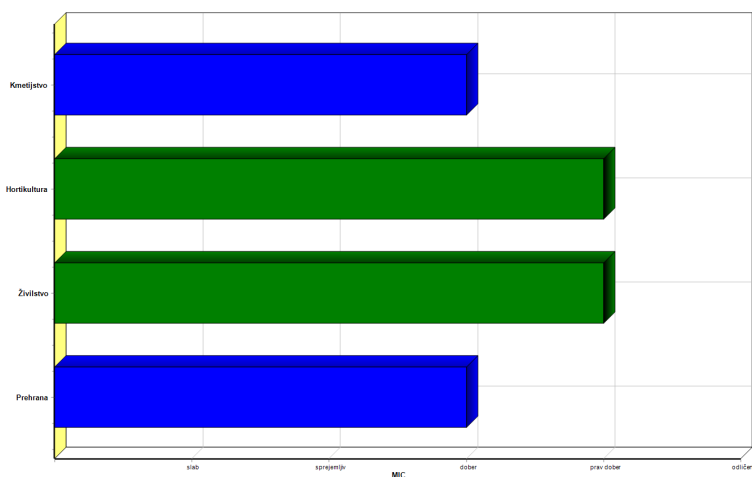
Vir: lasten

... Zelene kompetence	visoka	visoka	visoka	solidna
.... Novelacija izobraževalnih vsebin	je v postopku	je v postopku	prenovljeno	ni
.... Novi programi (inoviranje)	ni	ni	manj kot četrtina	ni
.... Raziskovalni proces trajnostnih vsebin	zelo dober	zelo dober	zadovoljiv	slab
.... Partnerstva zelenih kompetenc	močne	močne	primerne	šibke
.... Doseganje standardov kakovosti	zelo dobro	zelo dobro	primerno	zadovoljivo
... Uporaba digitalnih orodij	bolj pomembni	srednje pomen	bolj pomembni	srednje pom
.... Uporaba digitalnih tehnologij pri izobraževanju	primerna	primerna	pogosta	primerna
.... Uporaba digitalnih tehnologij pri vodenju / organizaciji procesa	pogosta	primerna	primerna	primerna

Slika 4: Zelene kompetence in Uporaba digitalnih orodij za Strokovni in pedagoški proces za štiri variante

Vir: lasten

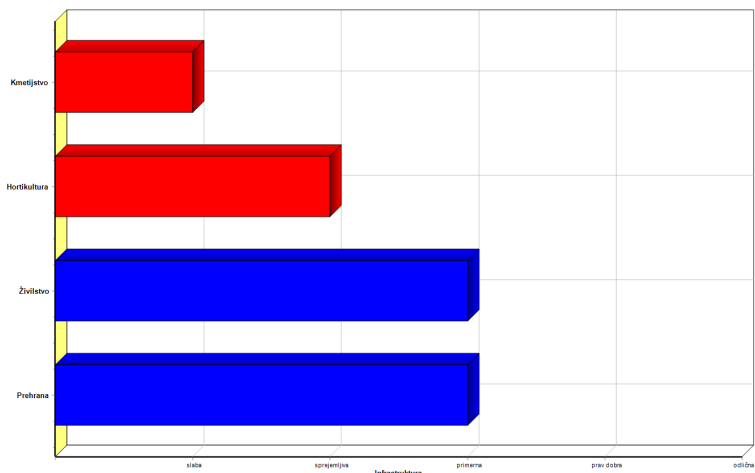
Na sliki 4 so prikazane ocene »Zelene kompetence« in »Uporaba digitalnih orodij«. Na podlagi primerjalnih rezultatov imata končno oceno prav dobro oceno »Živilstvo« in »Hortikultura«, dobro oceno pa »Kmetijstvo« in »Prehrana« (slika 5).



Slika 5: Končna ocena izobraževanja in usposabljanja na poligonih MIC

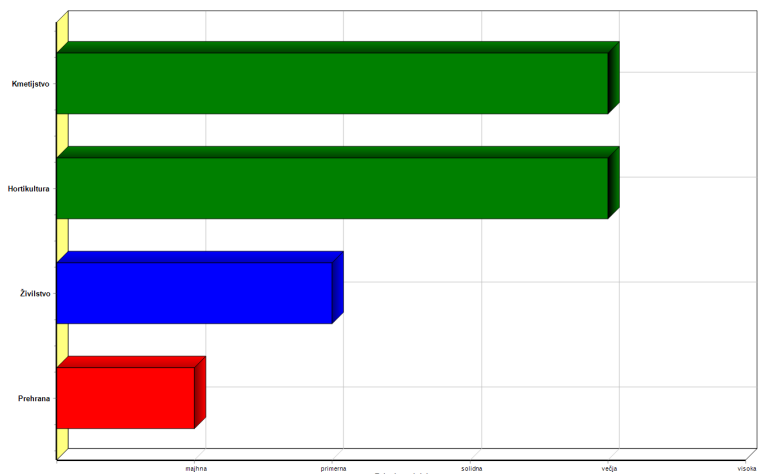
Vir: lasten

Ocena infrastrukture MIC (slika 6) kaže potrebe po vlaganjih na poligonu »Kmetijstvo«, sprejemljiva je oprema na poligonu »Hortikultura«, primerna pa je oprema na poligonih »Živilstvo« in »Prehrana«. Ocena novih zelenih produktov za trženje je večja na poligonih »Kmetijstvo« in »Hortikultura«, primerna na poligonu »Živilstvo« in majhna na poligonu »Prehrana« (slika 7).



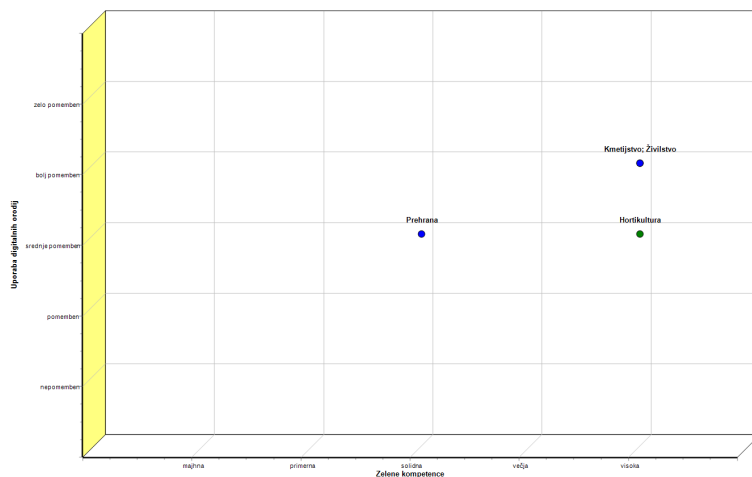
Slika 6: Ocena infrastrukture na poligonih MIC

Vir: lasten



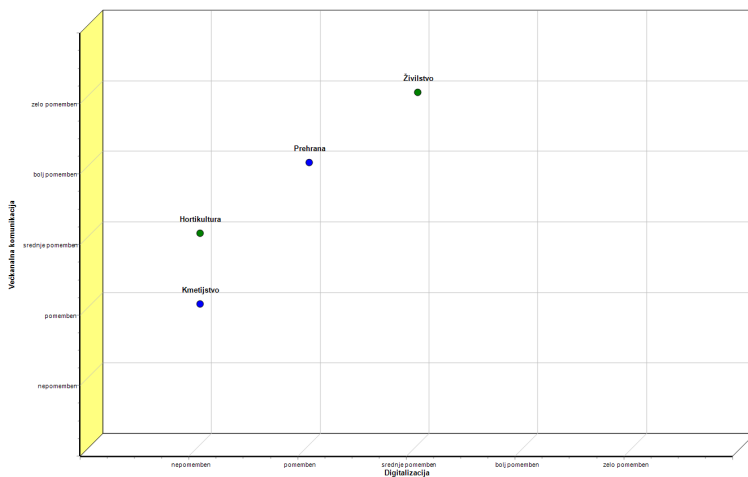
Slika 7: Ocena zelenih produktov za trženje na poligonih MIC

Vir: lasten



Slika 8: Uporaba digitalnih orodij in zelene kompetence v strokovnem in pedagoškem procesu

Vir: lasten



Slika 9: Digitalizacija tehnologije in večkanalna komunikacija pri trženju

Vir: lasten

Na sliki 8 grafično prikazujemo parametra »Uporaba digitalnih orodij« in »Zelene kompetence« v strokovnem in pedagoškem procesu, na sliki 9 pa parametra »Digitalizacija tehnologije« in »Večkanalna komunikacija« pri trženju.

5 Zaključek

Na podlagi ocen z metodo Kepner-Tregoe in programa DEXi smo primerjali procese. Končna ocena izobraževanja in usposabljanja na poligonih MIC-a je bila skladna z rezultati metode Kepner-Tregoe. Na področju izobraževalnih poligonov do prav dobri rezultati na področju živilstva in hortikulture in dobri rezultati na poligonih kmetijstva in prehrane.

Končni rezultat raziskave glede na tveganja je znižanje ocene za 4,9 % na poligonu »Prehrana«, znižanje za 3,5 % na poligonu »Kmetijstvo«, za 2,2 % na poligonu »Živilstvo« in za 1,6 % na poligonu »Hortikultura«. Za praktično izobraževanje na poligonu »Prehrana« je potrebno sprejeti dodatne ukrepe za obvladovanje tveganj. Na poligonih živilstva in prehrane, kjer poteka izobraževanje in usposabljanje v učnih delavnicah, lahko s postopnimi vključevanji sistemov za digitalno vodenje ter spremljanje poslovanja in procesov postopoma dosežemo premike k bolj zelenim produktom in večji samooskrbi.

Na področju kmetijstva in hortikulture imajo največji potencial prav zeleni produkti, ki so priložnost za razvoj. Zaradi razvoja posameznih strok ter zelene in digitalne razsežnosti so potrebne naložbe v digitalne izobraževalne sisteme na poligonih, njihovo vzdrževanje ter kompetenten kader.

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PROCESS MANAGEMENT OF ORGANIZATIONAL CHANGES IN THE CASE OF EDUCATION PROCESS WITHIN ORGANIZATIONS

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In the rapidly changing business environment of recent years, organizations aim to constantly improve efficiency and effectiveness by adding value to products and services for their clients. One of the most critical factors is employees' knowledge and skills, which organizations address through modern technology. Exploring digital solutions revealed potential benefits: environmental impact, resource efficiency, accessibility, scalability, data insights, innovation opportunities, and economic competitiveness. This article explores the transformative potential of integrating digitalization into traditional education processes. We conducted a thorough analysis using the EPC technique with the ARIS tool, resulting in a well-documented and conceptually developed digital education process. Comparing traditional and digitalized processes, we investigate education process challenges. The outcome reveals a dynamic education process with fewer activities and documents, a bigger percentage of activities supported by the information technology, and a shorter process throughput time. With summarizing achievements, this article guides organizations in considering a similar transition.

Keywords:

organizations,
organizational
changes,
process
management,
education
process,
digitalization



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1 Introduction

The purpose of organizations is to constantly improve the efficiency and effectiveness of operations by continually creating added value in products and services for customers (Plucinski and Gruchman, 2002). Adaptability and innovation have become critical in the landscape of contemporary organizational dynamics. In several ways, the most important factors are employees, processes, and resources. Of course, it is important that employees are constantly educated and trained in their fields and that the management provides quality education with an optimal education process. Organizations know the described need and recognize the increasing opportunities of modern information-communication technology. With information-communication technology evolving and accelerating, organizations must continuously rethink their operational approaches (Aleksić, 2014). This article delves into the complexities of organizational change management in education, focusing on the integration of digitalization. As the educational landscape shifts from traditional methods to a digitally enhanced future, we highlight the key challenges organizations encounter in this transformation and articulate the core purpose of this research.

The lack of a digital platform for the education process within organizations poses significant challenges. The conventional print-centric approach primarily contributes to increased paper consumption and a substantial carbon footprint, leading to environmental impact (Optimod A, 2023). Resource inefficiency is another issue, as traditional methods consume time, physical space, and necessitate travel, conflicting with sustainable practices and economic growth. Limited accessibility and inclusivity are critical concerns, hindering education outreach to remote areas and individuals with mobility limitations. Physical meeting and seminar scalability limitations further restrict audience reach. The absence of a digital platform also deprives organizations of essential data insights, innovative teaching opportunities, and the ability to adopt emerging educational technologies. Failure to include digitalization in business processes can jeopardize organizations' growth and competitiveness in today's increasingly digitalized environment. The above can potentially result in a loss of market share.

This article aims to uncover the intricate process driving organizational change in education. We tested the possibilities offered by digitalization with the help of the Business Process Management approach. We used the ARIS tool and the EPC technique and made a comparative analysis with structural and operational efficiency indicators. The result of the article is an analysis of the opportunities and challenges organizations face when implementing organizational changes (e.g., digitalization) in the field of the education process. The narrative goes beyond technicalities, highlighting the roles of stakeholders, communication pathways, and activities in crafting a dynamic and sustainable educational platform. This article provides insights, guidance, and a compelling narrative that transcends conventional organizational change management discourse, paving the way for an innovative and accessible future in education.

2 Theoretical overview

The chapter is divided into two parts: a presentation of the Business Process Management approach and a presentation of the Education Center, which has a digital education process that we analyze.

2.1 Business Process Management

Process orientation is essential and profoundly impacts many aspects of the organization. Through process orientation, the ways of communication and work change. There is an integration of Business Process Management and an increase in the connection between functional departments (Kregel et al., 2021), but also an improvement of overall business performance by adopting a process view of business. A business process is a combination of activities in an organizational and technical environment with a structure that describes their logical sequence and dependencies to achieve the desired result and achieve a business goal (Aguilar-Saven, 2004; Weske, 2007). When changing or improving business processes, it is first necessary to ask what is to be achieved by the change, i.e., what is the goal of the change. Next comes the question about the required change to achieve the set goal in the business process improvement (Krhač Andrašec, 2022). When the business process is successfully applied and implemented, new questions may appear that need to be answered, such as whether our goal is achievable and how we will act in the future (Urh, Kern in Roblek, 2010).

The answer lies in the Business Process Management approach, which aims to achieve a dynamic cycle of continuous improvements and enable significant gains in the efficiency and success of both the product and the overall aspects of the business. Identifying key business processes and their development and continuous improvement makes it possible to focus on clients and their greater satisfaction (Plucinski and Gruchman, 2002). The extensive literature on Business Process Management suggests how organizations can improve performance by adopting a process view of business. However, most literature lacks research or empirical focus (Milanović Glavan, 2014). Business Process Management is a systematic and structured approach to analyzing, improving, controlling, and managing processes to enhance the quality of products and services. It also encompasses a series of tools and techniques for improving the performance of business processes, whether they be categorized as operational, support, or directions set (Elzinga et al., 1995; Armistead et al., 1997). Business Process Management is both the art and science of overseeing how work is performed in an organization. Its primary goals are to ensure consistent outcomes and identify improvement opportunities. Typical examples of improvement objectives include reducing costs, execution times, and error rates. It is about managing entire chains of events, activities, and decisions that ultimately add value to the organization (Dumas et al., 2013). Using Business Process Management, the organization is viewed as a series of functional processes linked across the organization, which is how the work gets done (DeToro and McCabe, 1997).

In recent years, challenges involving information and communication technologies have become increasingly prevalent in creating and implementing business processes. Information and communication technology changes and evolves every day. As a result, it is necessary to respond to these changes and the challenges of the environment on time. Therefore, business processes require constant changes with evident improvement. Business Process Management is a management approach that developed with a strong focus on adopting information technology (Vom Brocke and Sinnl, 2011). It plays a pivotal role in the organizational changes explored in this article, particularly concerning implementing digitalization into education processes.

2.2 Education Center

Education Center goes beyond the conventional definition of a facility or institution, embodying a dynamic space where knowledge is imparted and nurtured to empower entrepreneurs at every stage of their journey. Through its operation, it systematically deals with challenges in various areas in the entrepreneurial environment. It is a versatile hub for collaborative knowledge exploration, creating continuous intellectual development. The Education Center is committed to facilitating an interactive and immersive learning environment, providing enriched experiences for personal and professional development.

While many education centers cater to specific demographics or focus areas, the Education Center we describe stands out with its unique target audience. Unlike institutions that may prioritize academic students or specialize in one professional field, this Center embraces a more inclusive approach. It specifically addresses the needs of a diverse group, targeting a broad audience that includes entrepreneurs, founders, business professionals, CEOs, students, and individuals passionate about learning. This positioning allows the Education Center to become an inclusive educational space that empowers learners across diverse domains. It features distinct tracks for leadership development, networking opportunities, and skill-building resources (Optimod B, 2023).

The Education Center is transforming to align with the evolving modern landscape. This includes recalibrating business processes, integrating cutting-edge technologies, and adapting organizational strategies for sustained relevance and competitiveness. This entails redefining processes supporting the educational journey in a digital format (Optimod C, 2023).

3 Methodology and results

In tandem with implementing redesigned education processes, the Education Center is envisioned as a knowledge repository. This repository grants access to various educational resources such as pre-recorded webinars, white papers, e-books, and case studies. It endeavors to provide tailored resources that cater to a diverse audience, thereby actively contributing to the intellectual growth of its participants.

The Education Center and its digital education process can be applied to various organizations, but its effectiveness can vary depending on factors such as organizational size and industry type. For example, larger organizations with diverse processes may require more complex models. Customization to meet specific organizational needs is key to optimizing results and optimal performance.

In support of the presented in the preceding chapters, this article delves into two primary views of the education process:

- processes impacting user experience,
- processes affecting internal organizational aspects.

Numerous processes fall under the highlighted views:

- Processes impacting user experience - student registration and enrolment process, curriculum access, communication channels, assessment and feedback, student support, library service/resource management, interactive learning, graduation ceremony, etc.
- Processes affecting internal organizational aspects - student registration and enrolment process, curriculum development and research, class scheduling, speaker booking, technology integration, assessment and evaluation, administrative processes, resource management, student record management, communication channels, event planning, budgeting and financial processes, continuous improvement, etc.

This article focuses on the education process from both views, where the traditional education process is shown in the AS-IS model (Figure 1), and the redesigned education process is designed in the TO-BE model. Figure 1 presents a structured flowchart outlining the conventional steps involved in the educational process, typical of a non-digital, traditional learning environment. We used the ARIS tool's EPC technique to display the selected process models. Each model is equipped with several key objects for comprehensive structural analysis, including the number of activities, the number of employees (positions), the number of documents or information-communication technology, the number of decisions, and other pertinent factors. Also, we prepared a second model that vividly depicts the redesigned education process and represents the TO-BE state after integrating

digital technologies and modern methodologies. The model portrays a dynamic and interconnected flowchart emphasizing flexibility, digital interaction, and learner-centric approaches.

For a better comparison of the traditional education process with the digital education process (Figure 2), we created a structural analysis (Urh et al., 2019) that evaluates the process across several different indicators (Table 1).

Table 1: Structural analysis

Process	No. of activities	No. of employees (positions)	No. of documents	No. of decisions	Per. of activities supported by the information technology
Traditional	34	3	12	3	44,12%
Digital	30	3	6	3	93,33%

Source: own research

The table demonstrates that the education process exhibited structural improvements after the redesign, with enhancements we made in three out of the five most crucial structural indicators (Krhač Andrašec, 2022):

1. The number of activities decreased by 11.76 %,
2. The number of documents decreased by 50%,
3. The percentage of activities supported by the information technology improved by 49.21%.

The remaining two indicators did not deteriorate but remained the same as in the traditional education process.

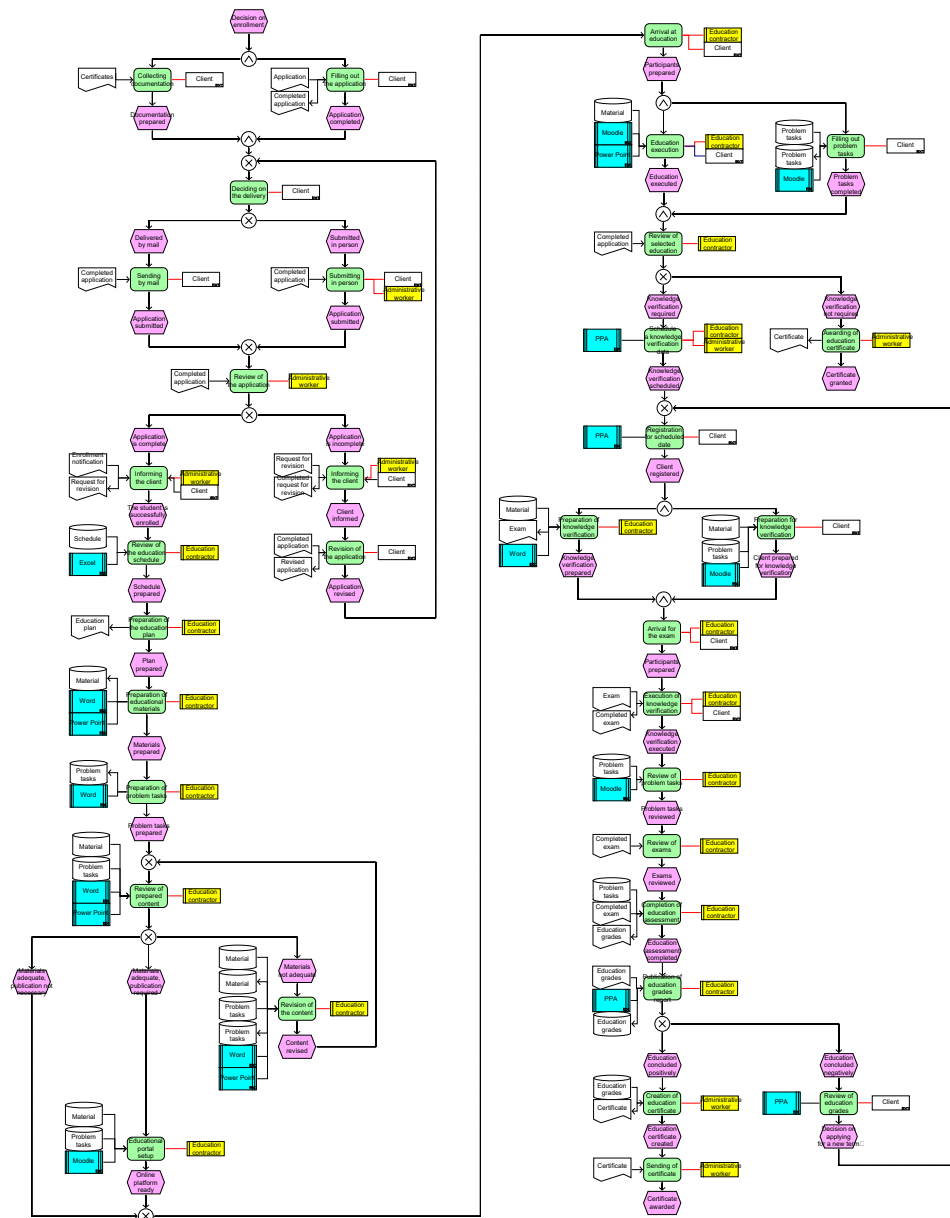


Figure 1: AS-IS model of the traditional education process

Source: own research

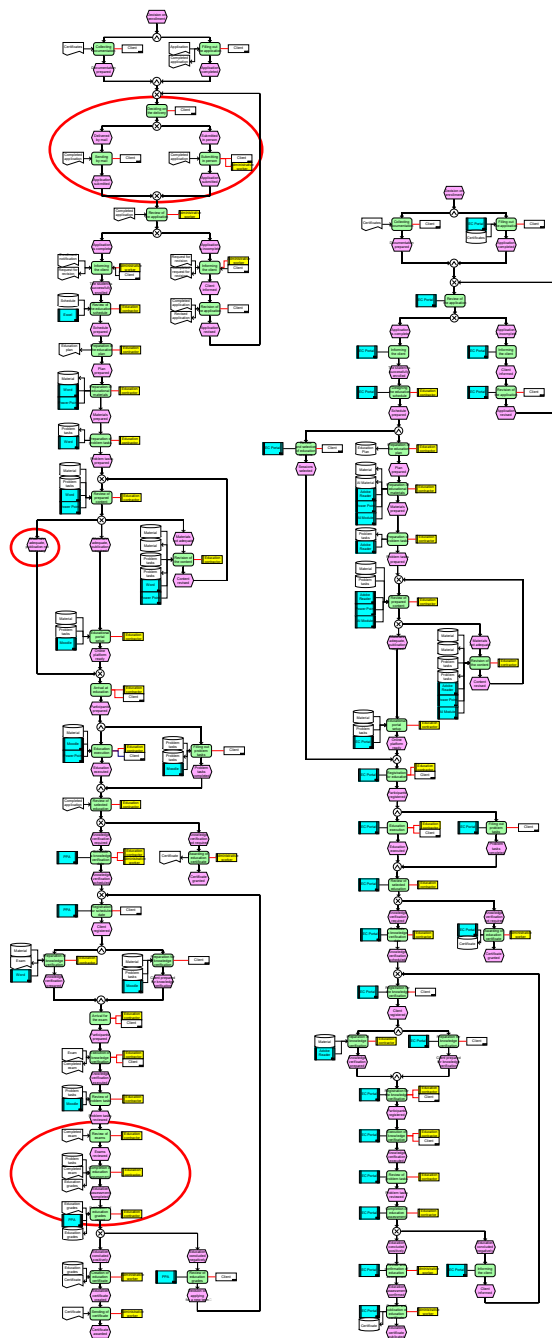


Figure 2: Comparison of the traditional education process and the digital education process

Source: own research

Furthermore, each process undergoes a detailed operational analysis covering the time dimension. To calculate the throughput time of individual process activities, each activity was divided into wait time, orientation time (preparation-finishing time), and processing time (Davis, 2008). The times presented in Table 2 represent average estimates of individual activity execution. It's worth noting that the times may vary for each education center due to various factors.

Table 2: Extract of the time analysis results of the traditional education process

EPC: Traditional		Time (function is carried out once)		
Function	Processing time	Orientation time	Processing/Orientation sum per	Wait time
Revision of the content	480 Minute(s)	5 Minute(s)	485 Minute(s)	0,5 Minute(s)
Revision of the application	30 Minute(s)	5 Minute(s)	35 Minute(s)	480 Minute(s)
Filling out problem tasks	30 Minute(s)	5 Minute(s)	35 Minute(s)	10 Minute(s)
Filling out the application	30 Minute(s)	5 Minute(s)	35 Minute(s)	
Education execution	180 Minute(s)	5 Minute(s)	185 Minute(s)	10 Minute(s)
Education execution	180 Minute(s)	5 Minute(s)	185 Minute(s)	
Execution of knowledge verification	60 Minute(s)	10 Minute(s)	70 Minute(s)	10 Minute(s)
Execution of knowledge verification	60 Minute(s)	10 Minute(s)	70 Minute(s)	
Creation of education certificate	60 Minute(s)	10 Minute(s)	70 Minute(s)	960 Minute(s)
Publication of education grades report	30 Minute(s)	1 Minute(s)	31 Minute(s)	0 Minute(s)
Informing the client	15 Minute(s)	3 Minute(s)	18 Minute(s)	1 Minute(s)
Informing the client	15 Minute(s)	3 Minute(s)	18 Minute(s)	
Informing the client	15 Minute(s)	3 Minute(s)	18 Minute(s)	
Submitting in person	5 Minute(s)	3 Minute(s)	8 Minute(s)	480 Minute(s)
Submitting in person	5 Minute(s)	3 Minute(s)	8 Minute(s)	
Deciding on the delivery	10 Minute(s)		10 Minute(s)	
Awarding of education certificate	60 Minute(s)	10 Minute(s)	70 Minute(s)	960 Minute(s)
Sending of certificate	5 Minute(s)	5 Minute(s)	10 Minute(s)	480 Minute(s)
Sending by mail	5 Minute(s)	10 Minute(s)	15 Minute(s)	480 Minute(s)
Review of problem tasks	480 Minute(s)	10 Minute(s)	490 Minute(s)	480 Minute(s)
Review of selected education	30 Minute(s)	5 Minute(s)	35 Minute(s)	480 Minute(s)
Review of exams	240 Minute(s)	10 Minute(s)	250 Minute(s)	480 Minute(s)
Review of education grades	5 Minute(s)	5 Minute(s)	10 Minute(s)	180 Minute(s)
Review of the content	60 Minute(s)	1 Minute(s)	61 Minute(s)	15 Minute(s)
Review of the education schedule	15 Minute(s)	0,5 Minute(s)	15,5 Minute(s)	9600 Minute(s)
Review of the application	10 Minute(s)	10 Minute(s)	20 Minute(s)	480 Minute(s)
Arrival at education	60 Minute(s)	60 Minute(s)	120 Minute(s)	3360 Minute(s)
Arrival at education	60 Minute(s)	60 Minute(s)	120 Minute(s)	

Source: own research

The time analysis of the current, traditional education process (the AS-IS state) shows significant delays mainly due to long waiting times and manual processing. Paperwork and the need to be physically present at locations add to these hold-ups. Plus, these steps take even longer because they are done by hand, which is slow and less convenient for everyone involved. Simply put, the current way is time-consuming and not user-friendly, highlighting the need for a more modern, digital approach that could speed things up and make the process easier for users. The exposed challenges are also shown in Table 3, which shows the savings of each type of time after redesigning the education process.

Table 3: Comparison of time analysis

EPC	Time					
Process	Processing time	Orientation time	Processing /Orientation sum per	Wait time	Sum (min)	Sum (h)
Traditional	14521	444,5	14965,5	23747,5	38713	645,2 2
Digital	14244	145,5	14389,5	9379	23768,5	396,1 4
Progress	1.91 %	67.27 %	3.85 %	60.51 %	38.60 %	

Source: own research

Table 3 shows that after the digital redesign, the process improved by 67.27 % in terms of orientation time and 60.51 % in terms of waiting time. In total, this means that the throughput time of the education process was reduced by 38.60 %.

4 Discussion and conclusion

The article has examined the transformative journey of integrating digitalization into the education processes within organizations. At its core, it illuminates this transition's benefits and challenges, especially in a business environment increasingly reliant on rapid adaptation and technological advancements. The compelling narrative underscores digitalization as a strategic necessity in enhancing employee skills and operational efficiency. The employment of the EPC technique and the ARIS tool has been instrumental in revealing the stark contrasts between traditional and digitalized education processes. These insights offer a comprehensive view of the improvements, most notably in environmental sustainability, structural and operational efficiency, and accessibility. In parallel, studies by Kern et al. (2019) and Krhač Andrašec et al. (2021) have demonstrated similar structural and time enhancements achieved through implementing digitalization in the coatings industry.

Digital transformation, however, is not without its challenges. The most pronounced investment is required to establish a fully digitized education process. Organizations must weigh this against the long-term operational cost savings and the myriad opportunities digitalization presents, including resource efficiency, scalability, and innovation. This initial financial commitment is a pivotal consideration but is offset

by the long-term benefits and the potential for continuous improvement. Regarding operational costs, the shift to digital processes promises significant reductions, primarily in transportation and time-related expenses. Yet, this transition brings into question the quality of education, which can be addressed by increasing the available digital resources and continuously refining these tools. On the flexibility front, while digitalization might initially seem to limit options to a single process, it inherently offers greater flexibility regarding scheduling and geographical independence, thereby enhancing the ability to balance other obligations more effectively.

Digitalizing the education process within organizations is a technological shift and a strategic move towards more sustainable and efficient educational practices. The time analysis of the redesigned digital process exemplifies a significant leap in efficiency and user experience. Automation has streamlined process, reducing manual intervention and hastening task completion while diminishing the potential for human error. Furthermore, the digital platform eradicates the need for physical presence, enabling remote access to educational services and broadening the reach to a more diverse audience. This transformation has led to a leaner, more efficient, and user-centric education process. Reflecting on the findings of Kern et al. (2019) and Krhač Andrašec et al. (2021), the significant structural and operational (time) efficiency improvements in other sectors underscore the versatile benefits of digitalization.

However, this study's limitations include modeling the education process in a generic version without specifically analyzing different process variants and relying on average time estimations and rough assessments. Despite these constraints, we have successfully demonstrated digitalization's substantial benefits and improvements to organizational education.

As organizations continue to navigate the complexities of the digital era, they must acknowledge the importance of this transition for maintaining competitiveness and contributing to operational efficiencies and a more environmentally conscious and resource-efficient world. Looking ahead, embracing continuous learning and adaptation, along with a readiness to invest in new technologies, will be crucial in shaping the future of organizational education. Building on the insights from this article, future research could significantly enhance the digitalization of education processes within organizations, drawing inspiration from the advancements in other

industries. This could include conducting long-term impact studies to analyze the effectiveness of digital education, assessing efficiency, and pinpointing improvement areas. Additionally, research could focus on customizing digital education tools across various industries and organizational sizes. Considering the psychological and social impacts, especially on employee engagement, motivation, and team dynamics, is also vital. Integrating artificial intelligence, virtual reality, and augmented reality into digital education platforms could provide insights into enhancing learning experiences and engagement. Furthermore, performing cost-benefit analyses of digital education models would help optimize investments and explore funding models and long-term cost-saving strategies. Finally, developing frameworks for evaluating the quality of digital education content would establish benchmarks for continuous improvement, thus deepening the effectiveness of digital education in organizational development.

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THE INFLUENCE OF DIGITALIZATION ON THE CONCEPT OF SUSTAINABLE DEVELOPMENT

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Digitalization has become an essential part of modern business, facilitating the conversion of analog data into digital format for easier storage, sharing, and access. As organizations continue to adopt digital technologies to streamline their operations and improve efficiency, they are also recognizing the importance of sustainability. Sustainability includes reducing environmental impact, minimizing waste and maintaining ethical business practices. This paper explores the intersection of digitalization and sustainability in the business world. Digitalization has had a significant impact on business operations, leading to increased efficiency and productivity at the same time, sustainability has emerged as a critical issue for organizations, with consumers and stakeholders demanding environmentally responsible practices. This paper seeks to examine how businesses can use digitalization to achieve sustainability goals and create a positive impact on the environment and society.

Keywords:

sustainable development, goals of sustainable development, digitalization, modern business, organizations

1 Introduction

The world is passing through an era of digitization where most of our daily activities are highly dependent on innovative digital and computer technologies. These modern technologies have found their application in socio-economic, environmental, sustainable and climate research to improve the productivity and efficiency of the given system (Balogun et al., 2020). The 2030 Agenda for Sustainable Development, adopted by the UN General Assembly in 2015, sets out an ambitious program for the universal achievement of economic, social, environmental and institutional goals, concretized in 17 sustainable development goals (SDG - *Sustainable Development Goals*).

The need for better digital technology infrastructure is often seen as a challenge to social sustainability that can widen the gap between developed and developing regions instead of narrowing it. There is a need to provide infrastructure and equal access to the Internet in order to achieve the goals of reducing inequality and poverty, in line with the need to provide end users with all the benefits of digitalization.

Companies today, recognizing the importance of sustainability, are increasingly adopting digital technologies in order to simplify their operations in order to improve efficiency and effectiveness. Digitization has become an essential part of modern business, facilitating the conversion of analog data into digital format for easier storage, sharing, and access. The digitalization of enterprises has had a profound impact on various aspects of their operations. Digital technologies have enabled companies to collect and analyze data more efficiently, leading to better decision-making and improved overall performance (Petković, 2023).

2 The concept of sustainable development

Until today, sustainable development had various definitions and interpretations that differed significantly. Consensus in defining this term was provided by the World Commission on Environment and Development (WCED), which in 1987 in one of its reports (the Brundtland Report) defined sustainable development as "... development that meets the needs present without jeopardizing the ability of future generations to meet their own needs." With this definition of sustainable

development, the World Commission on Environment and Development highlighted as the leading goal the satisfaction of current needs by the safe use of available resources from the environment so that the needs of future generations can be met by using non-depleted resources. According to Levi Jakšić & Marinković (2012) "Sustainable development is an interdisciplinary scientific and teaching field that has been intensively developing in recent decades and finds its basis in practically all scientific fields - natural, technical, social, mathematical, medical".

In this paper, the emphasis will be on the impact of ubiquitous digitalization on the concept and dimensions of sustainable development.

3 Digital transformation and sustainable development

Industry 4.0 (a term that describes digital transformation in industry) will profoundly change industrial operations. In a recent review of Industry 4.0 and implications for sustainability, Bonilla et al. (2018) identify in the literature "a consensus that the long-term impacts of Industry 4.0 on sustainable development are still unclear". Liao et al. (2021) state that assessing digital transformation requires a multidisciplinary framework that integrates industrial ecology, economics and engineering, with the focus of their work on artificial intelligence in industrial applications. Muller et al. (2018) report the results of a questionnaire distributed among several hundred industry practitioners and find that "Industry 4.0 is expected to transform industrial production as well as society, with the aim of economic, environmental and social achievements". Quantitative and specific research on the interdependence of digital transformation and sustainable development is emerging and growing.

A number of studies, for example, Andrae and Edler (2015) and Jones (2018), express concern about the growing use of electricity for digital services and the increasing share of digital technology in global electricity consumption. Also, the materials contained in ICT and future volumes of waste are concerns that warrant further research into future growth and the impacts and potential of circular economy strategies. Bai et al. (2020) state that there is a lack of sufficient guidance in the scientific and practical literature regarding the sustainability implications of Industry 4.0. At a conceptual level, the link between digital transformation and sustainable development is well established at the level of industrial process clusters. From numerous case studies and surveys, specific potential benefits and negative

impacts of sustainability have been identified. Examples include increased recycling, increased technology transfer around the world and better quality and more durable products, but also increased waste streams, resource extraction and energy use. The immediate benefits of implementing digital transformation lie at the process and process cluster level, but the ultimate (long-term) sustainability gains and constraints, especially those relevant to the Sustainable Development Goals, are found at higher system levels involving policy and transformations throughout the economy and society (Pauliuk et al., 2022).

4 The two-way impact of digitization on sustainable development

The fourth industrial revolution is a unique phase in the history of mankind because the development of technology lays the foundation for the progress of society as a whole. This fact emphasizes the necessity of studying the impact of digital technology on the goals of sustainable development as an imperative for the development of modern society.

4.1 Potential disadvantages of the impact of digitization

Digital technologies have been one of the main vectors of economic growth in recent years and will retain that role in the long term. Developed countries offer a higher level of social and economic development, but a moderate (slower) rate of economic and digital growth (Ju & Hou, 2020). The main social costs of digital economic growth in developed countries are related to the education of personnel through mass training. This cost increases social tensions and competition between sellers in the market. Environmental costs are associated with increased energy consumption because automation increases the energy intensity of production and consumption. However, these costs are being successfully reduced through the use of leading energy-intensive digital technologies, the smart grid, and the transition to alternative energy sources (Zhang et al., 2020). Developing countries are vulnerable to the negative consequences of digital economic growth, which is much higher. They suffer social costs associated with a higher unemployment rate, a decrease in wages and living standards of the population, as well as environmental costs manifested by an increase in the volume of consumption of natural resources and the accumulation of production waste, which leads to the degradation of the environment and the quality of life.

4.2 Examples of digitization in the service of sustainable development

Digital technologies enable companies to increase production capabilities and fully satisfy public demand for goods and services. Digital finance ensures transparency and control of the economy. Digital training is available, encouraging the popularization of lifelong learning. A digital approach to the organization of value added chains enables full-scale monitoring and guarantees product quality and on-time delivery (Wamboye et al., 2020). The benefits of digital technology development are more obvious in developed countries. Social benefits are associated with the creation of highly efficient, highly paid, intensive and creative jobs. Developing countries have social benefits for labor force and social mobility, while the environmental benefits are poorly manifested. Different aspects of digital technology development contribute differently to the Sustainable Development Goals.

The work of Popkov et al. (2022) aims to study the 10 most developed and the first 10 developing countries, which have shown the best results in the implementation of the Sustainable Development Goals and their perspective on the development of digital technology to solve current major challenges. The research provides a description of the cause-and-effect relationships between the development of digital technology and the likelihood of achieving progress in each of the 17 goals. This makes it possible to prove that the development of digital technologies is suitable for solving the great challenges of sustainable development and the most complete characterization of the impact of digital technologies on the implementation of sustainable development goals. Progress in the implementation of sustainable development goals in developed and developing countries should be investigated separately, taking into account their specificities.

The Internet is one of the most critical manifestations of the advancement of digital technology. According to most authors, it is developing intensively in smart cities. Another manifestation of the progress of digital technology is the analysis of big data, which, according to Bertello et al. (2020), depends on the telecommunications infrastructure. Kovaleva and Kanke (2021) prove that the development of intelligent technologies takes place during the transition to the digital economy under the influence of state and corporate management. Thus, the aforementioned publications formed a clear idea of the advancement of digital technology as a socio-

economic category, which is treated as a process of creating and spreading leading technologies, which include artificial intelligence, the Internet, blockchain, ubiquitous computing and robots. Scientists emphasize the potential contribution of the advancement of digital technology to the implementation of the Sustainable Development Goals. Bebbington and Unnerman (2020) propose that the Sustainable Development Goals be integrated into accounting practice to ensure their accurate quantitative and comprehensive monitoring worldwide. Fakhar Manesh et al. (2020) believe that it is necessary to manage knowledge in the conditions of the fourth industrial revolution in order to support sustainable development. Mhlanga (2021) confirms that artificial intelligence in Industry 4.0 has a negative impact and creates challenges for the fight against poverty, innovative development, infrastructure development and the implementation of sustainable development goals in developing economies. Khan et al. (2021) present a systemic reflection of the triple bottom line and the perspective of the circular economy and sustainable business models, proving that Industry 4.0 changes the rules on the implementation of sustainable development goals and makes it difficult to achieve them. Chen et al. (2021) demonstrate the potential negative impact of technological innovations on energy efficiency in the age of Industry 4.0 and determine the moderate character of the gray economy in sustainable development.

Summarizing the results of existing studies, it is possible to conclude that the progress of digital technology could stimulate major challenges of sustainable development. Reducing or preventing the negative consequences of the progress of digital technology is possible with the help of: the spread of smart technologies that save resources and energy; development of distance learning and robotization of education for mass training of qualified digital personnel.

Mirgaderi (2021) recommends the use of an artificial neural network to estimate the index of sustainable development goals. Leading technologies will enable monitoring of progress in the sphere of implementation of sustainable development goals. Advances in digital technology also enable a (potentially) effective response to the COVID-19 pandemic and crisis by: using leading technologies to develop telemedicine and increase the quality and availability of public health services; increasing the quality of life and environmental protection based on smart economic practices.

The work of Popkov et al. (2022) shows that the impact of digital technologies on sustainable development is two-way - it is positive for some of the goals of sustainable development, and harmful for others. The quantitative impact of the development of digital technology on the implementation of sustainable development goals is positive. This enables the use of digital technologies as an advanced tool for the SDGs, although different aspects of digital technology development contribute differently to the implementation of the SDGs. Social development in developed countries has a high correlation with digital knowledge (75.16%) and digital technologies (77.16%); globalization, with digital knowledge (74.15%). In developing countries, digital technologies contribute little to the development of institutions and the implementation of sustainable development goals. The most prominent (although statistically insignificant) connections are observed between social development and digital infrastructure (9.94%) and digital technologies (11.71%) and between economic freedom and digital infrastructure (40.86%).

5 The impact of digitization on individual sustainable development goals

Information and communication technologies can help accelerate progress towards each of the United Nations' 17 Sustainable Development Goals. Efficient and affordable ICT infrastructure and services help countries engage in the digital economy and boost their economic competitiveness and prosperity. Most of the world's 42 least developed countries are making impressive progress towards SDG 9, with significant impact on financial inclusion, poverty reduction and improved health. ICTs provide the means to deliver high-quality goods and services in health, education, finance, commerce, governance, agriculture and other vital areas. According to the latest statistics from the International Telecommunication Union (ITU), less than half of the world's people still do not use the Internet. Disadvantaged populations, especially women and girls, the elderly, persons with disabilities, indigenous populations and the economically disadvantaged, as well as people living in the world's least developed countries, landlocked developing countries and small island developing states, should be included in the emerging digital society to meet all 17 SDGs. Much of the ITU's work is aimed at expanding ICT networks, promoting an enabling environment, encouraging investment in telecommunications/ICT networks and fostering digital inclusion.

The COVID-19 pandemic has increased connectivity, as more people have moved online to continue working, studying and staying in touch with friends and family during quarantine. However, the challenges of the pandemic and the economic slowdown have created additional problems for achieving the Sustainable Development Goals. The international community has pledged to draw lessons from the global challenge of the pandemic. Increased connectivity and ICT can form a major part of building better, countries can use increased connectivity to better engage with their citizens to achieve the SDGs.

- SDG 1

A world without poverty: More than 2 billion people in the world do not have bank accounts, while access to digital financial services has been proven to help lift people out of poverty. The Financial Inclusion Global Initiative (FIGI), launched in 2017 by the ITU, the World Bank and the Committee on Payments and Market Infrastructure, with support from the Bill & Melinda Gates Foundation, is expanding digital financial inclusion in developing countries.

- SDG 2

A world without hunger: By making farming practices more data-driven, ICT solutions can help farmers increase crop yields while reducing energy use. The UN Food and Agriculture Organization (FAO) has been working closely with the ITU since 2017 to foster ICT innovation in agriculture.

- SDG 3

Good health: Direct interaction with patients, health informatics and telemedicine can be improved through better connectivity. The Digital Health for Africa partnership, launched by the ITU and the World Health Organization in 2017, has enabled the development of digital health capacity for more than 15 countries in Africa. Be Healthi, Be Mobile is another ITU-WHO collaboration. Current and upcoming ITU standards for multimedia systems, developed in collaboration with other organizations, will support the widespread use of digital health applications, including telemedicine and remote medical imaging.

- SDG 4

Quality education: The ITU and the International Labor Organization (ILO) are leading the Digital Skills for Decent Jobs Campaign, which aims to equip 5 million young men and women with job-ready digital skills by 2030. The Giga Initiative, founded by ITU and UNICEF, monitors and promotes connectivity in schools.

- SDG 5

Gender equality: According to ITU statistics, 250 million fewer women were online than men in 2017. Globally, 62% of men use the internet compared to 57% of women. Although the digital gender divide has narrowed in all regions of the world and virtually eliminated in the developed world, a large gap still exists in the least developed countries (where 31% of men are online, compared to only 19% of women) and in developing countries with no access to the sea (where 38% of men compared to 27% of women). To close the digital gender gap, ITU members organize the annual International Girls in ICT Day to encourage more women and girls to pursue science, technology, engineering and mathematics. Gender equality initiatives in which ITU is directly engaged include EQUALS, a ground-breaking global network for building the evidence base and improving women's access to technology, building relevant digital and other skills and promoting women's leadership in the technology sector.

- SDG 6

Clean water and sanitary conditions: New digital technologies facilitate smart management of water and sewage. The ITU Smart Sustainable Cities Focus Group monitors key trends in urban smart water management, including ICT for wastewater management.

- SDG 7

Available and renewable energy: The increasing use of technology contributes to the emission of carbon dioxide and other greenhouse gases. The industry is exploring ways to harness greener energy, make appliances more energy efficient and incorporate solar, wind and other renewables into the value chain. At the same time,

cutting-edge technology will be essential to reducing global emissions, building smart grids and cities, electrifying transport and building sustainable economies and societies. The ITU has helped set stricter energy efficiency and emission control standards for ICT and has shown how smart grids can help build more controlled and efficient energy systems and reduce carbon emissions.

- SDG 8

Decent work and economic growth: Technology creates new jobs, enables resilient work and trade, and stimulates broader social and economic development. The ITU Digital Innovation Framework helps countries, cities and other communities and systems accelerate their digital transformation, stimulate innovative ICT-focused entrepreneurship and boost the small and medium-sized enterprise (SME) sector.

- SDG 9

Industry, Innovation and Infrastructure: Much of the ITU's work is directly aimed at improving the scope and quality of the ICT infrastructure of radiocommunication networks and expanding networks to underserved remote and rural areas. ITU standards improve the energy efficiency and performance of ICT networks, in wired and radio communication networks.

- SDG 10

Reduced inequalities: ITU works to reduce inequality within and between countries, communities and populations by expanding access to technologies and knowledge to vulnerable segments of society.

- SDG 11

Sustainable cities and communities: United for Smart Sustainable Cities (U4SSC), launched by the ITU and the United Nations Economic Commission for Europe (UNECE) in 2016, helps cities take key steps to become smart and sustainable. Fifty cities from several countries around the world have joined this project

- SDG 12

Responsible consumption and production: E-waste, including ICT-generated waste, is growing worldwide. ITU has launched a coalition to produce a Global Monitor of e-waste and strengthen cooperation in solving the global challenge of electrical and electronic equipment waste. The ITU also develops global strategies, standards and policies that offer guidance for the sustainable management of e-waste.

- SDG 13

Action for the climate: Digital tools enable increasingly sophisticated climate modeling. ITU facilitates international cooperation on policies and standards to reduce energy consumption for ICT products and services. Key ITU standards promote green data centers and green energy power systems. ITU is conducting a joint project to model cities using digital twin modeling.

- SDG 14

Life under water: ICTs are widely used to monitor the changing marine environment (eg the movement of ice flows and the movement of glaciers). Buoys can be equipped with remote monitoring to monitor changing sea conditions (eg salinity levels of the water above the buoy). Sensor networks and RFID chips can be used to protect endangered animals (eg whales and dolphins) to learn about their migratory patterns and needs.

- SDG 15

Life on land: ICTs can be used to identify, monitor and photograph wildlife populations. Sensor networks and RFID chips can be used to protect endangered animals (eg lions, elephants and tigers) to learn more about their migratory patterns and protection needs.

- SDG 16

Peace, justice and strong institutions: E-government services help improve the relationship between citizens and the state and improve the efficiency of the provision of state services. ITU helps empower citizens through its work on smart sustainable cities and key performance indicators (KPIs) that measure social

inclusion, such as voter participation or the number of government services delivered electronically.

- SDG 17

The power of partnership: Public-private partnerships are key to bringing ICT to all nations, peoples and communities. Partnerships are particularly needed to build the physical infrastructure needed to deliver Internet services to hard-to-reach areas and currently vulnerable populations, as well as to facilitate the investment, inclusion and innovation needed to meet the SDGs across the board.

6 Conclusion

Digitization has played a significant role in facilitating and improving the lives of individuals. From a social vision, the digital network has enabled the citizens of the world to open up to other cultures, to access additional information, to predict natural disasters, etc. The digital revolution, with the increased digitization of content and services and the development of the Internet, has provided undeniably significant benefits. The use of remote sensing is increasing agricultural production, and the early application of various hardware (eg sensors, drones, precision fertilization, etc.) combined with geo-mapping is leading a new agricultural revolution, given the opportunities to increase production yields and improve sustainable agriculture. Smart cities of the future should provide affordable water of the highest quality for all its citizens. Big data and digitization play a key role in meeting these goals. Digitization can improve energy efficiency and provide sustainable alternatives. Healthcare and equal access to health have been revolutionized by digitization. Digital tools play a vital role in promoting well-being and improving quality of life by facilitating access to healthcare. The interconnectedness of the goals of sustainable development is indisputable. Digitization and artificial intelligence support low-carbon energy systems while integrating highly efficient renewable energy that can also monitor and model climate and biodiversity responses over time. Digitization defines the path to a green planet by providing solutions and helping sustainable development. The integration of the Internet and the management of big data have already shown numerous advantages. Particular attention should be paid to the implications of unequal access to data that can lead to digital poverty and therefore increase inequalities instead of

reducing gaps. However, the benefits of integrating digitization into everyday life can drastically help humanity face sustainable challenges.

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ANALIZA IN PREDLOGI ZA TRAJNOSTNO UPRAVLJANJE ZEMLJIŠČ

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Slovenija spada v evropskem prostoru med države z najmanj kmetijskih površin na prebivalca (0,22 ha) in z nizko stopnjo samooskrbe s prehranskimi proizvodi (60 %). Kar 75 % zemljišč je na področju z omejitvenimi dejavniki pridelovanja. Zato imamo le 14,5 % zemljišč z boniteto nad 60 točk. Največja tveganja pri pridelavi v zadnjih dvajsetih letih predstavljajo ekstremni dogodki, ki zmanjšujejo količine pridelkov in zvišujejo cene proizvodom. V zadnjih 20 letih smo imeli v Sloveniji približno 1,4 milijarde EUR škode na področju kmetijstva in iz državnih rezerv izplačali približno 210.000 EUR. Zadnje poplave v Sloveniji, v avgustu 2023, so nas opomnili na skromna vlaganja v zaščito kmetijskih zemljišč pred pogostimi izjemnimi dogodki, ki so predmet podnebnih sprememb. Pri tem so mišljeni pojavi kot so: moča, suša, zemeljski plazovi, toča, pozeba, žled. Avtorja v svojem prispevku analizirata izredne vremenske pojave v zadnjih 20 letih z ocenami nastale škode. Na podlagi pregleda literature in mednarodnih izkušenj sta pripravila predloge za zmanjševanje škod v naslednjem desetletju, ki upošteva trajnostno upravljanje kmetijskih zemljišč, ki omogočajo uporabnikom kakovostno gospodarjenje z viri.

Ključne besede:

upravljanje
zemljišč,
kmetijska
zemljišča,
naravne
nesreče,
poplave,
usadi

ANALYSIS AND PROPOSALS FOR SUSTAINABLE LAND MANAGEMENT

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Slovenia is one of the countries in the European area with the least agricultural land per capita (0.22 ha) and a low level of food self-sufficiency (60%). 75% of the land is in an area with limiting factors for cultivation. As a result, only 14.5% of the land has a rating above 60 points. The biggest risks to production over the last 20 years have been extreme events that reduce crop quantities and increase product prices. Over the last 20 years, we have had approximately EUR 1.4 billion of damage to agriculture in Slovenia and paid out approximately EUR 210 000 from the national reserves. The latest floods in Slovenia, in August 2023, reminded us of the modest investments made to protect agricultural land against the frequent extreme events that are the subject of climate change. This includes events such as: floods, droughts, landslides, hail, frost and frost. In their paper, the authors analyse extreme weather events over the last 20 years, with estimates of the damage caused. Based on a review of the literature and international experience, they make proposals for reducing damage over the next decade, taking into account sustainable management of agricultural land that allows users to manage resources with quality.

Keywords:

land
managemet,
agricultural
land,
natural
disasters,
floods,
landslides

1 Uvod

Slovenija se s površino 20.271 km², s 2.116.972 prebivalcev in gostoto poseljenosti 99 prebivalcev/km² uvršča med manjše evropske države (SURS, 2023). Večina prebivalcev, 60 %, je poseljena na ravninskih delih, ki predstavljajo 20 odstotkih ozemlja. Od vseh zemljišč v uporabi, 896.008 hektarov (ha), je 369.184 ha (41 %) gozdnih zemljišč, 494.641 ha (56 %) pa kmetijskih zemljišč, ostalo 3 %, je nerodovitnih zemljišč. Kmetijstvo za svojo obdelavo uporablja le 474.633 ha (94 %) zemljišč, kar pomeni le 0,22 ha kmetijske zemlje na prebivalca Slovenije (SURS-podatki za 2020).

V strategiji prostorskega razvoja Slovenije 2050 je poudarjen pomen podeželskega okolja, saj ima Slovenija nadpovprečno število teh področij v primerjavi z ostalimi evropskimi državami. Prebivalcem na podeželju je potrebno omogočiti primerljive življenjske razmere in ustrezno dostopnost storitev. Regionalni načrti s področja kmetijstva morajo biti usmerjeni v oskrbo prebivalstva s kakovostno lokalno pridelano hrano, ki upoštevajo zavarovana področja in kulturno dediščino prostora. Pri gozdarski dejavnosti se naj načrti usmerjajo v razvoj gozdnih lesnih verig, ki služijo podporo trajnostnim gradnjam (Resolucija ..., 2023).

Za doseganje slovenskega cilja samooskrbe glavnih prehranskih produktov nad 80 % bomo morali posvetiti večjo pozornost trajnemu varovanju 350.000 ha najboljših kmetijskih zemljišč (Zagotavljanje prehranske varnosti ..., 2021). Prav tako bo potrebno spremeniti strukturo kmetijske pridelave, saj delež njiv le 36 % ter trajnih nasadov 7 %, ostalo pripada travniškim površinam. Prav tako imamo največji delež kmetijskih zemljišč, 74 %, na območjih z naravnimi in drugimi posebnimi omejitvami (OMD); (Strateški načrt, 2022). V ta del spadajo zemljišča z območja Natura 2000 s 355 območji, ki zajemajo 38 % vse površine Slovenije. Poleg tega imamo še 13,2 % od celotne površine Slovenije zavarovanih območij. K temu lahko prištejemo še 337 ekoloških pomembnih območij, ki obsegajo 66 % ozemlja Slovenije. Omejitve pri intenzivnem kmetovanju predstavljajo tudi naravne vrednote, kar 17.431 je vrednih delov narave. V slovenskih gozdovih imamo še približno 9 % varovanih gozdov in gozdnih rezervatih. Prav tako omejitve pri pridelavi predstavljajo tudi območja in objekti kmetijske dediščine in poplavna območja (Dodatek za presojo ..., 2022). V Sloveniji imamo evidentirano 86

ogroženih poplavnih območij, ki so grupirana v 18 porečij, ki se večinoma stekajo v povodje Donave (Načrt zmanjševanja poplavne ogroženosti ..., 2023).

Največja tveganja pri kmetijski pridelavi predstavljajo naravne in druge nesreče, ki pomembno vplivajo na zmanjševanje pridelane hrane in hkrati zagotavljanju primerne dohodka pridelovalcem. Pod naravnimi in drugimi nesrečami so mišljene poplave, suše, nenadni pojav bolezni in škodljivcev, pozebe, žled, usadi, ...

V članku smo prikazali vrednotenje kmetijskih površin in pogostih škod, ki v zadnjih letih nastajajo zaradi podnebnih sprememb. Te nesreče imajo velik vpliv z vidika trajnostnega gospodarjenja in zagotavljanja zadostne samooskrbe prebivalcem Sloveniji. Naravne nesreče zmanjšujejo dodani vrednosti na zemljiščih in vplivajo na zmanjševanje zanimanja za pridelavo hrane. V članku smo se osredotočili na posledice zadnjih poplav in usadov na področju upravne enote Škofja Loka.

2 Upravljanje s kmetijskimi in gozdnimi zemljišči na Gorenjskem

Gorenjska regija je po površini 2.137 km² na šestem mestu v Sloveniji. V njej je leta 2021 živel približno 10 % prebivalstva Slovenije, ki imajo na voljo 9 % kmetijskih površin. Največ prebivalcev je leta 2021 živel v občini Kranj (27 %), 10 % pa v občini Škofja Loka. Kar 30 % prebivalstva odhaja na delo v druge slovenske regije, največ (88 %) v osrednjo slovensko regijo. V gorenjski regiji je leta 2021 delovalo 21.300 podjetij z 80.000 zaposlenih s povprečno plačo 1.235 EUR (3 % manj kot SLO). Bruto domači proizvod v letu 2021 znašal 20.462 EUR, kar pa je 17 % manj v primerjavi s Slovenijo (SURS, 2021). Na Gorenjskem je delež njiv še manjši (27 %) kot v Sloveniji (37 %), delež travnikov je kar 71 % in le 2 % trajnih nasadov. Delež žit v primerjavo s Slovenijo je na njivah le 1,89 %, 10 % pridelamo zelenjave, krompirja kar 27 %, več kot 10 % njivskih površin v slovenskem merilu uporabimo za pridelavo krme za živino. Na tem področju je velik delež gozda v primerjavi z kmetijskimi površinami, 67 %, ki hkrati omogoča višjo dodano vrednost lastnikom zemljišč. Na področju upravne enote Škofja Loka (Gorenja vas-Poljane, Železniki, Škofja Loka je 1.162 ha njiv (14 % Gorenjske), 7.510 ha travnikov (34 % Gorenjske) 179 ha trajnih nasadov (31 % Gorenjske) in 19.291 ha gozda (42 % Gorenjske); (SURS-prirejeno, 2020). Na področju živinoreje je na Gorenjskem 10,2 % goveda, 0,9 % prašičev, 1,5 % perutnine, 8,3 % konjev, 7,4 % ovc in 10,3 % koz. Skupaj so imele gorenjske kmetije 38.054 GVŽ živali, kar je 9,1 % v primerjavi s Slovenijo

(SURS-prirejeno, 2016). V raziskavi o samooskrbnosti s hrano na Gorenjskem je bilo izpostavljena premajhna pridelava zelenjadnic in sadja (Pogačnik, 2016).

2.1 Vrednotenje zemljišč

Kmetijska in gozdna zemljišča so neobnovljiv naraven vir, ki ga lahko pridobimo na novo le na račun drugih (gozdna, degradirana, ...); (Zupan, 2021). So deklarirane kot redke in posebne dobrine, zato za njih veljajo določeni pogoji in omejitve. V EU pridobivanje kmetijskih zemljišč spada na področju prava Unije z namenom zagotavljanja zemljišč za kmete in preprečevanja njihove koncentracije. Kmetijska zemljišča predstavljajo skoraj polovico ozemlja EU in so podvržena stalnim pritiskom za nekmetsko rabo (Razlagalno sporočilo ..., 2017).

Najpomembnejši podatek o vrednosti kmetijskih in gozdnih površin je podatek o pridelovalni zmožnosti zemljišča, t.j. boniteta zemljišča, ki se ocenjuje od 0 (pozidana zemljišča) do 100 točk. Bonitetne točke se izračunajo na podlagi lastnosti tal, klime, reliefa in posebnih vplivov. V Sloveniji imamo le 15 % zemljišč (122.535 ha) z boniteto nad 60 točk (Smernice za določanje ... 2022).

$$B = \sqrt{Tx \times Kx \times Rx \times \left(1 - \frac{\% \text{ posebni vplivi } x}{100}\right)} \dots \dots \dots (1)$$

Pri tem pomeni: B=bonitetne točke, T=točke lastnosti tal, K= točke lastnosti klime R= točke lastnosti reliefa; Σ= % posebni vplivi vsota deležev posebnih vplivov.

Pri ocenjevanju kmetijskih zemljišč lahko uporabimo tudi model množičnega vrednotenja kmetijskih zemljišč (KME). Pri modelu množičnega vrednotenja se določa lokacija, površina in boniteta. Na vrednost zemljišča vplivajo tudi oblika, velikost, dostopnost in vrsta rabe. V Sloveniji imamo le 122.535 ha (14,5 %) zemljišč z boniteto nad 60 (Smernice za določanje ..., 2022).

Na kakovost tal pomembno vpliva tudi erozija tal, kjer ti procesi potekajo počasi, dolgoročno pa vplivajo na kakovost tal. Raziskave kažejo, da se v mediteranskem območju pri neprimerni uporabi rastlin, prihaja do trajne degradacije zemljišč (Carnillo-Lopez, et al., 2022).

Povprečna cena transakcij za njivske površine v Sloveniji je leta 2013 znašala 15.545 EUR, v letu 2022 pa že 23.282 EUR (49,8 % povečanje). Na zahodnem delu Slovenije je cena njive v letu 2022 stala povprečno 39.493 EUR, kar je 18,3 % več kot v letu 2013 (SURs, 2022).

2.2 Tveganja pri gospodarjenju s kmetijskih in gozdnimi zemljišč

Ekstremni vremenski dogodki predstavljajo tveganje kmetijstvu. Kmetijstvo je zelo izpostavljen sektor glede obilnejših padavin oziroma sušnih obdobj. Med največja tveganja v zadnjih dvajsetih letih spadajo naravne nesreče, ki so posledice neugodnih vremenskih razmer (zmrzal, toča, led ali žled, deževje ali suša, požar-povzročena z naravnimi dejavniki). Med te naravne nesreče spadajo tudi množični izbruhi rastlinskih škodljivih organizmov in živalskih bolezni. Prav tako v to kategorijo spadajo zemeljski usadi, ki se pojavljajo kot zemeljski plazovi ali udori in ogrožajo infrastrukturo in zmanjšujejo vrednost zemljišč, cesta ali stavb. Kot naravno nesrečo v kmetijski proizvodnji razglasimo, ko je uničeno več kot 30 % pridelka (Zakon o odpravi posledic ..., 2023). Škoda v kmetijstvu se ocenjuje na kmetijskih zemljiščih, kmetijskih stavbah, strojih, opremi, kmetijskih pridelkih, večletnih nasadih, živalih, divjadi, perutnini in ribah. Metodologija za ocenjevanje škode se se največkrat računa po formuli:

$$\check{S}K=V_0-V\check{S}D.....(2)$$

ŠK=višina škode v EUR

V₀=ocenjena dejanska vrednost pred nesrečo v EUR, z upoštevanjem amortizacije

VŠD=vrednost po nesreči v EUR

Lahko se ocenjuje tudi s primerjavo poškodovane stvari pred in po nesreči, takrat pa stopnjo poškodovanosti ocenimo s faktorjem do 1 (Uredba o metodologiji ..., 2008). Za zmanjšanje tveganj pri gospodarski dejavnosti se poslužujemo zavarovanj.

Za gozdarstvo ni zanimanja za tovrstno zavarovanje, medtem ko je za kmetijstvo predvideno sofinanciranje države. Predvideno je sofinanciranje primarne kmetijske proizvodnje za zavarovanje posevkov, nasadov in plodov pred nevarnostjo toče, požara, udara strele, pozebe, poplave ter viharnega vetra in viharja ter za zavarovanje materialne škode na sredstvih v primarni kmetijski proizvodnji pred nevarnostjo

toče, viharja, viharnega vetra, teže snega in za zavarovanje živali na kmetijskem gospodarstvu za primer bolezni. Višina sofinanciranja je do 60 % obračunane zavarovalne premije z zavarovalnim kritjem z odbitno franšizo najmanj 15 % zavarovalne vsote posevka, nasada ali plodov. Najvišja zavarovalna vsota za posamezno poljščine ali vrtnine je omejena z zgornjim zneskom (Uredba o sofinanciranju ..., 2023).

2.3 Posledice naravnih nesreč

Neurja so naravni pojav, ki ima za posledico poplave, hudourniške vode in zemeljske usade. Verjetnost nastopa intenzivnih vremenskih pojavov je v naraščanju zaradi globalnih sprememb. Ne znamo jih preprečiti; nekatere človekove dejavnosti pa še dodatno prispevajo k večji verjetnosti pojava, nepremišljeni posegi v prostor pa lahko povečajo škodljive posledice poplav, hudournikov in zemeljskih usadov. Raziskava v Ordu v Turčiji je pokazala, da lahko s pomočjo satelitov in letalskih posnetkov napovemo nevarnosti poplav in usadov na določenem območju (Kocaman, et al., 2020).

Poplavna območja so odprti sistemi, kjer voda se voda, sedimenti in hranila izmenjujejo, med pretokom in poplavno ravnico. Vse večje poseganje človeka v rečna in poplavna območja pa ima tudi svoje posledice. V Sloveniji je poplavno ogroženo 15 odstotkov ozemlja. Veliko rek in rečnih pritokov je hribskih oz. gorskih vodotokov, ki imajo erodibilno zlivno zaledje in strugo (rušenje in naglo odplavljenje hribinskega materiala); velik in pogosto spreminjajoči se padec; velika nihanja velikosti pretokov; hitro koncentracijo in nastop visokih hudournih voda; veliko transportno sposobnost rinjenih plavin in praviloma značilni „hudourniški vršaj“; specifične pojave hudourniške erozije v obliki rušilnih preplavljanj in drobirskih tokov idr. (Papež, Kopal, 2020).

V ujme je potrebno ukrepati hitro in učinkovito. Izziv prvega koraka so aktivnosti povezane z varnostjo zdravjem, dobrim počutjem in ponovnega vračanja v normalno življenje; pomembno je poskrbeti z zmanjšanje nove škode in vplivov na okolje. Hudournike in hudourniška območja je treba urejati na sonaraven način s trajnostnim in interdisciplinarnim pristopom do zmanjšano vzroke za nastanek poplav, hudournikov in zemeljskih plazov.

Eden izmed načinov urejanja so tudi ekoremediacije, kjer v večji meri upoštevamo naravne zakonitosti (Kociper, 2009).

Tabela 1: Ocena škode po naravnih nesrečah v EUR po letih

Leto	Velikost škode po naravni nesreči (EUR)	Obseg škode (ha)	Državna pomoč-skupaj (EUR)	Delež pomoči (%)	Izplačilo državne pomoči (EUR)
2003	130.609.889	427.337	37.485.038	28,7	35.581.629
2004	34.671.476	30.394	8.857.274		8.857.274
2005	42.028.280	25.495	11.641.834	27,7	9.611.179
2006	60.570.142	194.344	12.414.229	28	10.214.409
2007	16.510.695	27.875	4.545.160		4.424.054
2011	7.067.033	2.711	0		0
2012	60.066.582	106.540	5.851.035	16	5.670.019
2013	106.205.331	185.551	5.310.267	5	5.242.852
2014	6.609.600		476.690	7,2	397.245
2016	44.280.701	7.706	3.500.000	7,9	3.487.332
2017	116.170.468	149.410	14.722.438	15	13.202.701
2019	9.367.672	8.080,40	1.463.103		1.316.278
2021	40.064.109,34	6.551,60	8.283.874		6.692.477,68
2022	674.416.322	235.182	143.783.023	136	104.697.450
Skupaj	1.348.638.300	/	258.333.965		209.394.900

Vir: Naravne nesreče ...-prirejeno, 2023

V letih od 2003 do 2022 smo v kmetijstvu ocenili za približno 1,3 milijard (mrd.) škode zaradi naravnih nesreč (preseženo 0,3 promila proračuna). V ta del spadajo suše, neurja s točo, pozebe, poplave, viharji, hrušev ožig in pomor čebel. Iz državne pomoči je bilo za oškodovance izplačano 81 % odobrene škode (209.394.900 EUR).

3 Raziskava

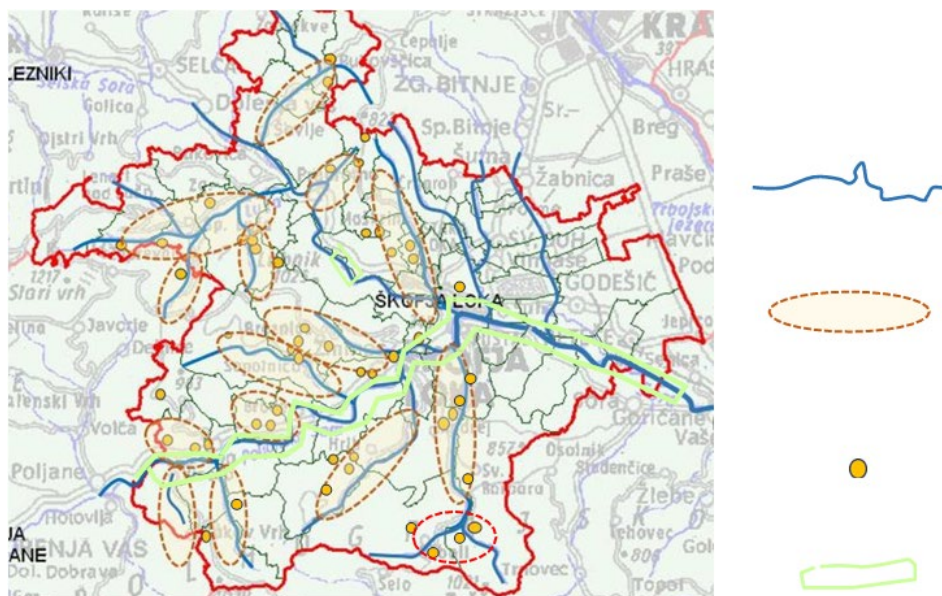
V času intervencijskih aktivnosti od avgusta do decembra 2023 smo na območju občine Škofja Loka izvedli terensko raziskavo. Cilji raziskave so bili: terensko kartiranje poplavnih površin, hudournikov in zemeljskih plazov ter ugotavljanje vzrokov nastanka škodnih primerov.

Na začetku smo proučili ustrezne znanstvenih in strokovne članke, da smo lahko začeli z zbiranjem podatkov. Soavtor članka, dr. Franc Vidic, je bil del intervencijske ekipe, ki je bila že v prvih dneh na terenu. Prvi koraki so bili: evidentiranje, terensko kartiranje in popis škodnih primerov na poplavnih površinah, hudournikih in večjih zemeljskih plazovih. V prvi vrsti smo se ukvarjali s tistimi, ki so vezani varnost (stanovanjski objekti) in na infrastrukturo (mostovi, ceste, oskrba z vodo, elektriko, telekomunikacijo). Vsi podatki terenskega dela so bili del interventne obnove. Pri svojem delu smo pisali zapisnike in poročila. V pomoč so nam bile topografske, geološke karte in spletna aplikacija LIDAR Slovenija (Geoportal ARSO, 2023).

4 Rezultati raziskave

4.1 Terensko kartiranje poplavnih površin, hudournikov in zemeljskih plazov

Poplave, hudourniki in zemeljski plazovi so se pojavljali predvsem v hribovitih predelih, značilni za predalpska območja. Geomorfološke značilnosti Škofjeloškega območja so izrazito hudourniške. Nalivi, hudourniške poplave in zemeljski plazovi so povzročili razdejanje. Naše delo je bilo popis in ocena škod ter kartiranje območij, ki so jih prizadele poplave, hudourniško razdejanje in zemeljski plazovi.



Slika 1: Grafični prikaz poplavljenih in erodiranih površin ob Selški in Poljanski Sori ter Sori; podivjanih hudourniški pritokov ter zemeljskih usadov/plazov

Vir: Vidic, F., 2023



Slika 2: Poškodovane površine in infrastruktura

Vir: Vidic, F., 2023

Na sliki 2 je razvidna moč vode, ki se kaže v poškodovanih brežinah, mostovih in cestah ter nanosu različnega materiala kot so: drevesna debla, vejevje, proda, mulja...

Glede na geološko sestavo podlage in morfološke značilnosti terena so izražene posledice hude ure. Poljanska Sora, Selška Sora, ter združeni reki v Sori so spodkopavale brežine, s seboj nosile veliko materiala in ga odlagale na poplavljenih površinah. Ob njihovem toku je bilo poplavljeno in porušeni več objektov, uničenih polj, travnikov (slika 2).

S pobočij Polhograjskega in Škofjeloškega hribovja se v rečne doline stekajo hudourniške vode. V Selško Soro se izlivajo potoki: Prifarški in Vincarski potok, Srednjiška grapa, Bukovščica in Luša. V Poljansko Soro se stekajo: Brezniška, Baja Ženkova, Gabrška, Petruzova in Kumrova grapa, na drugem bregu pa: Krniška grapa, Hriboska, Močilska in Bodolska grapa ter Sovpat in Hrastnica. Hudorni zaradi svoje naklonine in velike količine vode erodirajo brežine, na ta način prožijo usade in odnašajo velike količine materiala, ki ga odlagajo v svojih vršajih. Posledica so bile povsem neprehodne dolina Hrastnice, Bodoveljske in Sopotniške grape. Veliko domačij več dni ni imelo dostopa do mest. Po drugi strani pa imajo povirne vode so povirne vode v porečjih in imajo velik vpliv na ekološko stanje voda, vodno bilanco in sedimentni režim rečnega sistema.



Slika 3: Moč naraslih hudournikov in njihova erodilnost

Foto: Vidic, F., 2023

Na sliki 3 je vidna moč hudourniški pritokov in spodjedanje brežin. Prihaja tudi do velike hitrosti pretoka in posledično do povečanja erozije zemlje in odnašanja materiala s seboj. Ta material se nabira ob ožinah (mostovi, ...) in zapira poti odtekanju vode. Za proženje zemeljskih plazov sta pomembna dva dejavnika, ki delujeta drug proti drugemu: težnost, ki »vleče« zemeljske gmote navzdol po pobočju in notranja trdnost v zemljinski masi, ki se upira premiku. Obilne padavine so nasičile z vodo preperel ali nanešeni pobočni material ter močno povečale porni pritisk, zlasti tam, kjer se porozne vodoprepustne plasti tal srečajo z manj prepustnimi tlemi. Enako velja tudi za nasut material, ki tvori podlago lokalnih in gozdnih cest, nasutih za odlagališča oziroma deponije. Razmočena tla postanejo nestabilna in pobočni material zdrsi po pobočju navzdol. Na področju občine Škofja Loka smo popisali več kot 50 zemeljskih plazov/usadov.



Slika 4: Zemeljski usadi na Škofjeloškem območju

F. Vidic, F., 2023

Na sliki 4 vidimo različne zemeljske usade, ki so nastali zaradi prevelike napojenosti zemljine z vodo. Razvidno je, da moramo biti pozorni na pravilno odvajanje vode, kjer so možni manjši pritiski na zemljino. Ta problem je poseben ob nasutih cestah, kjer prihaja do odvajane večje količine vode na posameznih mestih.

4.2 Vzroki nastanka škodnih primerov

Nastala škoda je posledica naravnih in antropogenih dejavnikov. Glavni vzrok v danem primeru je bila izredna količina padavin v kratkem časovnem intervalu. Škodni primeri so poplave, hudourniki in proženje zemeljskih plazov. Vse to zavisi od več dejavnikov, od: geološke zgradbe, razgibanosti terena, vremena, vegetacije, raznih posegov (izkopi, ceste) in dodatnih obremenitev terena.

Teren Škofje Loške občine je značilno za predalpski svet, ki ga grade predvsem kalstiti in karbonatne kamenine. Med škodnimi primeri je največ takih ki so nastali na podlagi, ki pripada nestabilnemu območju mlajše paleozojskim klastičnim kamninam (karbon, spodnji in srednji perm). Med kamninami prevladujejo rdeči, zeleni in sivi skrilavci, meljevci in peščenjaki, na nekaterih mestih najdemo kremenove konglomerate. Kamnine so zaradi narivov in prelomov tektonsko poškodovane, na površini pa preperete.

5 Razprava

Slovenija ima le 0,22 ha kmetijskih zemljišč na prebivalca, kar jo v EU-26 uvršča med države z najmanj površine. Poleg tega imamo 75 % zemljišč z omejenimi dejavniki pridelovanja, 122.535 ha (14, 5 %) zemljišč ima boniteto nad 60 točk. Tudi iz tega razloga je samooskrba s hrano nizka, dosegamo približno 60 % presežka uvoza hrane za slovensko prebivalstvo. Pomemben vpliv na pridelavo imajo ekstremni dogodki, ki so v zadnjih letih stalni pojav. Podatki za EU-27 od 1980 do 2021 kažejo na izgubo 560 mrd. EUR, samo v letu 2021 smo škodam namenili 56 mrd. V Sloveniji smo od leta 2003 do 2022 za 674.416.322 mio. EUR škode izplačali iz državne blagajne 104.697.450 EUR pomoči ob razglašeni naravnih nesrečah (Naravne nesreče..., 2023). Povprečno smo za vse naravne nesreče v zadnjih 20 letih izplačali 9,4 mio. škode, kar znaša 0,12 BDP (Komac, 2021). Samo v zadnjem avgustovskem neurju smo imeli v kmetijstvu 145 mio. škode in je bilo prizadetih več kot 2.700 kmetijskih gospodarstev (Finance, 23. 11. 2023).

Do škodnih primerov namreč prihaja tudi zaradi nespametnega poseganja človeka v prostor. Najpogostejše napake, ki jih delamo v prostoru:

- gradbeni posegi: izkopi za vreze cest, zasipavanje skladiščnih platojev, gradbene jame in drugi podobni posegi. Vkopi in nasipi povzročajo prekomerne obremenitve nestabilnih brežin, posledično nastajajo plazovi destabiliziranih zemljin, ki se v naravno okolje sprožajo nad in pod posegom;
- plazovi na travnikih, ki so posledica kopičenja prsti v spodnjem delu nekdanjih njiv, izdelava dostopnih poti;
- izdelave gozdnih poti, neurejeno odvodnjavanje;
- pomanjkljivo načrtovanje in vzdrževanje cest. Ponekod so nalivi s svojimi nanosi zamašili prepuste, voda je odtekala po vozišču, erodirala in spodkopala nezavarovano brežino;
- neustrezen način gradnje in neustrezne lokacije objektov:
- neupoštevanje navodil strokovnjakov in njihovih projektnih rešitev pri odpravljanju posledic sanacije v preteklosti:
- neurejene in pogoste gozdne vlake predstavljajo rane, ki so žrtve hudournikov.

Iz tega razloga bo potrebno več pozornosti in sredstev vlagati v trajnostno upravljanje prostora, vključno s kmetijskimi zemljišči in s prilagajanjem kmetijskih kultur na posameznih območjih (Azadi, et al., 2022). Izbira primernih kultur na posameznih ogroženih področjih lahko bistveno pripomore do zmanjševanja škod, je pokazala raziskava v Indoneziji (Jumivati, et al., 2020). Pri tem je pomembna tudi strategija upravljanja, vključno s politikami na tem področju, ki morajo zagotoviti tudi potrebna sredstva (Prenger-Bernighoff, et al., 2014). Primeri v svetu kažejo, da za kvalitetno izvedbo in uporabo v praksi, moramo sodelovati z lokalnim prebivalstvom (Thanh, 2021).

Z upoštevanjem naštetih priporočil in ukrepov ter z dobrim sodelovanjem z vsemi strokami, lahko bistveno zmanjšamo višino škode in zagotovimo varnost prebivalstva na posameznemu prostoru. S tem pa pomembno vplivamo tudi na našo prehransko varnost.

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POMEMBNOST ORGANIZACIJSKIH DEJAVNIKOV DIGITALNE PREOBRAZBE V SLOVENIJI

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Prispevek predstavlja in analizira organizacijske dejavnike, ki vplivajo na digitalno preobrazbo slovenskih podjetij. V ta namen smo izvedli raziskavo z anketo, v kateri je sodelovalo 131 podjetij. V prispevku podajamo pregled rezultatov in jih primerjamo z raziskavo, ki je bila izvedena v letu 2020. Rezultati nakazujejo na relativno dobro razvite osnovne digitalne kompetence, medtem, ko so naprednejše razvite v manjšem deležu podjetij. Anketiranci so pozitivno ocenili digitalno kulturo v podjetjih, ki spodbuja inovativnost, odprto komunikacijo, sodelovanje in avtonomnost pri digitalni preobrazbi podjetja. Kljub temu ugotavljamo, da ima strategijo izobraževanja, usposabljanja in razvijanja digitalnih kompetenc manj kot polovica podjetij. Le v približno tretjini podjetij razvijajo naprednejše digitalne kompetence za inoviranje poslovnih modelov. Razvijanje naprednih digitalnih kompetenc in sprejemanje novih digitalnih tehnologij sta področji, ki sta povezani z inovativnostjo. Prav zato bodo morala vodstva podjetij vlagati v njun razvoj.

Ključne besede:

digitalna
preobrazba,
organizacijski
dejavniki
digitalna
kultura,
podjetja,
Slovenija

IMPORTANCE OF ORGANIZATIONAL FACTORS FOR DIGITAL TRANSFORMATION IN SLOVENIA

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This paper presents and analyses organizational factors that influence the digital transformation of Slovenian enterprises. For this purpose, we conducted the survey in which 131 participated enterprises. In the paper, we provide an overview of the results and compare them with a survey conducted in 2020. The results indicate relatively well-developed basic digital competencies, while advanced digital competences are developed in a smaller proportion of enterprises. Respondents positively rated the digital culture, which promotes innovation, open communication, collaboration, and autonomy in the enterprises. Nevertheless, we found out that less than a half of the enterprises have established a strategy for development of digital competencies. Only about a third of enterprises are developing advanced digital competencies for business models innovation. The development of advanced digital competencies and the adoption of new digital technologies are areas associated with innovation potential. Therefore, enterprises must invest in their development in the future.

Keywords:
digital
transformation,
organizational
factors,
digital
culture,
enterprises,
Slovenia

1 Uvod

Digitalne tehnologije imajo vse bolj pomembno vlogo pri zagotavljanju konkurenčnosti organizacij. Predstavljajo temelj za digitalno preobrazbo, ki jo opredelimo kot proces, pri katerem organizacije uporabljajo digitalne tehnologije (pogostokrat njihovo kombinacijo) za poenostavitev poslovanja, povečanje učinkovitosti, spreminjanje načina dela zaposlenih, vzpostavljanje izboljšanih odnosov s kupci, dobavitelji in partnerji, inoviranje poslovnih modelov, izdelkov in storitev (Jeansson & Bredmar, 2019; Pucihar et al., 2021; Vial, 2019; Warner & Wäger, 2019). Digitalne tehnologije povzročajo organizacijske spremembe (Hanelt et al., 2020; Matt et al., 2015). Prav digitalne tehnologije v zadnjih letih predstavljajo strateški vir vsake organizacije (Nadkarni & Prügl, 2020; Pucihar et al., 2021; Zammuto et al., 2007).

Pomembno je razumevanje, da morajo organizacije za uspešno in učinkovito izrabo priložnosti, ki jih ponujajo digitalne tehnologije poleg tehnološke infrastrukture vzpostaviti tudi ustrezne organizacijske zmogljivosti, ki zajemajo ustrezne kompetence in znanja zaposlenih (Pucihar et al., 2021), drugačne načine vodenja (Foerster-Metz et al., 2018; He et al., 2023; Ko et al., 2022; Pucihar et al., 2021; Vijay Gurbaxani & Debora Dunkle, 2019) in drugačno kulturo organizacije (digitalna kultura) (Li et al., 2018; Liu et al., 2011; Pucihar et al., 2021). Brez tega in ustrezne strategije (Li et al., 2018; Pucihar, 2020; Vijay Gurbaxani & Debora Dunkle, 2019), organizacije ne bodo sposobne zajeti prednosti uporabe digitalnih tehnologij in dosežati visoko stopnjo digitalne preobrazbe.

Za načrtovanje digitalne preobrazbe je pomembno, da organizacije in države poznajo trenutno stanje, v katerem se nahajajo. Za ocenjevanje le te poznamo vrsto pristopov in uveljavljenih modelov. Na evropskem in nacionalnem nivoju je najbolj poznan DESI indeks. Slovenija je v letu 2022 11. mestu med državami članicami (European Commission, 2022). DESI indeks se osredotoča na merjenje človeškega kapitala, povezljivosti, integracije digitalnih tehnologij v poslovanju in digitalizacije javnih storitev. Poleg tega so se v zadnjih letih pojavili številni modeli, ki omogočajo merjenje stanja v posameznih organizacijah. V Sloveniji je bil razvit nacionalni model za ocenjevanje digitalne zrelosti v okviru Digitalnega inovacijskega stičišča Slovenije (Kljajić Borštnar & Pucihar, 2021). Uporaba omenjenega modela omogoča organizaciji vpogled v doseženo stanje na poti digitalne preobrazbe.

Omeniti velja, da različne raziskave, metrike in modeli ponujajo različen vpogled v doseženo stanje bodisi posamezne organizacije bodisi celotne populacije. Pogostokrat širše raziskave (usklajene na nivoju EU) ne ponujajo vpogleda v določeno, specifično področje (Pucihar et al., 2021). Zato so dobrodošle tudi druge vrste raziskav, ki podajajo vpogled v dogajanje med organizacijami in v družbi. To je še posebej pomembno za državo in druge deležnike odločevalce, saj bodo ti le na podlagi čim več informacij lahko zagotovili ustrezne spodbude za razvoj omenjenega področja (European Commission, 2023).

Uvodoma smo pojasnili pomembnost organizacijskih dejavnikov na poti digitalne preobrazbe. Ker dosedanje raziskave ponujajo malo informacij o doseganju zelene stopnje zrelosti organizacijskih dejavnikov na poti digitalne preobrazbe, smo v ta namen pripravili raziskavo, ki smo jo izvedli med organizacijami v Sloveniji. V nadaljevanju v prispevku podajamo pregled literature na področju pomembnosti organizacijskih dejavnikov pri digitalni preobrazbi in prikažemo preliminarne rezultate raziskave, ki je v teku. Izpostavljamo podatke o opredeljeni strategiji, doseženih digitalnih kompetencah, njihovem načinu zagotavljanju in področij razvoja, načinih vključevanja zaposlenih v uvajanje novih tehnologij in o digitalni kulturi, vzpostavljeni v podjetju. Sledita diskusija rezultatov in zaključki.

2 Organizacijski dejavniki digitalne preobrazbe

Organizacijsko zmogljivost opredelimo kot zmožnost organizacije, da izvaja koordinirane naloge z uporabo organizacijskih virov za doseganje ciljev. Organizacijske zmogljivosti imajo pomembno vlogo pri doseganju ciljev digitalne preobrazbe. Pri tem je pomemben vidik dinamičnih zmogljivosti, ki omogočajo odzivanje na hitre spremembe iz okolja in pripomorejo k doseganju konkurenčne prednosti (Konopik et al., 2022). Dinamično zmogljivost organizacije določata hitrost in stopnja prilagajanja virov organizacije (in s tem povezani stroški) ter sposobnost prilagajanja poslovnega modela potrebam strank (trga). Organizacije morajo neprestano spremljati in izrabljati priložnosti in po potrebi preoblikovati svoje strukturo, poslovanje in kulturo, da se lahko soočajo z novimi pretnjami in priložnostmi iz poslovnega okolja (Teece, 2018)

Predhodne raziskave so pokazale pomembnost digitalnih kompetenc, kreativnosti in sposobnosti inoviranja kot pomembnih organizacijskih dejavnikov pri digitalni preobrazbi (El Sawy et al., 2016; Muehlburger & Koch, 2019; Pucihar et al., 2021). Dalje je zelo pomembna organizacijska kultura, ki spodbuja inovativnost, kreativnost, podjetniško naravnano miselnost, učenje na napakah, spodbujanje generiranja novih idej, sprejemanje rizika in eksperimentiranja, tekmovalnosti, podpora managementa spremembam in konstruktivno upravljanje konfliktov kot osrednje organizacijske vrednote (Bärenfänger & Otto, 2015; Kane et al., 2015; Muehlburger & Koch, 2019). Sodelovanje znotraj organizacije in vključevanje deležnikov izven organizacije v inovacijski proces (odprto inoviranje) prav tako pomembno prispeva k digitalni kulturi organizacije (Chesbrough, 2006; El Sawy et al., 2016; Hylving, 2015; Muehlburger & Koch, 2019). Ustrezna kultura organizacije predstavlja pomemben temelj za uspešno digitalno preobrazbo (Hanelt et al., 2020; Nadkarni & Prügl, 2020).

Za načrtovanje digitalne preobrazbe organizacije v zadnjih letih poleg poslovne strategije vzpostavljajo tudi strategijo digitalizacije (Hanelt et al., 2020; Kane et al., 2015; Pucihar et al., 2021). Vloga in podpora managementa ima izjemen pomen pri zastavljanju in doseganju ciljev organizacije, kar velja tudi pri načrtovanju in izvajanju digitalne preobrazbe (Kane et al., 2015; Muehlburger & Koch, 2019; Pucihar et al., 2021). Vse večje priložnosti, ki jih prinašajo digitalne tehnologije in dinamika poslovnega okolja narekujejo drugačne vloge managementa. Pri tem je pomembno, da management vzpostavi skupno razumevanje, da digitalne tehnologije predstavljajo strateški vir organizacije in da za učinkovito izrabo njihovih potencialov organizacije vzpostavijo tudi vodjo področja. V praksi lahko zasledimo različne vloge pod skupnim imenovalcem digitalnega voditeljstva (vodja digitalizacije, vodja digitalne preobrazbe, vodja inovacij in digitalne preobrazbe itd.) (El Sawy et al., 2016; Hanelt et al., 2020; Muehlburger & Koch, 2019; Nadkarni & Prügl, 2020; Pucihar et al., 2021; Tijan et al., 2021).

3 Metodologija raziskave

Za namen raziskave smo pripravili anketni vprašalnik, ki smo ga sestavili v sodelovanju raziskovalcev Fakultete za organizacijske vede Univerze v Mariboru s predstavniki Gospodarske zbornice Slovenije – IKT horizontalna mreža in drugimi strokovnjaki področja.

Vprašalnik sestoji iz 43ih vprašanj. Anketa je bila izvedena v letih 2022 in 2023. Vsebinsko vprašalnika smo testirali z 10imi anketiranci. Vprašanja se nanašajo na podatke o anketirancu in podjetju ter o organizacijskih ter tehnoloških dejavnostih digitalne preobrazbe. V tem referatu se usmerjamo na organizacijske dejavnike.

Anketni vprašalnik smo sestavili v orodju 1ka, ki omogoča spletno vzpostavitev vprašalnika. Povezava do vprašalnika je bila javna. Sodelujoči deležniki smo jo posredovali prek različnih obvestil v širšo javnost. Raziskava je v teku. Na vprašalnik je odgovorilo 131 predstavnikov podjetij.

4 Rezultati

4.1 Podatki o anketiranih podjetjih

V raziskavi je sodelovalo 131 podjetij iz različnih dejavnosti. Največji delež predstavljajo podjetja IKT (28%), sledijo podjetja z drugih raznovrstnih poslovnih dejavnosti (16%), predelovalne dejavnosti (8%), strokovne, znanstvene in tehnične dejavnosti (8%) in druge dejavnosti (8%), kmetijstvo (6%) in gradbeništvo (5%). Največji delež sodelujočih predstavljajo mikro podjetja (56%), sledijo mala (26%), srednje velika (10%) in velika (8%) podjetja. Na anketo so večinoma odgovarjali direktorji (49%), sledijo vodje področij (20%), informatiki (9%) in vodje informatike (8%) in zaposleni na drugih delovnih mestih.

4.2 Strategija digitalne preobrazbe in njeno izvajanje

V polovici podjetij je za vodenje digitalne preobrazbe odgovoren direktor, v 14% podjetij vodja digitalizacije in v 10% vodja informacijske tehnologije. Ostala podjetja so navedla druge odgovorne osebe kot na primer vodja marketinga, vodja projektov, projektni vodja, direktor in razvojni direktor). Le 22% anketiranih organizacij ima formalno zapisano strategijo digitalne preobrazbe, več kot polovica digitalne preobrazbe nima opredeljene (54%), v 24% anketiranih podjetij pa je ta v postopku izdelave. Polovica podjetij digitalno preobrazbo izvaja, medtem, ko jih le 7% podjetij ne načrtuje izvajanje digitalne strategije. Ostala podjetja načrtujejo izvajanje digitalne preobrazbe v prihodnjih letih.

4.3 Digitalne kompetence

Manj kot polovica podjetij ima strategijo izobraževanje, usposabljanja in razvijanja digitalnih kompetenc (41%). Skoraj polovica podjetij (48%) ocenjuje, da imajo zaposleni napredna znanja in veščine, ki jih tudi stalno nadgrajujejo. Osnovne digitalne kompetence imajo zaposleni v 35% podjetij. V 17% podjetij pa zaposleni nimajo zadostnih digitalnih kompetenc.

Glede zagotavljanja izobraževanja največ podjetij omogoča sodelovanje zaposlenih na konferencah, seminarjih in delavnicah (55%), sledi samoizobraževanje (44%), redna interna izobraževanja zaposlenih (kot na primer prenos znanja, mentorstva, ...) (37%). Podrobnejši rezultati so prikazani na Sliki 1.

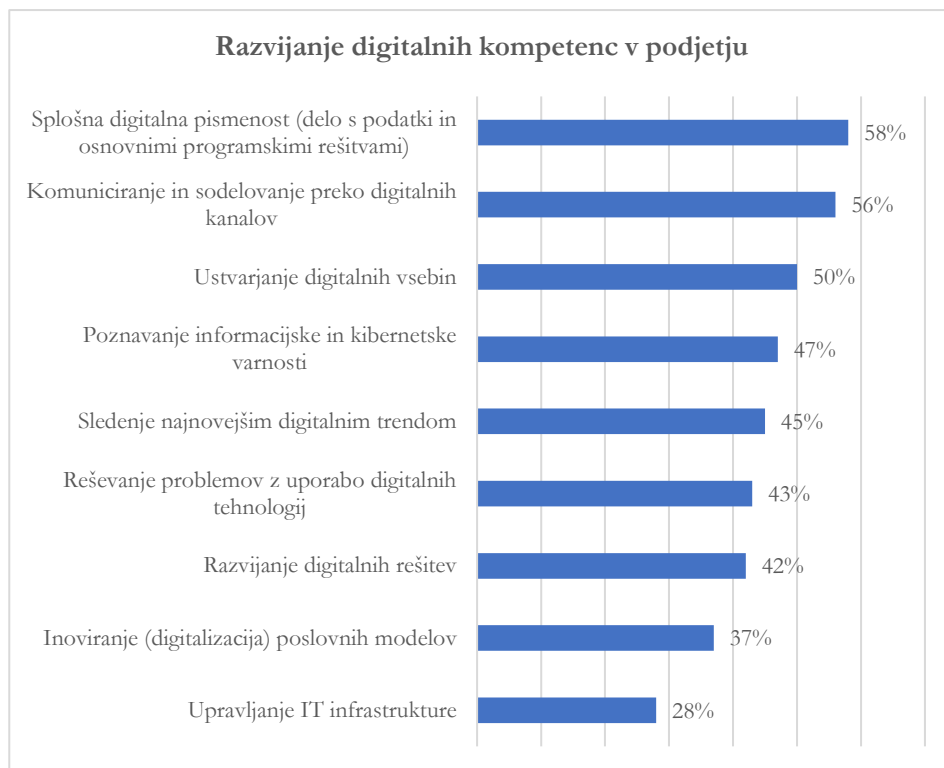


Slika 1: Načini zagotavljanja izobraževanja zaposlenih in razvoj digitalnih kompetenc

Vir: lasten

Podjetja smo vprašali tudi o vrstah digitalnih kompetenc, ki jih razvijajo v podjetju (Slika 2). V več kot polovici podjetij razvijajo splošno digitalno pismenost kot na primer delo s podatki in osnovnimi programskimi rešitvami (58%), komuniciranje in sodelovanje preko digitalnih kanalov (56%), ustvarjanje digitalnih vsebin (50%). Sledi razvijanje kompetenc poznavanja informacijske in kibernetске varnosti (47%),

sledenje najnovejšim digitalnim trendom (45%) in reševanje problemov z uporabo digitalnih tehnologij (43%). Manj poudarka v podjetjih dajejo na razvijanje kompetenc za inoviranje in digitalizacijo poslovnih modelov (37%) in upravljanje IT infrastrukture (28%).



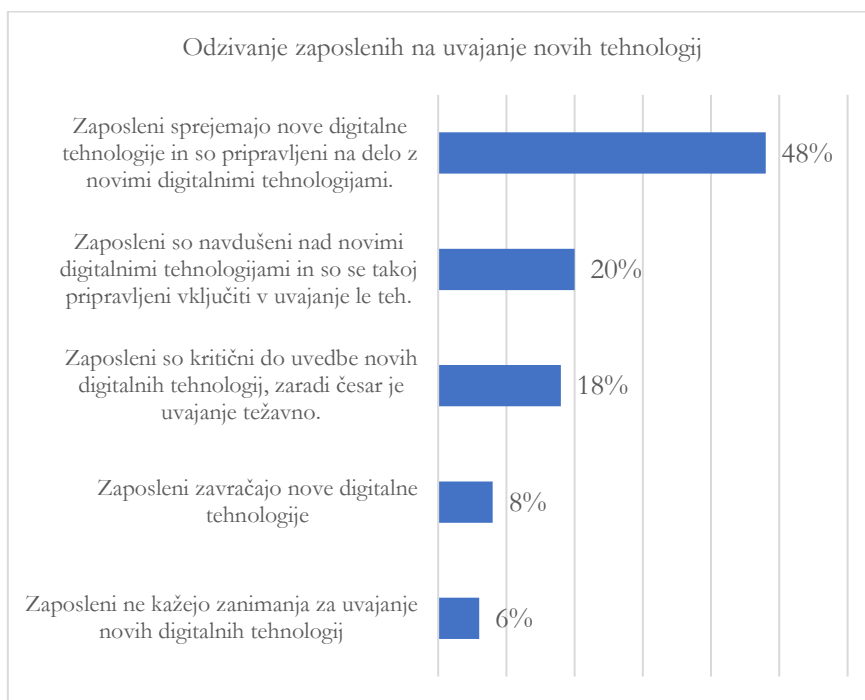
Slika 2: Vrste digitalnih kompetenc, ki jih razvijajo v podjetju

Vir: lasten

4.4 Odzivi zaposlenih na uvajanje novih tehnologij

V 66% podjetij so zaposleni vključeni v načrtovanje in uvajanje novosti. V 14% podjetij so zaposleni seznanjeni s procesom uvajanja novih tehnologij, v 21% pa so zaposleni seznanjeni z novostmi šele po uvedbi.

V manj kot polovici anketiranih podjetij zaposleni sprejemajo nove digitalne tehnologije in so pripravljeni na delo z njimi (48%). V približno petini podjetij so zaposleni navdušeni nad novimi tehnologijami in so se pripravljene vključiti v uvajanje le-teh. V manjšem deležu anketiranih podjetij zaposleni ne kažejo zanimanja za uvajanje novih digitalnih tehnologij (6%) (Slika 3).



Slika 3: Odzivanje zaposlenih na uvajanje novih tehnologij

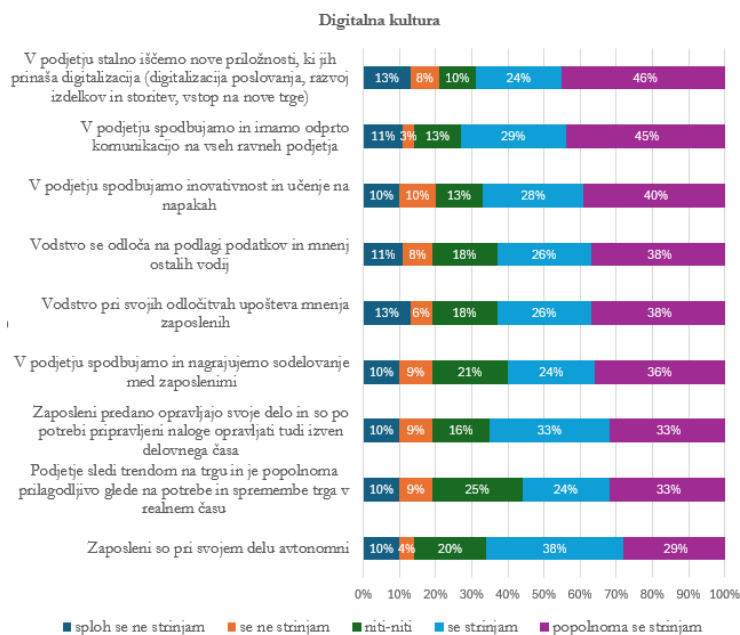
Vir: lasten

Najpogostejši razlogi za zavračanje novih tehnologij s strani zaposlenih so nepoznavanje priložnosti, strah pred izgubo zaposlitve, pomanjkanje znanja, dodatne obremenitve z izobraževanjem in delovnimi nalogami.

4.5 Digitalna kultura

Anketiranci so zelo ugodno ocenili digitalno kulturo v podjetjih. Prevladuje mnenje, da v podjetjih stalno iščejo nove priložnosti, ki jih prinaša digitalizacija, podjetja spodbujajo in imajo odprto komunikacijo, spodbujajo inovativnost in učenje na

napakah, vodstvo se odloča na podlagi podatkov in mnenj ostalih vodij in pri svojih odločitvah upošteva mnenja zaposlenih. Prav tako v podjetjih spodbujajo in nagrajujejo sodelovanje med zaposlenimi, zaposleni predano opravljajo svoje delo, tudi po potrebi izven delovnega časa ter so pri svojem delu avtonomni. Podrobnejši rezultati so prikazani na Sliki 4.



Slika 4: Dejavniki digitalne culture

Vir: lasten

5 Diskusija

Pri načrtovanju in doseganju ciljev digitalne preobrazbe ima pomembno vlogo management. Prepoznavanje digitalnih tehnologij kot strateškega vira organizacije se odraža v oblikovani strategiji in razporeditvi virov za vodenje in izvajanje digitalne preobrazbe (Hanelt et al., 2020; Kane et al., 2015; Pucihar et al., 2022). Rezultati raziskave so pokazali, da je v polovici podjetij za vodenje digitalne preobrazbe odgovoren direktor. Le 14% podjetij ima za vodenje digitalne preobrazbe določenega vodjo področja, kar zmanjšuje priložnosti za celovito izrabo priložnosti digitalne preobrazbe. Zanimivo je, da več kot polovica podjetij nima vzpostavljene strategije digitalne preobrazbe, medtem, ko jo ima formalno opredeljeno približno

petina podjetij. Polovica anketiranih podjetij navaja, da že izvajajo digitalno preobrazbo. Področje digitalne preobrazbe zajema celotno organizacijo. Zajema identifikacijo priložnosti uporabe digitalnih tehnologij in načrtovanje ter razporejanje virov za doseganje ciljev organizacije. Digitalna strategija povezuje in usklajuje poslovno strategijo z drugimi strategijami organizacije, vključno z IT strategijo, ki morajo biti za doseganje rezultatov med seboj usklajene (Levstek et al., 2022; Pucihar et al., 2021). Kljub temu, da ima manj kot polovica podjetij vzpostavljeno strategijo digitalne preobrazbe, opažamo v primerjavi z letom 2020 izboljšanje, saj je takrat imelo vzpostavljeno strategijo digitalne preobrazbe imelo le približno tretjina organizacij (Pucihar et al., 2022). Tudi v letu 2022 je v skoraj polovici anketiranih podjetij za digitalno preobrazbo bil odgovoren direktor. Le v 10ih odstotkih pa vodja področja digitalne preobrazbe. Tudi na tem področju opažamo manjše izboljšanje (4%).

Kljub temu, da konkurenčnost danes temelji na inovativnosti in sposobnosti izrabe digitalnih tehnologij (Hanelt et al., 2020; Pucihar et al., 2021), kjer ima znanje ključno vlogo, ugotavljamo, da ima strategijo izobraževanja, usposabljanja in razvijanja digitalnih kompetenc manj kot polovica podjetij. Kljub temu pa skoraj polovica podjetij ocenjuje, da imajo zaposleni napredna znanja in veščine, ki jih stalno nadgrajujejo, kar je povezano tudi z rezultati, da v približno enakem deležu podjetij zaposleni sprejemajo nove digitalne tehnologije in so pripravljeni na delo z njimi. Med najbolj priljubljenimi načini izobraževanja zaposlenih so konference, seminarji in delavnice ter samoizobraževanja. V podjetjih razvijajo predvsem splošno digitalno pismenost, ki zajema delo s podatki in osnovnimi programskimi rešitvami, komuniciranje in sodelovanje preko digitalnih kanalov, ustvarjanje digitalnih vsebin.

Le v približno tretjini podjetij razvijajo naprednejše digitalne kompetence za inoviranje poslovnih modelov. V še manjšem deležu podjetij (približno petini) so zaposleni navdušeni nad novimi tehnologijami in so se pripravljene vključiti v uvajanje le-teh. Najpogostejši razlogi za zavračanje novih tehnologij s strani zaposlenih v anketiranih podjetjih so nepoznavanje priložnosti, strah pred izgubo zaposlitve, pomanjkanje znanja, dodatne obremenitve z izobraževanjem in delovnimi nalogami. Podatki so primerljivi s podatki Statističnega urada RS, kjer je bilo ugotovljeno, da skoraj tretjini podjetij primanjkuje ustreznih kadrov ali znaj, potrebnih za digitalno preobrazbo (SURS, 2021). Razvijanje naprednih digitalnih

kompetenc in sprejemanja novih digitalnih tehnologij sta področji, ki sta povezani z inovativnostjo. Prav zato bodo morala vodstva podjetij vlagati v njun razvoj.

Anketiranci so zelo ugodno ocenili dejavnike digitalne kulture v podjetju. Prevladuje mnenje, da v podjetjih stalno iščejo nove priložnosti, ki jih prinaša digitalizacija, podjetja spodbujajo in imajo odprto komunikacijo, spodbujajo inovativnost in učenje na napakah, vodstvo se odloča na podlagi podatkov in mnenj ostalih vodij in pri svojih odločitvah upošteva mnenja zaposlenih. Prav tako v podjetjih spodbujajo in nagrajujejo sodelovanje med zaposlenimi, zaposleni predano opravljajo svoje delo, tudi po potrebi izven delovnega časa ter so pri svojem delu avtonomni. Vse to so karakteristike digitalne kulture, ki je izjemnega pomena pri vzpostavljanju (dinamičnih) zmogljivosti organizacije za doseganje ciljev digitalne preobrazbe (Kane et al., 2015; Muehlburger & Koch, 2019; Pucihar et al., 2021).

6 Zaključek

V prispevku se predstavljamo pomembnost organizacijskih dejavnikov za doseganje ciljev digitalne preobrazbe. Predhodne raziskave na področju digitalne preobrazbe so večinoma usmerjene na merjenje izrabe priložnosti digitalnih tehnologij in so manj usmerjene v proučevanje vloge organizacijskih dejavnikov oziroma zmogljivosti organizacije za odzivanje na dinamične spremembe v okolju z uporabo digitalnih tehnologij.

V ta namen smo pripravili anketni vprašalnik, na katerega je odgovorilo 131 podjetij. V prispevku podajamo rezultate in jih primerjamo z raziskavo, ki je bila izvedena v letu 2020.

Ugotavljamo manjše izboljšanje stanja na področju vzpostavljene strategije in vodenja digitalne preobrazbe. Zanimivo je, da rezultati nakazujejo na relativno dobro razvite osnovne digitalne kompetence, medtem, ko so naprednejše razvite v manjšem deležu podjetij. Zaključimo lahko, da bo na področju razvoja naprednejših digitalnih kompetenc potrebno v prihodnosti nameniti več pozornosti, da bodo organizacije lahko vzpostavile inovacijsko kulturo.

Zanimivo je tudi, da so anketiranci označili relativno visoko stopnjo vzpostavljene digitalne kulture v organizacijah. Tu velja opozoriti, da so na vprašalnik odgovarjali

vodstveni delavci, odgovori na vprašanja pa so lahko do določene mere tudi subjektivni, kar je omejitev raziskave.

Prav tako je omejitev raziskave, da je ta bila izvedena na relativno majhnem vzorcu podjetij, ki ni bil naključno izbran. Na vprašalnik so odgovorila podjetja, ki so zasledila povabilo k anketiranju v digitalnih medijih.

Za razumevanje organizacijskih dejavnikov in njihovega vpliva, bi bilo smiselno proučiti primere dobre prakse digitalne preobrazbe podjetij s poglobljeno študijo primera. Le tako bi lahko povezali teorijo s prakso in potrdili vplivne organizacijske dejavnike. Njihovo pomembnost pa bi lahko v nadaljevanju potrdili z anketiranjem v širši populaciji.

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GOODBYE CSR? - ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) FACTORS IN TOURISM

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The study examines whether the growing popularity of the ESG approach could result in the decline or disappearance of the CSR concept, which has encountered numerous challenges in practical implementation. The question is analyzed in the context of the tourism sector. After introducing the relationship between CSR and ESG, this paper examines the connection between responsibility and tourism, with a focus on sustainability in the sector under study. The empirical research methodology used is bibliometric analysis, which involves 924 studies using Publish or Perish (PoP) software and PRISMA methodology. The analysis has explored the relationship between sustainability and tourism, as well as between tourism and ESG. The bibliometric maps reveal a strong relationship between CSR and ESG concepts in the study area. It is important to note that ESG does not replace CSR, but rather provides a measurement and framework for it to address its problems. In the tourism sector, the ESG field is dominated by the first 'E' pillar, meaning that sustainability is mainly focused on environmental and natural aspects, while social or even economic sustainability, and ethics are less prominent.

Keywords:

sustainable tourism, CSR, corporate social responsibility, ESG, bibliometric analysis

1 Introduction

In recent years, there has been an increasing focus on addressing the shortcomings and unanticipated negative effects of the CSR concept. Bajic and Yurtoglu (2018) draw attention to the problem of measuring CSR in a heterogeneous or even particular way, which can obscure the real driver(s) of CSR. They propose the ESG approach as a general measurement tool for CSR. Szczanowicz and Saniuk (2016) identified trends for improving CSR in the SME sector by examining CSR assessment and reporting models. The authors developed an assessment model based on monitoring and reporting ESG risks. In addition, some studies have used ESG approximations or specific ESG databases to measure CSR performance, such as the Bloomberg ESG database (Wang et al., 2017; Taylor et al., 2018).

What are the similarities and differences between CSR and ESG that could lead to the conclusion that ESG can solve the problems of CSR measurement and prevent color washing (whitewashing, greenwashing, etc.) practices while being suitable for measuring CSR? ESG stands for Environment, Social, and Governance pillars, and primarily refers to a set of criteria that investors can use to make decisions. The aim of ESG is to enable organizations, such as companies, and countries, to shift from a short-term profit-maximizing mindset to a longer-term and ethical profit-maximizing one. Csapi and Balogh (2020) have shown that profitability and size can contribute to competitiveness growth for SMEs, while ESG is playing an increasingly important role in the perception of companies. The three pillars of ESG (Environmental, Social, and Governance) have been present in CSR (Corporate Social Responsibility) measurement solutions. ESG and CSR are similar in essence, but they are carried out by different groups of people. CSR describes a company's socially responsible commitment, efforts, and practices and is often used by the corporate side. ESG is a term used by asset managers and investors to assess corporate behavior and identify financial risks and growth opportunities for companies. CSR and ESG are becoming cornerstones of corporate success by improving companies' reputation, innovation, risk management, and revenues (Godfrey et al., 2009; Porter-Kramer, 2011; Sen et al., 2016).

Although this paper does not cover all the problems related to CSR, it is important to note that consumers have become increasingly skeptical. CSR has been an unregulated field for a long time since its emergence in practice, with no accurate

measurement and reporting standards. The International Organization for Standardization (ISO, 2010) introduced ISO 26000:2010 to clarify the practice of CSR. This standard lists several criteria and standards for socially responsible practices of public and private sector companies. However, CSR was perceived by many organizations as a new marketing communication tool with no real substance, causing the concept to erode. ESG presents an opportunity to renew and integrate previous content and concepts in a more verifiable form, primarily aimed at investors and decision-makers. While it may still influence consumer decisions, ESG's primary target group is investors, unlike CSR.

ESG evaluates companies based on their environmental, social, and governance efforts, like CSR, but with a more integrated approach. The reporting of ESG scores has significantly increased in recent decades. According to the KPMG International Survey on Corporate Responsibility Reporting 2017, the reporting rate of N250 companies (the 250 largest companies in the Fortune Global 500) has remained stable at 90-95% over the past four years. For N100 companies, there is a steady catch-up, with a current rate of 75 percent (Cheffi et al., 2021).

The practical implementation of CSR has been imperfect, which has tarnished its reputation and called its credibility into question. The theoretical concept of CSR should not disappear but rather be renewed and reborn in a more reliable and credible form, eliminating the problems. This is where the concept of ESG can be useful. The following analysis examines whether international literature supports our ideas and whether CSR is being replaced by ESG by narrowing the analysis to tourism industry.

2 Tourism and ESG

Firstly, our study explores how ESG can be understood in tourism and how responsibility and sustainability are reflected in this sector. Tourism is a significant industry that promotes economic development and generates income in many countries. However, the rapid growth of tourism has resulted in negative impacts on the environment and host communities and societies (Forster, 1964; Pizam, 1978; van der Borg et al., 1996; Fun et al., 2014; Baloch et al., 2023; Alamineh et al., 2023). It is important to note that ESG considerations are becoming increasingly important in the tourism industry, and businesses must take responsibility for their impact on

the environment and society. The concept of sustainable tourism aims to mitigate negative impacts while promoting economic growth and preserving natural resources for future generations (Harris et al., 2012; UNWTO, 2017; Job et al., 2017; Fennell-Cooper, 2020; Peng, 2021). However, there is no uniform understanding of this concept.

The World Economic Forum Travel & Tourism Development Index 2021 (TTDI) represents the first indication of an ESG approach in the tourism sector. It enables sustainable and resilient development of the sector, marking a shift from the previous competitiveness-focused Travel & Tourism Competitiveness Index (TTCI). The TTDI index evaluates destinations based on five pillars: (1) enabling environment, which includes ethical tourism and economic sustainability, (2) policy and enabling conditions, (3) infrastructure, (4) demand drivers, which reflect social sustainability and destination stewardship, and (5) sustainability, with a focus on environmental sustainability (World Economic Forum, 2022). How can sustainable tourism be defined based on all of this? We are discussing a form of tourism that adopts a responsible approach to travel and seeks to reduce adverse effects on the environment while promoting cultural and social awareness, as well as contributing to economic development. According to the World Tourism Organization (WTO), sustainable tourism fully considers its present and future economic, social, and environmental impacts while also taking into account the needs of visitors, the industry, the environment, and host communities (UNWTO, 2017).

Sustainable tourism has numerous benefits for local communities. These include preserving natural resources and cultural heritage, creating jobs, supporting local businesses, and generating income. Additionally, it can contribute to reducing poverty, improving living standards, and increasing social well-being. Sustainable tourism can provide environmental benefits, including biodiversity and ecosystem conservation, pollution and greenhouse gas emission reduction, and sustainable use of natural resources (Bramwell-Lane, 1993; Neto, 2003; Jarvis et al., 2010; Harris et al., 2012; Saarinen, 2019; Fennell-Cooper, 2020). However, sustainable tourism faces several challenges, such as balancing economic development with environmental protection. The pursuit of economic growth may result in the exploitation of natural resources and harm to the environment, which can compromise the sustainability of tourism. Furthermore, the challenge of sustainable tourism lies in the lack of awareness and understanding among stakeholders and the general public, as well as

the absence of clear metrics for measuring success. Addressing these issues will require a collective effort to increase awareness, promote education, and establish policies and regulations that promote sustainable tourism (Bramwell-Lane, 1993; McMinn, 1997; Jarvis et al., 2010; UNWTO, 2017; Pan et al., 2018).

Sustainable or responsible tourism involves various elements that follow the principles of sustainable development and have a positive impact on the environment, local communities, and the economy. This definition is based on the works of Harris et al. (2012), Swarbrooke (2014), UNWTO (2017), Pan et al. (2018), and Gonda-Rátz (2023):

- Environmental sustainability involves minimizing the impact of tourism on the environment through sustainable practices such as reducing carbon emissions, conserving natural resources, and protecting biodiversity. Tourism businesses can achieve environmental sustainability by implementing environmentally friendly policies such as energy-efficient operations, waste management, and water conservation.
- Social sustainability in tourism development involves promoting social equity, cultural diversity, and community involvement. Tourism enterprises can achieve social sustainability by supporting local businesses, promoting cultural awareness, respecting local customs and traditions, and involving local communities in decision-making processes.
- Economic sustainability involves ensuring that tourism generates economic benefits for local communities while contributing to the long-term economic development of the region. Tourism businesses can achieve economic sustainability by promoting sustainable employment, supporting local businesses, and investing in community infrastructure.
- Ethical tourism involves promoting ethical behavior among tourism stakeholders, including tourists, tourism businesses, and local communities. Ethical tourism practices involve promoting animal welfare, respecting human rights, and ensuring fair labor practices.
- Destination Stewardship involves managing tourism development in a way that preserves its natural and cultural heritage. Tourism businesses can achieve destination stewardship by adopting sustainable tourism practices,

such as reducing the impact of tourism on the environment and promoting the conservation of natural resources and cultural heritage.

Instead of the broad and general approach, there is no consensus in the literature regarding the concept of sustainable tourism and its relationship to responsible tourism. Some approaches combine them as 'sustainable and responsible tourism' (UNWTO, 2012; Mihalic et al., 2021). Additionally, although sustainable tourism is dominant, 'green tourism' and 'ecotourism' are also used as synonyms (Mihalic et al., 2021; Saarinen, 2021). In our research, we examine these concepts separately in order to gain a comprehensive picture of this area of tourism. We use Pan et al.'s (2018) segments as a basis, we can identify the ESG elements - environmental, social, and corporate governance pillars - for tourism (see Figure 1). The E (environmental) pillar encompasses alternative and ecotourism, as well as carbon footprint reduction. The S (social) pillar includes elements related to culture and community, while the G (governance) pillar includes newer types of economic models, such as circular economy or behavioral economics.

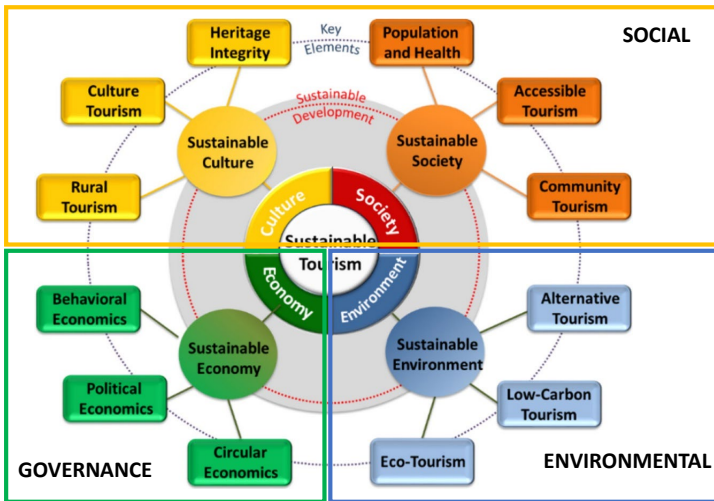


Figure 1: Classification of specific areas of sustainable tourism into ESG pillars
Source: Pan et al. (2018, 454.) is supplemented by the authors' ESG categorisation

In conclusion, sustainable tourism is a concept that promotes responsible travel, seeks to minimize negative impacts on the environment, and fosters economic development. It brings several benefits, including the conservation of natural resources and cultural heritage, the preservation of communities, economic model change, new governance mechanisms that create jobs, support local businesses, and generate income. After explaining the concept of sustainable tourism and the ESG pillars in tourism, we will compare the popularity of CSR and ESG in the tourism industry.

3 Tourism and Corporate Social Responsibility (CSR) or Environmental, Social, and Governance (ESG)? A Bibliometric Analysis

3.1 Methodology of bibliometric analysis

The research question stated above is addressed through bibliometric analysis. Bibliometric analysis enables the discovery, processing, and analysis of large amounts of scientific data, illustrating the development of a given field and highlighting current research trends. Mukherjee et al. (2022) state that high-quality bibliometric analyses can advance a field by identifying research gaps and defining new research directions. To establish the basis for a systematic literature review and bibliometric analysis, we used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) method (Moher et al., 2009). This method is widely used in the literature to ensure clear, objective, and transparent analysis.

The keywords were selected through the literature review and based also on Pan et al. (2018) classification. The following keywords were used in our search and were separated using a Boolean operator, i.e., if any of the following terms matched, the studies could be selected: 'sustainable tourism' OR 'green tourism' OR 'responsible tourism' OR 'ecotourism' OR 'cultural tourism' OR 'circular tourism'. Sustainable tourism was first mentioned in 1995 in the Charter for Sustainable Tourism at the first World Conference on Sustainable Tourism. However, some authors, such as Mihalic et al. (2021), attribute its appearance to the academic debate on the sustainability of tourism following the publication of the Brundtland Report. This study examines studies published between 1990 and 2023.

We used the Publish or Perish (PoP) software for scientometric analysis, which can also contribute to mapping a concept or related studies using other databases. The PoP software uses, among others, the freely accessible Google Scholar database, covering a wide range of scientific publications. Through the use of keywords, a detailed search can be initiated on Google Scholar within the specified time interval.

However, the only disadvantage is that during this period, we can only collect and examine the first thousand hits. Running the search under the conditions above allowed for creating a sample of 1000 elements, but its review is necessary as part of the PRISMA method. The PoP software and Google Scholar search do not allow for the inclusion of non-English language studies in the sample, and only focus on studies published in scientific journals. Therefore, we conducted a review and removed studies that were not written in English based on their titles, as well as book excerpts, book reviews, and conference papers. As a result, we narrowed down the original sample of 1000 elements to 824 studies.

The PRISMA method can be divided into four steps:

1. Identification of publications using the Publish or Perish (PoP) software and the Google Scholar database (n=1000).
2. Screening (n=1000): excluded records (language, duplicates) (n=58).
3. Eligibility (n=942): evaluation for acceptability, exclusion of conference proceedings, book reviews and unrelated topics (n=118).
4. Inclusion (n=824): studies that passed the screening were included in the analysis.

3.2 Results of bibliometric analysis

We created a bibliometric science map using the computer program VOSviewer to investigate the topic further. As described by Van Eck and Waltman (2010), this program allows for the investigation of citation relationships between studies and journals, collaborations between researchers, and occurrence relationships between scientific terms and concepts. The VOSviewer employs its own clustering technique (Waltman et al., 2010) to examine clusters at an aggregate level using visualization techniques. One method that can be used is the concept map. This tool visualises the relationship between concept clusters through distances, and each term is marked with a circle. Some terms also have a label, which is only visible for certain

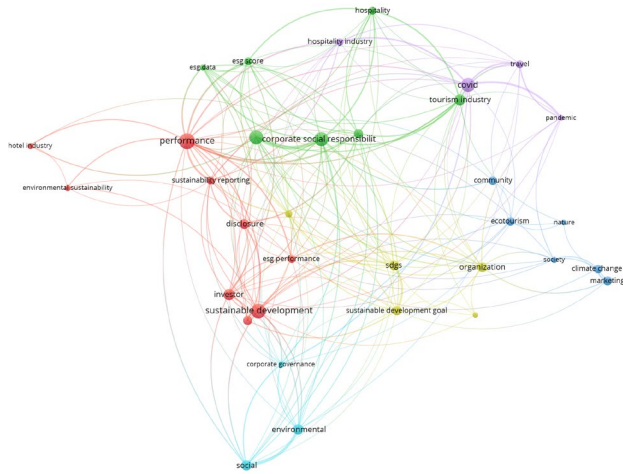


Figure 3: Bibliometric map of sustainable or responsible tourism and ESG

Source: own construction with the Vosviewer program

Based on the results, sustainable and responsible tourism prioritises environmental and natural sustainability over social sustainability, culture, ethics, and destination care. This highlights the significance of the 'E' pillar in ESG, which is also evident in other sectors.

When examining the sustainable or responsible tourism linkages with ESG, we identified six clusters ranked in order of strength: 1. CSR, 2. ESG (including ESG data and scores, country ranking in tourism, and ESG performance at country and company level), 3. Sustainable Development, 4. COVID-19 and hospitality, 5. Corporate Sustainability and SDGs, and 6. Marketing, Community, and Ecotourism.

4 Conclusions

Our study uses bibliometric analysis to investigate whether CSR is still the dominant focus in tourism or whether ESG is emerging as a new priority. The study analyzed 824 papers using the PoP software and PRISMA methodology. The results indicate that the environmental and natural resource aspects of tourism are currently the most prominent. The results indicate that sustainability and sustainable development are becoming more significant in tourism, including ecotourism and responsible

tourism. The link between ESG, CSR, and corporate social responsibility not only remains but has emerged as a distinct cluster and the strongest of the six identified.

This suggests that CSR will continue to exist but will have a new position and function within ESG. It is probable that the experts who predicted that ESG will function more as a measurement and evaluation tool, as a framework, will be correct. Meanwhile, CSR, which has not been able to fulfil this role, or rather has been lacking in this aspect, can support ESG efforts providing appropriate content, activities, and action plans to address the weaknesses and gaps identified by ESG assessments. ESG and CSR can complement each other in the life of companies. The link between ESG and tourism results in a strong focus on natural resources and environment in the ESG approach. However, the social, cultural, economic, and ethical elements of sustainable tourism are less popular. This leads to a more prominent emphasis on Pillar E, which pertains to the natural environment, in publications. This emphasis on Pillar E is not surprising, as it is observed in most sectors. Pillar S and especially Pillar G are much more neglected.

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HIGHER EDUCATION INSTITUTIONS AS PIVOTAL CHANGE AGENTS FOR ENVIRONMENTAL SUSTAINABILITY: A CASE STUDY OF FAZON

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Universities serve as hubs for the creation and dissemination of knowledge – through educating future leaders, fostering scientific research and encouraging development – they pose perfect vessels for sustainable change. These institutions frequently participate in outreach activities, environmental projects, and partnerships to actively interact with their local communities, all the while arranging events, workshops, and campaigns with the aim of increasing awareness about environmental concerns and advocating for sustainable lifestyles. Universities can set an example by adopting sustainable practices on their premises. A “perfect” sustainable university is an educational institution that trains students to become global citizens equipped to address pressing societal concerns and contribute to sustainable development. Precisely for these reasons, the aim of this paper was to investigate implementation of sustainable practices at the University of Belgrade–Faculty of Organizational Sciences. For the purpose of the paper, the authors conducted a survey among faculty and staff members during the academic 2022/2023 year. The results of the survey were analysed using SPSS 24 software package.

Keywords:
environmental
sustainability,
sustainable
development,
HEI,
project
FAZON,
pivotal
change

1 Introduction and context

*"There is no power for change greater than
a community discovering what it cares about."*

– Margaret J. Wheatley

The pursuit of sustainability is directly connected to having the capacity to overcome intricate and multidimensional challenges that lack evident and straightforward resolutions. Professors focusing on sustainability studies and other transdisciplinary fields are responding to a crucial demand of our era: to create and provide high-quality educational courses that effectively help with tackling the most significant, comprehensive, and interconnected group of challenges the human race has ever faced. Environmental issues have reached a critical point in the 21st century and are rapidly escalating (Bonnett, 2007; Mert, 2006). Given the growing environmental challenges, adopting sustainable practices has never been more crucial. As the world contends with issues like climate change, loss of biodiversity, and pollution, the role of institutions in fostering a sustainable future grows increasingly significant (Radaković et al., 2017). Among these, Higher Education Institutions (HEIs) stand out. Sustainability has become a subject of debate in society, demanding higher education to foster innovation, critical thinking, and sustainability-focused skills (Scharmer, 2018; Yanez et al., 2019). HEIs are not only recognized for their innovation, research, and educational offerings, but they are also increasingly recognized as key contributors to environmental sustainability. This study positions HEIs at the vanguard of the sustainability movement, investigating their capacity to act as catalysts for sustainable development (SD) and guardians of the environment, having in mind that HEIs are drivers of social change (Purcell et al., 2019); incubators of talent and innovation (Adams, 2018; Hassan, 2020); creators of “future leaders, decision-makers, and intellectuals across numerous social, political, economic, and academic sectors and areas” (Bai et al., 2017; Radaković et al., 2023); participants in the progress of society (Tomasella et al., 2022).

This paper explores the role of HEIs in fostering environmental sustainability, with a focus on the University of Belgrade–Faculty of Organizational Sciences (FON) and the internally conducted project “FAZON” aimed at increasing and promoting sustainability and sustainable practices at the faculty.

The University of Belgrade is a state university. Over the course of two centuries, the University of Belgrade has played a vital role in serving its community. The past students and faculty of the university have made significant contributions to the advancement of the Republic of Serbia's cultural, scientific, educational, political, and economic spheres. The FON is a HEI that is a part of the University of Belgrade. Its primary focus is on education, scientific research, and consultancy in the fields of management, information systems, and technology. The aim of the faculty is to equip future professionals with the necessary knowledge and skills to unlock the potential of commerce and society. The FON has adopted a "Development strategy 2030" in which it clearly highlights its new politic of an institution that cares about the environment and strives to achieve as many sustainable development goals as possible. In this context, the faculty has supported an internally project of the Centre for environmental management and sustainable development – "FAZON".

Conducting a survey during the academic year 2022/2023, the authors analysed the attitudes and habits of FON staff on sustainable practices and the implementation of sustainable measures, including renewable energy adoption, waste reduction, recycling promotion, and water management solutions. Moreover, the study underscored the proactive involvement of staff in promoting sustainability through various initiatives. Ultimately, the paper aims to shed light on the pivotal role universities play in shaping future leaders equipped to address global challenges and contribute to sustainable development, while simultaneously reducing their environmental and social footprint.

2 Methodology

During the month of December of the academic year 2022/2023, for the needs of the FAZON project, an online survey was conducted in the organization of the Center for Environmental Management and Sustainable Development. For research purposes, an online questionnaire intended for employees of the FON was used. The questionnaire consisted of a total of 32 questions, the first three of which were of a general nature. Other questions relate to employees' opinions on energy efficiency, water consumption and management, waste management, and the degree of application of recycling practices, but also to the assessment of their individual environmental awareness and environmental activism.

The survey was completed by 48 staff members, making up 16.11% of the total number of employees at the faculty (298). The average age of the participants was 42.12 years, with the youngest being 25 and the oldest 65 years old. The standard deviation for age was 9.443, indicating a relatively moderate variation in age within the sample. Of the respondents, 52.1% were men, and 47.9% were women. As for work experience, the average tenure in the sample was 13.75 years, with the shortest tenure being 1 year and the longest 30 years. The standard deviation for work tenure was 8.4539, also indicating a wide range of work experience among the participants.

Regarding education, most participants, specifically 64.6% had a doctorate. Those with a master's degree constituted 20.8%, while 6.3% had a bachelor's degree. Only one person had completed specialist studies, and 6.3% had completed high school.

To evaluate results of the survey, the statistical software package SPSS 24 was used. The authors used descriptive statistics, and the Kolmogorov-Smirnov test was employed for determining the normal distribution of the variables. The correlation between two variables measured on a scale was assessed using the parametric Pearson correlation, whereas the correlation between two variables measured nominally was examined using the non-parametric Spearman's rho correlation. A p-value has been used to determine the statistical significance of differences between two groups in this study. A p-value less than 0.05 can be considered statistically significant at a 95% confidence level.

3 Research

The survey focused on three separate environmental sustainability fields – energy efficiency, water management and waste management, through the comparison of the “old” building and the “new” building. For reference, the FON “old” building was the former primary school of Bora Stankovic, an endowment of Queen Marija Karadjordjevic from 1932, which was assigned to the FON in the 1980s. The “new” building is a 5,300 square meters modern additional wing built in 2022.

Firstly, for the purpose of the paper, the authors wanted to examine environmental awareness and environmental activism among the staff on Likert scale of 1 to 7, 1 being extremely low and 7 being extremely high. The average rating for environmental awareness is 5.06, with a relatively low standard deviation of 1.156.

This suggests that participants generally demonstrate higher awareness of environmental issues. The average rating for environmental activism is 4.10 with a standard deviation of 1.588. This indicates moderate engagement among participants in environmental activism. The obtained data suggested that the participants are relatively aware of environmental issues and show moderate to high engagement in various aspects of environmental sustainability. It is interesting to note that neither age nor sex of the respondents impacted their environmental awareness nor environmental activism according to Spearman's rho and Pearsons' correlation.

When it comes to energy efficiency, staff members were asked how they would rate the energy efficiency of the "old" Faculty building on a Likert scale from 1 to 7, where 1 was extremely inefficient and 7 was extremely efficient (energy efficiency was defined as the management and economical use of energy in a way that is environmentally acceptable, economically profitable and socially responsible, resulting in a reduction of the carbon footprint), and the results showed that the average rating for the energy efficiency of the "old" Faculty building is 3.46 with a standard deviation of 1.184, indicating moderate efficiency. On the other hand, when it comes to the "new" building of the Faculty, the distribution of answers is somewhat different in favour of greater efficiency - 27.1% gave a grade of 4, 27.2% gave a grade of 5, 16.7% gave a grade of 6, with an average efficiency score of 4.38 with a standard deviation of 1.525, suggesting an improvement in energy efficiency in the "new" building. When examined how the staff that was more environmentally aware answered to the issues of energy efficiency, Spearman's rho and Pearsons' correlation showed no statistical difference. The comparison of grades in terms of energy efficiency for the "old" and the "new" building can be found in Table 1.

Table 1: Comparison of energy efficiency

Ratings	N	Min	Max	Mean	SD
Energy efficiency of the "old" building	48	1	7	3.46	1.184
Energy efficiency of the "new" building	48	1	7	4.38	1.525

To determine whether the internally conducted project “FAZON” can reduce energy consumption in the buildings, the authors surveyed the staff on their computer use. Of the staff who filled out the survey, only one person declared that they do not use a computer at their workplace. The staff said that while working on the computer on their day-to-day basis, 57.4% of them use additional installed software that is specialized for their workplace, 27.7% of them use basic software tools, and 14.9% use additional installed software that is hardware demanding. This last figure is not negligible in the planning and execution of changes meant to reduce energy consumption.

Regarding teaching in computer labs, most staff members use additionally installed undemanding software 45.9%, 35.1% do not teach in computer labs at all, 13.5% use basic software tools, and 5.4% use demanding additional installed software. The largest number of employees conducts classes in the computer labs in both semesters - 79.2%, 12.5% use it in the summer semester, and 8.3% use it in the winter semester.

When it comes to the waste management at the Faculty, the staff members were asked to rate it in the “old” Faculty building on a Likert scale of 1 to 7, 1 being extremely poor and 7 being extremely good (waste management was defined as a process applied by organizations in order to dispose, reduce, reuse or prevent the generation of waste), and the employees showed dissatisfaction with the environmental aspect of this segment, giving it grades 2 (25%), 3 (22.9%) and 4 (18.8%), the mean average score was 3.44 and standard deviation of 1.610. The situation is similar for the “new” building – where grades were 2 (22.9%), 3 (20.8%) and 4 (16.7%), the mean average score was 3.38 and standard deviation of 1.645. This suggests that there has not been a significant improvement in waste management in the “new” building compared to the “old” one. The dissatisfaction of staff is most prominent with the level of recycling at the faculty, with the largest number of employees giving it a rating of 2 (27.2%). When examined how the staff that was more environmentally aware answered to the issues of waste management and recycling, Spearman’s rho and Pearsons’ correlation showed no statistical difference. The comparison of grades in terms of waste management for the “old” and the “new” building can be found in Table 2.

Table 2: Comparison of water management

Ratings	N	Min	Max	Mean	SD
Waste management of the “old” building	48	1	7	3.44	1.610
Waste management of the “new” building	48	1	7	3.38	1.645

Out of the staff surveyed, most of them (87.5%) have a printer in their office. More than half of the participants (54.2%) subjectively feel like they use negligibly few sheets per month, while 35.4% say they use less than 500 sheets per month. Only 10.4% of participants feel like they use between 500 and 1,000 sheets per month.

When it comes to water consumption and water management and the Faculty, the employees were asked to rate water consumption and management in the “old” Faculty building on a Likert scale of 1 to 7, 1 being extremely poor and 7 being extremely good (water management was defined as various activities such as appropriate planning, efficient distribution and optimal use of water so that the water resources available to us can meet both our current and future needs), the majority of employees gave ratings of 4 and 5 on the Likert scale - 41.6%. While for the “new building”, the grades are more evenly distributed between grades 4, 5 and 6 - 25%, 20.8%, and 22.9% respectively. Water consumption in the “old” building has an average rating of 4.02 with a standard deviation of 1.682, while the new building has a slightly higher average rating of 4.46 with a standard deviation of 1.515. This indicates that participants perceive the “new” building to have a slightly better water consumption management systems, probably since the bathrooms in the new wing have motion activated faucets instead of articulated ones. The comparison of grades in terms of water consumption for the “old” and the “new” building can be found in Table 3.

Table 3: Comparison of water consumption

Ratings	N	Min	Max	Mean	SD
Water consumption of the “old” building	48	1	7	4.02	1.682
Water consumption of the “new” building	48	1	7	4.46	1.515

5 Discussion

The staff members' ratings on various aspects of environmental efficiency, awareness, and activism provide valuable insights into the current state of sustainability and environmental education within the Faculty community. The results showed a moderately high level of environmental awareness, but a slightly lower degree of environmental activism, showing once again that in practice turning words into action is not an easy process. While the average ratings for energy efficiency and water consumption indicate moderate levels of environmental performance, there is a lot of room for improvement, particularly in waste management and recycling which were rated as the poorest out of the three categories.

The findings suggest a positive trajectory towards fostering a culture of environmental responsibility, as evidenced by the relatively high ratings for environmental awareness and activism. This indicates a growing consciousness among participants regarding environmental issues and a willingness to engage in sustainability efforts. When asked to provide the authors with their own input and ideas, the staff members listed a plethora of issues and possible recommendations for increasing the environmental sustainability of the faculty, such as recycling paper, using biodegradable cups instead of plastic, using reusable water bottles, using solar panels, internal educational seminars and workshops, etc...

The survey results shed light on the utilization of technology and resources within the HEIs setting, revealing both opportunities and challenges for advancing sustainability. The prevalence of computer usage among participants, particularly for job-specific software, highlights the potential for leveraging technology to enhance efficiency and productivity while minimizing environmental impact. However, unfortunately, the high reliance on printers and paper consumption underscores the need for targeted interventions to promote digitalization and reduce paper waste. Initiatives such as promoting sustainable printing practices and encouraging the use of digital platforms for document management can help mitigate the environmental footprint associated with traditional paper-based workflows.

The diverse representation of survey participants in terms of educational backgrounds and job positions, as well as the fact that statistical analyses showed no relevant difference between the age and sex of respondents and their environmental awareness within the faculty, underscores the importance of inclusivity and collaboration in promoting sustainable initiatives. The involvement of individuals with varied expertise and perspectives can enrich the development and implementation of sustainability programs, ensuring that they resonate with the entire academic community.

The papers' research findings have several implications for promoting sustainable practices within HEIs. Firstly, there is a need for targeted interventions to enhance resource efficiency and minimize environmental impact, particularly in areas such as waste management and recycling. Implementing more initiatives focused on sustainable procurement, energy conservation, and waste reduction can help achieve sustainability goals while fostering a culture of environmental responsibility among students, staff, and administrators. Additionally, promoting interdisciplinary collaboration and community engagement can further strengthen the HEIs' capacity to drive sustainable change and address complex environmental challenges.

5 Conclusion

By educating future leaders, conducting research and innovation, implementing sustainability initiatives, engaging with communities, and advocating for policy changes at the local, national, and global levels, HEIs serve as key drivers of environmental sustainability. Their concerted efforts contribute to the construction of a world that is more robust and sustainable for both the current generation and the generations to come.

The findings of this research point out several critical aspects of environmental sustainability within the context of HEIs, focusing particularly on the FON and the internally conducted project "FAZON". These aspects are: low level of recycling, irresponsible use of resources, low energy efficiency and high energy consumption, poor water management, as well as a level of environmental awareness and activism that is anything but high enough to provide a sufficient response to emerging environmental issues.

Moving forward, it is essential for HEIs to build on the insights gained from various research and continue investing in sustainable practices. This includes implementing evidence-based interventions, monitoring progress towards sustainability goals, and fostering a culture of innovation and collaboration. Moreover, there is a need for ongoing research and evaluation to assess the effectiveness of sustainability initiatives and identify areas for improvement. By embracing sustainability as a core value and prioritizing environmental stewardship, HEIs can lead by example and inspire future generations to become catalysts for positive change in addressing global environmental challenges.

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NEW CROATIAN CUSTOMARY PRACTICE IN THE HOSPITALITY INDUSTRY (2023) THROUGH DIGITAL TRANSITION CHANGES

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The new Croatian Customary practice in the hospitality industry (2023) were adopted by the Croatian Chamber of Economy and published in the Official Gazette of the Republic of Croatia (No. 74/2023) on July 06, 2023. There are no major changes regarding the old Customary practice (1995): 1. application of the customs is unchanged, 2. there are still arranged the same contracts and 3. structure of the customs content is almost identical. However, the important changes are the new "digital" provisions (modifications and amendments of old customs) related to 28 years of technological progress, digital improvement and better organization of providing hospitality services, manifested in the following groups of usances: 1. communication between the contracting parties, 2. use of digital resources and information equipment in the hotel, 3. mutual providing of the information and data and 4. insurance of payment of the used hotel services. The same changes represent the directions for improvement of other tourism and hospitality legislation in Croatia, as well as the ideas for the necessary "digital-transition" changes in the laws and hospitality practices of other countries and European and international business practices from the domain (European ECTAA-HOTREC Code of conduct and international IH&RA-UFTAA Code of practice).

Keywords:

customary practice, hospitality industry, customs, tourism law, Croatian law, ECTAA-HOTREC code of conduct, IH&RA-UFTAA code of practice

1 Introduction

In the Croatian law, many important contracts in hospitality and tourism (hotel-keeper's contracts and related contracts) are still governed by business customs, and not in their natural legislative "place" - in the Civil Obligations Act (hereinafter: ZOO 2005)¹ - although Croatian legal experts have been advocating the regulation of the same in that act for almost half a century.

In 1995, the Croatian Chamber of Economy (HGK) published the "old" Customary practice in the hospitality industry (hereinafter: PUU 1995)², which were unchanged for the entire 28 years, even though practices in the hospitality and tourism industry were changing rapidly and modernized (especially in the "digital" sphere) during that period. In addition, the new ZOO 2005 (Article 12) more clearly regulates the link³ between ZOO and business customs.⁴

Therefore, in 2023, the HGK decided to "comb" the existing customs and instead of the original idea of amending the old PUU 1995, and due to the established need for many changes in the text, it correctly decided to adopt the text of the "new"

¹ Zakon o obveznim odnosima, Narodne Novine, 35/05, 41/08, 125/11, 78/15, 29/18, 126/21, 114/22, 156/22, 155/23.

² Posebne uzance u ugostiteljstvu, Narodne Novine, 16/95, 108/96.

³ Zubović A., Primjena trgovačkih običaja, Zbornik Pravnog fakulteta Sveučilišta u Rijeci, Volumen 27, no. 1, Rijeka, Croatia, 2006, p. 307-343.

⁴ In the Croatian law, two of the three types of hotel-keeper's contracts (direct and agency) are regulated in the codification of business practices - PUU 2023, and the third type (allotment contract) is mostly regulated in the legislation - ZOO 2005, and, to a lesser extent, in practice arising from the application of the allotment contract - in PUU 2023. From this aspect, only the allotment contract is a "named" contract, while the direct and agency contract are legislatively "unnamed" contracts. From another aspect, according to the nature of the contract to which they belong, the direct hotel-keeper's contract is of a civil (civil law) nature and other types of hotel-keeper's contracts (agency and allotment) are of a commercial (commercial) nature. In Article 12 of the ZOO 2005, the Croatian legislator regulated the application (legal force) of civil and commercial customs to contractual relations: 1) civil (non-commercial) customs and covenants (direct hotel-keeper's contract) are applied only when they are expressly contracted or prescribed by law (article 12. paragraph 4 of the ZOO 2005), and 2) trade customs and usages (agency and part of the allotment contract) are applied if no other mutual practice has been contracted or developed between the parties, unless they are expressly or tacitly excluded (article 12. paragraphs 1 and 2 of ZOO 2005). Therefore, in Croatian law, the sources of law to a particular (civil or commercial) type of hotel-keeper's contract are applied in the following hierarchical order:

1) on the (civil) direct hotel-keeper's contract (article 12. paragraph 4 of the ZOO 2005) - primarily the contract between the contracting parties, secondarily, if their application is expressly agreed upon, customs (7-52) from PUU 2023, and then general rules of the ZOO 2005,

2) on the (commercial) agency hotel-keeper's contract (article 12. paragraph 1 and 2 of the ZOO 2005) - primarily a contract between the contracting parties, secondarily a mutual practice developed between the contracting parties, and only then, unless the contracting parties expressly or tacitly excluded, customs (53-84 and secondary 7-52) from PUU 2023.

3) on the (commercial) allotment hotel-keeper's contract (article 12. paragraph 1 and 2 of the ZOO 2005) - primarily the provisions of the ZOO that regulate the allotment contract, secondarily the contract between the parties, then developed mutual practice, and only then, unless the contractors explicitly or tacitly excluded them, customs (85-92) from PUU 2023.

Customary practice in the hospitality industry (hereinafter: PUU 2023)⁵ and put the old PUU 1995 out of force.

The new PUU 2023 were adopted by the Croatian Chamber of Economy and published in the Official Gazette of the Republic of Croatia (Narodne Novine), No. 74/2023 on July 06, 2023.

In the "new" PUU 2023 there are no major conceptual changes regarding the "old" PUU 1995: 1. application⁶ of the customs is *defacto* unchanged, 2. there are still arranged the same six contracts⁷ and practically in a very similar manner and 3. the structure of the content of the customs is almost exactly identical.

However, even they are not the subject of this work, it is also worth noting some more important substantive changes adopted by the new PUU 2023: a) harmonization of the text of the PUU 2023 with the text of the ZOO 2005 (especially in the domain of non-property damage and the application of the customs), b) the introduction into the subject of hotel-keeper's contracts of the so-called *all-inclusive* services, c) changes and additions to customs related to 28 years of technological (digital) progress in practice and outdated descriptions in the text, d) reduction of the number of customs from 152 to 141 and others.

In addition to the mentioned "major" changes, the "minor" changes and novelties in the text of the PUU 2023, which are the result of digital development in practice, went almost unnoticed. With those seemingly "minor technical" changes, but very important in the context of the digital legal transition, a dozen new solutions have entered into the Croatian customary law that will greatly clarify and facilitate the procedures of the parties in practice. Such new "digital" provisions related to 28 years of technological progress in the context of digital improvement and better organization of providing hospitality services can be classified in the following four groups of customs:

⁵ Posebne uzance u ugostiteljstvu, Narodne Novine, 74/2023.

⁶ Gorenc V., Šmid, V. (1999), Poslovno pravo u turizmu i ugostiteljstvu, Zagreb, Školska knjiga, Croatia, p. 10.

⁷ Those contracts are: 1. Direct hotel-keeper's contract on hotel services, 2. Agency hotel-keeper's contract, 3. Allotment hotel-keeper's contract, 4. Contract for accommodation in tourist apartments, 5. Contract on camping services, 6. The food and beverage services contract.

1. the communication between the contracting parties,
2. the use of digital resources and information equipment in the hotel,
3. the mutual providing of the information and data and
4. the insurance of payment of the used hotel services.

The paper's aim is to give an overview and analysis of the new PUU 2023 customs which show "digital" progress compared to the text of "old" customs through the systematization of the same into the mentioned four groups.

The paper is structured through four chapters. In the first chapter (introduction) is given a brief overview of the topic and are presented the research objectives and the content of the paper. The second chapter (New Croatian Customary practice in the hospitality industry (2023)) deals with the new PUU 2023 and their application, its customs and their structure. The third chapter (New "digital" provisions (customs) in the Croatian Customary practice in the hospitality industry (2023)) show the review and analysis of four groups of new "digital" customs from PUU 2023. The last fourth chapter (conclusion) summarizes paper's solutions and provides a final overview of all work results.

2 New Croatian Customary practice in the hospitality industry (2023)

PUU 2023 represent a new codification of business practices in the application of contracts in the hospitality industry in the Republic of Croatia. With their adoption, PUU 1995 ceased to be valid (article 141. of the PUU 2023)⁸.

It should be pointed out that with the adoption of the (new and better) PUU 2023, the Croatian legislation did not solve the problem of a "better" or "correct" regulation of hotel-keeper's and related contracts in Croatian law.⁹ However, until the legislator introduces into ZOO 2005 the contracts regulated in PUU 2023, it is

⁸ Usance 141. PUU 2023, Narodne novine, 74/2023: "With the entry into force of these Regulations, Regulations No. I.-55-35/3-1995 published in the Official Gazette of the Republic of Croatia "Narodne novine" No. 16/1995 cease to be valid."

⁹ In fact, it is a paradox that in Croatia, a country that primarily lives from the hospitality and tourism sector, the most important contracts from the entire field of hospitality and tourism (direct and agency hotel-keeper's contracts) are not regulated in the Croatian legislation.

good that there is a place (at least in customary law) that regulates the content¹⁰ of these contracts.¹¹

In the cross-section of the analysis of PUU 2023, it is necessary, for this chapter, to mention the most important things in terms of application (1), contracts (customs) to which usances refer (2) and their structure (3).

First, regarding the application, in the old PUU 1995 there were mentioned that these are codified business customs and that they are applied to relations from contracts on hospitality industry and that these customs are applied to relations from other contracts if the parties have contracted them or if it follows from the circumstances that wanted their application (usance 1. of the PUU 1995). With the new PUU 2023, the application of customs¹² is slightly changed, but essentially remained the same. In addition to the excellent link with article 12 of the ZOO 2005 (it was necessarily to precise that connection)¹³, the following categories are included in the scope of application: 1. practice from hospitality and tourism regulations, 2. contracts on hospitality services in the economy, 3. other contracts on hospitality services.

Second, the contracts on which the customs from the PUU 2023 are referring are exact the same from the old PUU 1995 with a few technical changes in the names¹⁴ of the contracts (usance 2. of the PUU 2023)¹⁵: 1. Hotel-keeper's contracts 2. Contracts for accommodation in tourist apartments, 3. Contracts on camping services and 4. The food and beverage services contracts.

¹⁰ Otherwise, PUU 2023 should not regulate the same contents of the contracts (these contracts would have to be regulated by the ZOO 2005), but only the application of these contracts in the practice of hospitality and tourism.

¹¹ Gorenc, V., Mandarić, A., Pokorić, D. & Šmid, V., *Posebne uzance u ugostiteljstvu s komentarom*, RRIF Plus, Zagreb, Croatia, 1996; authors mentioned similar almost 30 years ago with the connection of PUU 1995 to the ZOO 1978 (ex Civil Obligations Act from 1978).

¹² Usance 1. PUU 2023, Narodne novine, 74/2023: "(1) These Customary Practice in the Hospitality Industry (hereinafter referred to as: Regulations) establish business customs and basic guidelines for the performance of work related to the provision of hospitality services, i.e. those services regulated by regulations on hospitality and tourism regulations. (2) These Terms apply to relations from contracts for hospitality services in the economy, unless otherwise stipulated by contract between the contracting parties or a different mutual practice has been developed or terms are explicitly or tacitly excluded. (3) These Terms apply to relationships from other contracts on hospitality services if the parties have agreed on them."

¹³ Slakoper, Z., Radolović O., *Izvori prava za ugovore o hotelskim uslugama*, Zbornik radova "In memoriam prof.dr.sc. Vjekoslav Šmid", Split, Croatia, 2012, p. 367.

¹⁴ Thus, for example, the name of the contract on camping services ("ugovor o uslugama kampiranja"), which in the old PUU 1995 was called contract on camping ("ugovor o kampiranju"), was changed; in fact, only the name of the section is aligned with the name of the contract in the text (which was an omission in the PUU 1995).

¹⁵ Usance 2. PUU 2023, Narodne novine, 74/2023: "Businesses for which business customs are established in these Terms are those that normally belong to the scope of these contracts: 1. hotel-keeper's contracts, 2. contracts for accommodation in tourist apartments, 3. contracts on camping services, 4. food and beverage services contracts."

Third, the structure of the PUU 2023 (regarding the PUU 1995) is also changed but not in the significant way. PUU 2023 are structured by the 141 usances divided into four main parts:

1. Part One: general provisions (articles 1-2),
2. Part Two: common provisions for hospitality services contracts (articles 3-5)
3. Part Three: hotel-keeper's contracts¹⁶ (articles 6-139)¹⁷ divided in 6 chapters:
 - 3.1. direct hotel-keeper's contract (articles 7-52)
 - 3.2. agency hotel-keeper's contract (articles 53-84)
 - 3.3. allotment hotel-keeper's contract (articles 85-92)¹⁸
 - 3.4. contracts for accommodation in tourist apartments (articles 93-106)
 - 3.5. contracts on camping services (articles 107-119)
 - 3.6. food and beverage services contracts (articles 120-139)
4. Part Four: final provisions (articles 140-141).

Within such a structure of PUU 2023, the "digital" applications mentioned in the text of the usances can be seen in all contracts to which business customs apply, and will be look at and analyze them in the next chapter through their classification in the four groups of customs regarding:

1. the communication between the contracting parties,
2. the use of digital resources and information equipment in the hotel,
3. the mutual providing of the information and data and
4. the insurance of payment of the used hotel services.

¹⁶ There are authors in Croatian legal theory who emphasized that there is one contract on hotel services (divided into three versions): Šmid, V., *Ugovor o hotelskim uslugama*, *Stručna revija Ugostiteljstvo i turizam*, Volumen 32, no. 12 (5/6), Zagreb, Croatia, 1984, p. 483-492.

¹⁷ In the redaction of the text, in the creation of the PUU 2023 structure, one mistake also crept in. Namely, in the third part entitled "Hotel-keeper's contracts", other related contracts (apartments, camping, food and beverage) are regulated in addition to hotel-keeper's (direct, agency, allotment) contracts. Although the provisions of the hotel-keeper's contracts apply additionally to them as well, they should have been divided into a separate section of the contract.

¹⁸ It should be noted that the same contract has often changed names both in the Croatian literature and in legislation, but that its most correct term is the "allotment hotel-keeper's contract" (that term is not mentioned nor in the ZOO 2005 nor in the PUU 2023). Gorenc, V., *Ugovor o angažiranju ugostiteljskih kapaciteta (ugovor o alotmanu)*, *Pravo i porezi*, Volumen 11, no. 8, Zagreb, Croatia, 2002, p. 3-9; Šmid, V., *Ugovor o alotmanu*, *Zbornik radova Pravnog fakulteta u Mostaru*, Volumen 11, Mostar, Bosnia and Herzegovina, 1998, p. 79-95.

3 New "digital" provisions (customs) in the Croatian Customary practice in the hospitality industry (2023)

3.1 New customs in the communication between the contracting parties

The first group of provisions of PUU 2023 with "digital" changes compared to the old PUU 1995, which is analyzed in this chapter, are provisions related to communication between contracting parties. In this context, four usances are distinguished by which they are regulated:

- 1) an offer for booking accommodation in a direct hotel-keeper's contract (article 8. of the PUU 2023 in the section "conclusion of contract")¹⁹,
- 2) request for reservation in the agency hotel-keeper's contract (article 54. of the PUU 2023 in the section "conclusion of the contract")²⁰.
- 3) cancellation of the agency hotel-keeper's contract (article 63. of the PUU 2023 entitled "cancellation")²¹,
- 4) rules regarding order in the camp in the contract on camping services (article 113. of the PUU 2023 in the section "order in the camp")²².

¹⁹ Usance 8. PUU 2023, Narodne novine, 74/2023: "(1) The offer for booking an accommodation or pension contains the type of hospitality service, the start and duration of the service, and the guest's geographic (place of residence) and virtual (e-mail) address. (2) Reservation of accommodation or pension can be requested with the use of permitted means of communication or specified by the hotel-keeper. (3) If the hotel-keeper requests it during the reservation, the reservation requested orally or by telephone must be confirmed in writing using the means of communication permitted or specified by the hotel-keeper."

²⁰ Usance 54. PUU 2023, Narodne novine, 74/2023: "(1) The agency sends a reservation request to the hotel-keeper. (2) Every unwritten request for a reservation must be confirmed in writing without delay using the means of communication permitted or specified by the hotel-keeper. (3) If the agency requests in the reservation request that the hotel-keeper offer him a price, the hotel-keeper's contract is considered concluded when the hotel-keeper receives the acceptance of the offer from the agency. (4) The offer contains essential components from usance no. 3. The agency shall notify the hotel-keeper without delay of the acceptance or rejection of the offer."

²¹ Usance 63. PUU 2023, Narodne novine, 74/2023: "(1) Contracted services are cancelled in writing, indicating the date of cancellation. (2) Every unwritten cancellation is confirmed by the agency in writing. (3) In order for the cancellation referred to in paragraph 2 of this agreement to be valid from the day of the verbal notification, the hotel-keeper must receive written confirmation of cancellation no later than the following day by any permitted or prescribed communication method by the hotel-keeper. (4) If, in the meantime, the hotel-keeper confirms the receipt of the verbal or telephone cancellation in any written form, the agency is released from the obligation to confirm his verbal or telephone cancellation in writing."

²² Usance 113. PUU 2023, Narodne novine, 74/2023: "(1) Rules of conduct and house rules in the camp will be published by the camp-keeper in the usual way (at the reception and on the internet website). (2) By concluding a camping contract, the guest confirms that he is familiar with these rules of conduct and house rules and that he has accepted them."

The novelty in the offer for booking accommodation in the direct contract is that it must now contain a "virtual (e-mail) address" (article 8.1. PUU 2023). The same novelty is understandable when it is known that the largest number of booking offers to come mostly through e-mails. In addition, PUU 2023 states that a reservation can be requested using all "allowed or specified means of communication by the hotel-keeper" (article 8.2. PUU 2023).

If the hotel-keeper requests it during the reservation period (the process of booking of the direct hotel-keeper's contract via any means of communication), the reservation requested verbally or by telephone must be confirmed "in writing using the means of communication permitted or specified by the hotel-keeper" (article 8.3. PUU 2023).

Similar to the offer for the reservation²³ of a direct hotel-keeper's contract are the text news from the request for booking accommodation in the agency hotel-keeper's contract. Here, also, every request for a reservation must be confirmed "in writing with the use of permitted means of communication or specified by the hotel-keeper" (article 54.1. PUU 2023).

Both in the previous PUU 1995 and in Croatian literature²⁴, a lot of attention was paid to the cancellation (unconditional and conditional)²⁵ of the agency hotel-keeper's contract. When cancelling an agency hotel-keeper's contract, the huge novelty in the PUU 2023 is the facilitation of the activity for the travel agency in the procedure of contract cancellation: if the hotel-keeper "in any written form" (and by any means of communication) confirms receipt of the verbal or telephone cancellation of the agency hotel-keeper's contract, the travel agency is "released from the obligation to confirm its verbal or telephone cancellation in writing" (article 63.4. PUU 2023).

The biggest positive innovation in this group of "digital" usances is the introduction of the obligation of camp-keepers to publish the rules of conduct and house rules in the camp "both at the reception and on the internet website" (article 113.1. PUU 2023). Since by signing of a camping contract, the guest confirms that he is familiar

²³ Gorenc, V., *Izravni ugovor o hotelskim uslugama*, *Pravo i porezi*, no. 6/2002, Zagreb, Croatia, 2002, p. 14-17.

²⁴ Gorenc, Šmid, *op.cit.*, p. 133-135; Gorenc, V., *Agencijski ugovor o hotelskim uslugama (prvi dio)*, *Acta Turistica*, Volumen 7, no. 2, Zagreb, Croatia, 1995, p. 182-215; Gorenc, V., *Agencijski ugovor o hotelskim uslugama (drugi dio)*, *Acta Turistica*, Volumen 8, no. 1, Zagreb, Croatia, 1996, p. 58-87.

²⁵ Gorenc, V., Mandarić, A., Pokorić, D. & Šmid, V., *op.cit.*, p. 82.

with and has accepted these rules of conduct and house rules, it was logical that apart from the (as a rule, unfathomable) rules of conduct and order in the camp published in "paper form" somewhere around the reception, guests (and future interested guests in camp accomodation) will be familiar with them in advance via the Internet.²⁶

As can be seen from the solution of the PUU 2023, all these "digital" innovations in a new usances related to the communication between the contractual parties (the hotel-keeper, the guest and the travel agency) were adopted for the purpose of making communication between them in the fastest and widest possible way. At the same time, these solutions (as well as the solutions from the following chapters) are not the "final" solutions, but only a good basis for monitoring further digital innovations in practice and will certainly be supplemented in the future in this direction.

3.2 New customs regarding the use of digital resources and information equipment in the hotel

The second group of new "digital" provisions from PUU 2023 are usances that regulate the use of digital resources and information (IT) equipment in the hotel. In this context, three customs stand out:

- 1) for the use of the devices by the guest in a direct hotel-keeper's contract (article 18. PUU 2023²⁷ in the section "rights and obligations of the parties"),
- 2) for the use of other communication devices in a direct hotel-keeper's contract (article 30. PUU 2023²⁸ in the same section).

²⁶ Although Croatian camp-keepers mainly developed the same practice as early at the end of the last century (in the late 1990's all of them opened their websites), it was good for such a provision to end up in the text of the PUU 2023.

²⁷ Usance 18. PUU 2023, Narodne novine, 74/2023: "On the basis of the hotel-keeper's contract, the guest acquires the right to: 1. use the rooms intended for accommodation and associated services, and if the pension, half-pension or all-inclusive is contracted, he is also entitled to appropriate meals; 2. the use of all devices, common rooms and the use of the hotel staff services in that facility and other related facilities and areas of the hotel-keeper intended for guests."

²⁸ Usance 30. PUU 2023, Narodne novine, 74/2023: "The hotel-keeper can separately charge the guest for the use of telephones and other technical communication devices according to the hotel-keeper's price list."

- 3) for the payment of the special TV programs in the direct hotel-keeper's contract (article 31. PUU 2023²⁹ in the same section).

The change in relation to the use of devices by guests in the hotel is manifested by the possibility of using all devices (of any type, and the norm primarily refers to the use of devices for Internet access) *infra hospitium*. On the basis of the direct hotel-keeper's contract, the guest acquires the right, among other things, to use all "devices" in that facility and other related facilities and areas of the hotel-keeper's intended for guests (article 18.2. PUU 2023).

Second novelty in this group of usances is that in a direct hotel-keeper's contract, the hotel-keeper "may" (but does not have to) "separately charge the use of the telephone and other technical communication devices" from the guest according to his price list (article 30. PUU 2023). With the term "and other technical communication devices" (laptops, fax machines, printers...), PUU 2023 left the possibility of a broad interpretation of the provision, leaving the hotel-keeper the discretionary right to determine which services for the use of digital devices and IT equipment will be charged to the guests.

The latest innovation, actually just a codified long-standing practice in hotels, is that the hotel-keeper cannot charge guests in a direct hotel-keeper's contract for the use of TV receivers in hotel rooms for "regular programs" (article 31.1. PUU 2023), while for viewing of "special programs" from the hotel's *Pay TV*, the hotel-keeper may (but does not have to) charge for the use according to the his price list (article 31.2. PUU 2023).³⁰

3.3 New customs in mutual providing of the information and data

From the point of view of the new clauses from PUU 2023 in which the contractual parties must provide each other with mutual information and data, two usances are distinguished:

²⁹ Usance 31. PUU 2023, Narodne novine, 74/2023: "(1) The hotel-keeper does not charge for the use of TV receivers in hotel rooms for regular programs. (2) For watching special programs from the hotel's Pay TV, the hotel-keeper may charge for usage according to the price list."

³⁰ Although the text of PUU 2023 does not specify which TV programs are "regular" and which are "special" in the context of those provisions, in practice those offered automatically on TV receivers in the rooms should be "regular" and all others "special".

- 1) for providing information to the guest in a direct hotel-keeper's contract (article 24. of PUU 2023³¹ in the section "rights and obligations of the parties"),
- 2) for the safekeeping of the guest's propriety (things) in the direct hotel-keeper's contract (article 47. of the PUU 2023³² in the section "responsibility of the hotel-keeper for the guest's belongings").

Although the provision from article 24. of the PUU 2023 is almost identical to the old provision from PUU 1995, according to which the hotel-keeper is obliged to give the guest all "notices" related to the stay, hospitality services, cultural and entertainment events in the place and excursions, and information from train schedules and similar, until now in practice meant that the hotel-keeper had the obligation to hand over such "notices" to the guest in "written form" (through prospectuses, posters, flyers, etc.), it has now acquired a new dimension because it no longer exists "paper" obligation of the host (hotel-keeper) because he can deliver the same "notices" to the guest in any way he wants (in practice, it will usually be via e-mail, internet, sms text messages, etc.).

Secondly, the new provision (article 47.5. PUU 2023) which governs mutual obligations regarding the guest's belongings entrusted to the hotel-keeper, stipulates, among other things, that "things entrusted for safekeeping can be picked up by the guest or a person authorized by the guest (give him the key, code or confirmation)". The novelty of introducing a digital "code" as evidence for storing and retrieving things handed over for safekeeping is relevant to this paper. It is also interesting that a third person³³ can pick up an item from the safe or a special room if the guest authorized her to do so. Although one provision (article 47.1. PUU 2023) is identical to the provision from the old PUU 1995 according to which "the hotel-keeper has the right to inspect things that the guest gives for safekeeping", it should be kept in

³¹ Usance 24. PUU 2023, Narodne novine, 74/2023: "The hotel-keeper provides the guest at no extra charge with all information related to the stay, hospitality services, cultural and entertainment events in the place and excursions, as well as information and data from train schedules and the similar."

³² Usance 47. PUU 2023, Narodne novine, 74/2023: "(1) The hotel-keeper has the right to inspect the things that the guest gives for safekeeping. ... (5) Things handed over for safekeeping can be picked up by the guest or a person authorized by the guest (give them a key, code or receipt). (6) If the hotel-keeper has issued a receipt, the guest or a person authorized by the guest must return the receipt to the hotel-keeper."

³³ Usually it will be people from the guest's room, members of his family, people in his accompaniment, etc. In practice, it turned out to be inconvenient that only one person (the guest who closed the contract) can pick up these things and not the people who use the accommodation with him. An excellent solution was found in this direction.

mind that today, in the context of digital checks of the contents of things (with a scanner, radar, various detection devices, etc.) this provision gained a completely new dimension through the digital verification of things by the hotel-keepers.

3.4 New customs regarding the insurance of payment of the used hotel services

The last group of provisions from PUU 2023 that is analyzed in this paper are the customs by which is provided the insurance of the payment for the used hotel services (accommodation and accessory services). From this standpoint, two usances are relevant:

- 1) for the payment of services in a direct hotel-keeper's contract (article 35. of the PUU 2023³⁴ called "payment of services"),
- 2) for payment of services in the agency hotel-keeper's contract (article 60. of the PUU 2023³⁵ in the section "payment of services").

In the provisions of PUU 2023 which regulate the payment of services in a direct hotel-keeper's contract, the novelty is that for the use of services, the hotel-keeper has the new various rights to demand from the guest insurance of payment for those services. One of the new "digital" ways of such insurance is the "credit card pre-authorization" (article 35.6. PUU 2023). If the guest does not have "funds for pre-authorization" on the credit card as payment insurance, the hotel-keeper has the discretionary right to decide whether to provide accommodation³⁶ or cancel the reservation (article 35.7. PUU 2023).

³⁴ Usance 35. PUU 2023, Narodne novine, 74/2023: "(1) The bill for services can be charged immediately for the service provided or every seven days, if the services are provided over a longer period. (2) For services that he uses during his stay in the hospitality facility, and does not pay immediately, the guest signs an invoice indicating the room number immediately after the service has been provided. ... (6) In order to use the services, the hotel-keeper has the right to require the guest to pay for these services (advance payment/deposit, credit card pre-authorization, etc.). (7) If the guest does not have pre-authorization funds on his credit card as payment insurance, the hotel-keeper can decide whether to provide accommodation or cancel the reservation."

³⁵ Usance 60. PUU 2023, Narodne novine, 74/2023: "(1) If it is not agreed that the guest pays directly, the agency is obliged to issue a tourist voucher (voucher) to the guest and deliver it to the hotel-keeper with one copy, per guest, guide, by post, e-mail or in any other way permitted or prescribed by the hotel-keeper before he started providing the service. (2) After the calculation, the hotel-keeper sends to the agency, for the purpose of payment, an invoice with the original tourist voucher, certified by the guest or representative of the agency (guide, etc.), and keeps a certified copy of the voucher."

³⁶ Radolović, O., Hotel Guest's Liability for Non-Payment of Hotel Services in Comparative Law, WASET: Academic Science Research, Issue 66, June 2010, Paris, France, 2010, p. 430-438; hotel-keeper has the right to refuse accommodation to the guest only exceptionally and for two valid reasons (in comparative law): 1) if there is no available accommodation and 2) if the guest is in such a "condition" that he cannot pay for the services or disturb

The last "digital" novelty from PUU 2023 refers to the payment of services in the agency hotel-keeper's contract. If, namely, it is not agreed that the guest pays directly to the hotel-keeper, the travel agency is obliged to issue the guest a tourist voucher (*voucher*) with one copy, which can also be sent by "e-mail or in some other way permitted or prescribed by the hotel-keeper", deliver to the hotel-keeper before he starts providing the service (article 60.1. PUU 2023).

4 Conclusion

With the adoption of the new PUU 2023, Croatia changed the old PUU 1995 after 28 years. New Customary Practice in the hospitality industry are not the best solution for the Croatian tourism contract law, especially for the most important contracts (hotel-keeper's contracts and related ones). Even almost 30 years ago, authors stated that PUU 1995 are only needed temporary solution until the "hospitality contracts" will be settled in the ZOO.³⁷ But, on the other hand, it is also excellent that as long as the Croatian legislator does not introduce into Croatian ZOO 2005 the contracts regulated in PUU 2023, there is a place (at least in customary law) that regulates the content of these contracts. PUU should not regulate the same (these contracts would have to be regulated by the ZOO), but only the application of these contracts in the practice of hospitality and tourism.³⁸

In the "new" PUU 2023 there are no major conceptual changes regarding the "old" PUU 1995:

1. application of the customs is practically unchanged,
2. there are still arranged the same six contracts and practically in a very similar manner and
3. the structure of the content of the customs is almost exactly identical.

the other guests. Lack of funds on the guest's credit card that blocks the pre-authorization would fall under the (second) reasons related to the "guest's condition".

³⁷ Gorenc, V., *Nove hrvatske posebne uzance u ugostiteljstvu*, Acta turistica, Volumen 7, no. 1, Zagreb, Croatia, 1995, p. 23-24.

³⁸ *ibidem.*, p. 23-42.

However, there are some important substantive changes adopted by PUU 2023:

- a. harmonization of the text of the PUU 2023 with the text of the ZOO 2005 (especially in the domain of non-property damage and the application of the customs),
- b. the introduction into the subject of hotel-keeper's contracts of the so-called *all-inclusive* services,
- c. changes and additions to customs related to 28 years of technological (digital) progress in practice and outdated descriptions in the text,
- d. reduction of the number of customs from 152 to 141 and others.

In addition to the mentioned "major" changes, the "minor" changes and novelties in the text of the PUU 2023, which are the result of digital development in practice, went almost unnoticed. With those seemingly "minor technical" changes, but very important in the context of the digital legal transition - introduction of terms like e-mail address (1), digital code (2), internet website (3), means of communications (4), digital devices (5), etc. - a dozen new solutions have entered into the Croatian customary law that will greatly clarify and facilitate the procedures of the parties in practice. Such new "digital" provisions of the PUU 2023 can be classified in the following four groups of customs (and so were reviewed and analyzed in this paper):

1. the communication between the contracting parties,
2. the use of digital resources and information equipment in the hotel,
3. the mutual providing of the information and data and
4. the insurance of payment of the used hotel services.

It should be borne in mind that Croatia has been a member of the European Union since 2013, where two codifications of business practice of agency hotel-keeper's contracts³⁹ play a particularly important role for European countries: 1) European codification of business practice - the so-called ECTAA-HOTREC Code of

³⁹ Radolović, O., Hrvatske, europske i međunarodne uzance kroz ugovorne obveze turističke agencije prema ugostitelju, *Liber amicorum in honorem Vilim Gorenc*, Pravni fakultet Sveučilišta u Rijeci - Zavod za građansko pravo, Rijeka, Croatia, 2014, p. 261-287.

Conduct (1996)⁴⁰ and 2) International codification of business practice - the so-called IH&RA-UFTAA Code of Practice (1999)⁴¹.

The European ECTAA-HOTREC Code applies to every "internal" and international contract in which both the tourist (travel) agency and the hotel-keeper (hotelier) are based in the EU, unless there is a stronger law. The International IH&RA-UFTAA Code applies only when it comes to a contract with an international element⁴², unless there is a stronger law. It is also necessary to take into account the existence of "parallel" codifications (links) in the agency hotel-keeper's contract (although there are no major differences between the new PUU 2023 compared to the texts of those codes).⁴³ But it should be said that these codifications are also quite "old" (25 and 28 years) and that there is a room for the introduction of similar "digital" innovations in their texts also. Croatia's PUU 2023 could in that direction be a roadmap for changing and amending them.

Finally, all these "digital" innovations from the PUU 2023 are not the "final" solutions, but only a good basis for monitoring further digital news in hospitality practice and will certainly be supplemented in the future. The Croatian legislator should be pressured to include six "PUU contracts" (1. direct hotel-keeper's contract, 3.2. agency hotel-keeper's contract, 3.3. allotment hotel-keeper's contract, 4. contracts for accommodation in tourist apartments, 5. contracts on camping services and 6. food and beverage services contracts) in the text of the ZOO 2005 - and that PUU 2023 retain only the customs related to the application of these contracts in practice, as was resolved (in that precise way) with the allotment (hotel-

⁴⁰ ECTAA-HOTREC Code of Conduct (1996). ECTAA - The European Travel Agents' and Tour Operators' Associations. HOTREC - The trade association of hotels, restaurants and cafes in the European Union. ECTAA-HOTREC, Code of Conduct on hotel contracts and business relations between travel agents/organisers and hotels within the EU (1996), Bruxelles, Belgium.

⁴¹ IH&RA-UFTAA Code of Practice (1999). IH&RA - International Hotel and Restaurant Association (until 1996). IHA - International Hotel Association). UFTAA - Universal Federation of Travel Agents Associations. The Code is the result of all previous hotel conventions and codes of the same associations. In the introduction of the Code, it was pointed out that the text of the Code replaces the Code from 1991, which replaced the C Hot (19)79 convention.

⁴² On the forerunners of today's convention was also written about in Croatian legal literature. More about that: Šmid, V., *Hotelska konvencija AIH-FUAAV 1979*, *Privreda i pravo*, Volumen 17, no. 6, Zagreb, Croatia, 1980, p. 1-3; Šmid, V., *Kodeks poslovanja "IHA-FUAAV" 1991*, *Zbornik radova Pravnog Fakulteta u Splitu*, Volumen 31, no. 1-2, Split, Croatia, 1994, p. 49-61.

⁴³ Radolović, O., *Agencijski ugovor o hotelskim uslugama: ugovorna odgovornost ugostitelja u hrvatskoj, europskoj i međunarodnoj poslovnoj praksi*, *Pravni vjesnik, časopis za pravne i društveno-humanističke znanosti Pravnog fakulteta Sveučilišta u Osijeku*, Volumen 26, no. 2, Osijek, Croatia, 2010, p. 7-35.

keeper's) contract - which content is regulated in the ZOO 2005 and the application in practice is within the usances of the PUU 2023.

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IMPLEMENTATION OF INDUSTRY 4.0: EXAMPLES FROM THE SERBIAN MANUFACTURING INDUSTRY

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Industry 4.0 presents a revolution in the manufacturing sector by integrating advanced technologies such as the Internet of Things, artificial intelligence, augmented reality and others. This integration sets the foundation for autonomous, effective and highly efficient manufacturing processes, increasing the levels of digitization and automation. The purpose of this paper is to present examples of the implementation of Industry 4.0 in manufacturing companies. The aim of this paper is to analyze the key aspects of digital transformation through Industry 4.0 and present concrete examples of its implementation in manufacturing companies in the Republic of Serbia. The intention of this paper is to indicate the importance of the implementation of Industry 4.0, identify key challenges in the development of Industry 4.0 and define recommendations for improving production management in manufacturing companies, based on examples of Industry 4.0 application from the practice. Industry 4.0 creates an intelligent production environment with greater efficiency, effectiveness and adaptability.

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Republic of
Serbia



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1 Introduction

Industry 4.0, known as the digital revolution, presents a new industrial stage. It introduces a new paradigm in approaching technological innovations. Industry 4.0 aims to enable the digital transformation of all processes in the industry, whether it is manufacturing, transportation, logistics and others. It is achieved through the use of modern technologies such as Cloud Computing (CC), the Internet of Things (IoT), Data Analytics (DA), Artificial Intelligence (AI), automation, robotics and others (Frank et al., 2019). This concept is based on “smart” manufacturing as a central element but also relies on the application of digital technologies, used to collect data in real-time for analysis and provide useful information to the production system (Lee et al., 2015). Industry 4.0 was initiated in 2011 by the German federal government together with universities and companies, as “a strategic program for the development of advanced production systems, to increase the productivity and efficiency of national industry” (Kagermann et al., 2013).

This paper presents the term Industry 4.0, some of the most commonly used Industry 4.0 technologies, as well as examples of implementation of Industry 4.0 in manufacturing companies in the Republic of Serbia. This paper consists of four chapters. The first chapter is an introduction to the paper. The second chapter presents the theoretical concepts of the most commonly applied Industry 4.0 technologies in the manufacturing sector. The third chapter presents the current level of digitalization, as well as examples of the implementation of Industry 4.0 in manufacturing companies of the Republic of Serbia. The fourth chapter presents the conclusion of the paper.

2 Technologies of Industry 4.0 in manufacturing companies

Industry 4.0 applies a large number of technologies such as (Çınar et al., 2020; Wamba et al., 2015; Zheng et al., 2020): Big Data and Analytics (to collect and analyze large amounts of data), Cloud technology (to provide online data storage services without installation for all programs and applications on a virtual server), Blockchain (a database that creates a distributed and protected digital ledger of transactions), predictive maintenance (as an advanced maintenance strategy that refers to the continuous monitoring of the performance of the equipment to predict potential failures), Simulation and Modelling (technologies that create virtual

versions of the physical world, facilitating the design, as well as the operation and testing of systems). Authors Rajković, Vasiljević & Lečić-Cvetković (2023) consider that “in manufacturing, Industry 4.0 technologies are used to improve information flow and data exchange, control, business and process costs, warehouse, distribution/transport and employees“. Also, in Industry 4.0, the concept of digital twins emerges as replicas of existing machines, processes or systems to achieve “smart” manufacturing. They assist in decision-making and control of processes in real-time (Shao et al., 2020).

Authors Frank et al. (2019) consider that Industry 4.0 technologies can be divided into two layers according to their main objectives, as shown in Figure 1. The central “Front-end” technologies of Industry 4.0 have the purpose of end use for the value chain of companies and they transform production processes through new technologies, optimizing access to production and delivery of raw materials and products (“Smart” Supply Chain, “Smart” Manufacturing and “Smart” Products). These technologies also help employees perform activities through the use of new technology tools (“Smart” Working). The “Front-end” layer relies on the “Base technologies” layer, enabling connectivity into a complete integrated production system (Frank et al., 2019). Technologies that are within the “Base technologies” layer, as well as other key technologies of Industry 4.0, are presented in the following.

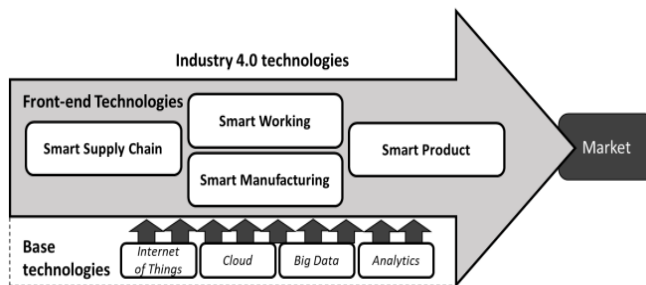


Figure 1: The conceptual basis of Industry 4.0 technologies

Source: Frank et al., 2019

2.1 Internet of Things (IoT)

The Internet of Things (IoT) presents a system that connects different technologies, computers, objects, digital and mechanical machines, or individuals. The IoT applies “smart” devices, i.e. devices such as communication hardware, sensors and processors, connected to the Internet, that collect large amounts of data, that are further processed and used to track employees’ performance, operations, production and others (Gaber et al., 2018). The advantages of the implementation of IoT in manufacturing are improved process efficiency, resource optimization and better control, while the main disadvantages are issues with data privacy and management of large amounts of data. The application of IoT in manufacturing allows devices to communicate with each other and perform tasks without direct human intervention but also provides the ability for people to communicate with devices and access data. IoT has great potential to transform the manufacturing sector for high contribution to improved integration of resources used in different stages of production.

2.2 Artificial Intelligence (AI)

Artificial Intelligence (AI) is defined as “the discipline of computer science that deals with the development of data processing systems and functions related to human intelligence, thereby redefining production processes and business models in the industry” (Peres et al., 2020). The increasing use of AI in industry highlights its importance for supporting manufacturers in solving challenges. It enables companies to make decisions through predictive analytics based on data, especially useful in complex and nonlinear environments. This technology is used within machine learning and robotics to solve problems within companies, emphasizing the importance of data infrastructure, algorithms, decision making and achieving concrete goals (Peres et al., 2020). AI enables the prediction of machine failures, changes on the market, reduces production stoppages through improved production quality, leading to faster decisions, improved services and reduced costs in production (Yao et al., 2017).

2.3 Digital Twins (DT)

A Digital Twin (DT) is “a digital replica of an existing product, machine, process or system that enables companies to better understand, analyze and optimize their processes in real-time” (Rai et al., 2021). The “twin” in this context presents the digital information connected with a physical system, available throughout its entire life cycle. Implementation of DT in manufacturing improves process analysis and control, while a lack of resources and standardization makes their effective implementation more difficult (Shao et al., 2020). Within the DT, manufacturing is supported by advanced technologies such as robots, Virtual Reality (VR) and additive (3D) manufacturing, while cloud technology, as a key driver of the DT, uses Internet connections for storage, access and data processing. A DT in manufacturing can be used for equipment monitoring (to minimize the impact of production stoppages and optimize production planning), supply chain optimization, virtual simulation and continuous performance monitoring to optimize processes and reduce production costs. This technology is also used to analyze the production process to identify potential improvements, as well as to simulate different scenarios to make optimal decisions to improve efficiency and productivity (Shao et al., 2020).

2.4 Robots

Robots have a wide range of applications in the manufacturing sector, such as picking and placing, sorting, assembling, storing and retrieving materials, parts and tools, as well as maintaining and monitoring machines. They are programmed to navigate a sequence of points in either two-dimensional (2D) or three-dimensional (3D) space, executing specific tasks. Modern methodologies, like collaborative robots (“Co-robots”), streamline programming by enabling the recording of these points through physical robot positioning. Combining AI with cameras empowers robots to steer clear of potential disruptions caused by humans or other robots, as well as to adjust to misplaced objects without the intervention of the operator (Bécue et al., 2021). Robots in manufacturing can be used to support employees in performing tasks where high physical effort is required, in tasks that are repetitive or are tasks of high risk, such as the manipulation of hazardous chemicals and materials. In addition, robots in “smart” factories can autonomously handle materials, where they can perform product measurement and quality control tasks. Robots such as AGVs (Automated Guided Vehicles) can efficiently transport

finished products or materials within the factory, thereby reducing transportation time (Grau et al., 2020).

2.5 Software in Industry 4.0

The software presents digital assistance for the execution of Industry 4.0, offering support in its implementation and has a key role in modern business. It enables efficient management and decision-making in complex systems. Among the many solutions, ERP (Enterprise Resource Planning), MES (Manufacturing Execution System) and SolidWork software are presented in the following as the most applied software in manufacturing companies.

ERP is a modular software that integrates multiple processes within a company. This software can be used to track movements of inventory, raw materials and finished products, for production planning, manage orders, track costs, optimize resource use and others. By monitoring these activities, the efficiency of the production process improves and production costs are reduced. MES is a system that provides information to optimize manufacturing activities from order to delivery of finished products, using accurate and current data. In addition, the application of MES software enables monitoring, initiating, reacting and reporting of production activities in real-time. This helps in continuous improvement of production through the monitoring of machines, employees and equipment. MES software is used to monitor the quality of the production process, allocate resources and generate reports by integrating all information following the set standards, but it also allows the adjustment of plans and reactions to changes in the production process (Mantravadi & Møller, 2019). SolidWorks software is a CAD (Computer-Aided Design) software used in manufacturing companies as a product design tool. It allows the creation of product models through the generation of technical drawings, that facilitate the design, development and manufacturing processes of components and assemblies. In addition, it is used for the detailed modelling of products, the creation of 2D drawings, simulation of mechanical characteristics of products, contributing to the improvement of the efficiency and quality of the manufacturing process (Planchard, 2019).

3 Examples of implementation of Industry 4.0 in the Republic of Serbia

In recent years, the level of digitalization in the Republic of Serbia has shown notable progress. However, numerous challenges remain to be overcome. The Government of the Republic of Serbia has recognized the significance of digitalization and adopted the Digital Agenda to improve the digital economy. This initiative outlines strategic priorities in electronic communications, e-health, e-commerce, e-justice, e-government, information and communication technologies (ICT) in education, science, culture and information security (Veselinović & Stanišić, 2021). ICT and Internet enable business transactions to become simpler, faster and more cost-effective (Rađenović et al., 2023). Examples of the implementation of modern technologies and Industry 4.0 in manufacturing companies of the Republic of Serbia are presented in the following.

The company “Toyo Tires”, a Japanese manufacturer of tires for a wide range of vehicles worldwide, has implemented the principles of a “smart” factory in factory in the Republic of Serbia by integrating digital innovations into production lines. The rise of the “smart” factory as a manufacturing model, driven by digital innovations such as the IoT, AI and automation, has transformed production processes, enhancing efficiency and enabling real-time data-driven decision-making (Shi et al., 2020). This factory implemented software for optimizing production processes, such as ERP and MES, a solar energy system (contributing to the reduction of CO₂ emissions) and lines for testing of tires (ToyoTires, 2022). In addition to the physical facility, there is a virtual environment called the “T-mode” that applies computer simulation and AI for virtual testing of tires on vehicles under various conditions, analyzing factors such as driving noise, uneven tread wear and others, to optimize tire design and improve performance. Figure 2 shows a simulation of tire behaviour in snowy conditions (figure left) and aerodynamic resistance (figure right). With effective aerodynamics, tires can contribute to the reduction of fuel consumption.

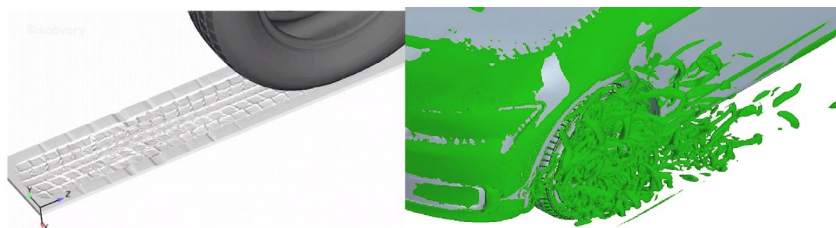


Figure 2: The T-Mode, a virtual testing environment for tires at "Toyo Tires" company

Source: Izrez zaslona (Discovery)

“Naftna Industrija Srbije” (NIS) presents the leading energy company in the Republic of Serbia, with a key role in the national petroleum industry sector (Lukić, 2018), that implements predictive maintenance. While “smart” factories enable real-time monitoring and control of the production system and processes, the implementation of predictive maintenance presents a crucial upgrade that enhances the reliability and durability of industrial systems. Predictive maintenance helps in reducing maintenance costs, extending the life of spare parts and reducing inventory, but also increasing the production volume (Çınar et al., 2020). The adoption of predictive maintenance has significantly improved the level of safety in operational processes within the refinery and simultaneously reduced operational costs, improving business efficiency and the company's competitive advantage (NIS, 2023). Figure 3 shows the outcomes of continuous monitoring of the condition of one of the centrifugal pumps used in the factory. Before the implementation of technologies for monitoring the machine condition, installation of sensors, as well as the application of predictive maintenance, the percentage of stoppages in NIS caused by faulty bearings was 34 [%], but after that implementation, the percentage decreased to 15 [%] (NIS, 2023). Furthermore, there has been a reduction in overall stoppage, while equipment availability has increased by 0,6 [%] (NIS, 2023). This system is crucial for the evolution of maintenance in refinery facilities, from a reactive to a proactive approach. Through continuous monitoring of operations, computers analyze past data about the equipment and provide predictions of potential failures, applying the latest machine learning techniques.

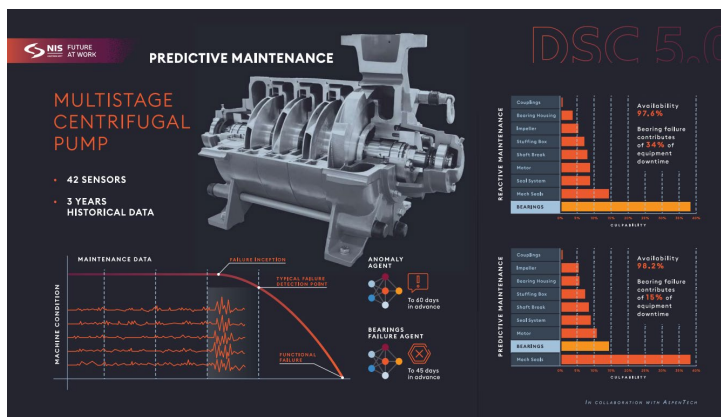


Figure 3: Predictive maintenance at NIS factory

Source: <https://www.nis.rs/blog/nove-tehnologije-u-rafineriji-nafte-pancevo-prepoznaju-kvar-i-prenego-sto-se-dogodi>

The company “Elixir Group” from the city of Šabac is a manufacturer of phosphoric acid and complex mineral fertilizers that has created a DT for one of its production lines. The most complex project involves the creation of a DT, necessitating the integration of advanced technologies to achieve precise simulation and optimization of a real system or product (Qi et al., 2019). This process includes translating a physical system into a digital format, where DT can be accessed through an Internet platform. This enables the easy defining of instructions and following the real-time status of the tasks (Solfins, 2023a).

“Delta Holding” is one of the largest companies in the Republic of Serbia, operating across various sectors such as retail, agriculture, energy, real estate, food and beverages. One of the primary investments of this conglomerate is the project titled “Digital Village”. Through this project, investments are made in digital technologies to improve the infrastructure and production in rural areas, striving towards an increased digital transformation of agriculture in rural communities. The main aim of this project is to enable easier, more efficient and sustainable production in the agricultural sector, by increasing the income of agricultural workers and making rural life more attractive, especially for the young population (DeltaHolding, 2023). “Delta Holding” actively participates in this project by providing expert support and training for agricultural workers. Digital platforms, training programs and virtual

cooperatives enable the modernization of production in the village of Mokrin, considered the first digital village in the Republic of Serbia.

The constant need for efficiency, precision and speed in creating new products sets challenges for engineers. In response to these challenges, the SolidWorks software emerged as a CAD 3D modelling software. This software translates digital models from STL (stereolithographic) files into physical models, enabling 3D printing of both individual components and entire assemblies (Jovanović & Jovanović, 2023). Leading manufacturing companies in the Republic of Serbia, recognized within and beyond the borders of the country, have implemented this software, as presented in the following (Solfins, 2023):

- “Metalac” (Gornji Milanovac), a manufacturer of kitchenware, has implemented this software, leading to accelerated product development. Application of this software automated the process of forming family parts and tools, resulting in increased efficiency and precision in construction;
- “Sloboda AD” (Čačak), a company known for its production and innovations in the field of the military industry, has adopted this software as a comprehensive solution in the development and construction of ammunition, machinery, equipment, tools, as well as for programming of the latest CNC machines;
- “Tigar Tires” (Piroć), a leading tire manufacturer in the Republic of Serbia, successfully applies this software for managing comprehensive documentation used in the maintenance of machinery and tools, as well as in the production process.

4 Conclusion

Implementation of Industry 4.0, globally, presents a new approach aimed at automation and digitalization of manufacturing processes. The application of technologies such as IoT, AI, DT, robotics and software, change how the activities are realised, as well as the level of human participation. Applying Industry 4.0 in the manufacturing industry significantly improves process efficiency, optimizes resources and enhances product quality by integrating technologies with physical devices. The implementation of Industry 4.0 in manufacturing companies of the Republic of Serbia is mostly done in large manufacturing companies (Marjanovic et

al., 2017), increasing the efficiency of e-commerce by over 80% (Rejman Petrovic et al., 2022), enabling improved communication with customers, production per their request and development of complex products (Medić, Anišić & Tešić, 2017). It indicates the importance of implementing new technologies to enhance manufacturing processes, reduce costs and consequently achieve a competitive position in the market. Despite continuous progress in the digitalization of industry in the Republic of Serbia, challenges persist, such as inadequate company structure and slow export growth in manufacturing sectors (Ćorović, Gligorijević & Manasijević, 2019), including the need for additional training of personnel and improved infrastructure. The direction of future research of the authors of this paper is to examine the implementation of other Industry 4.0 technologies in manufacturing companies in the Republic of Serbia, to assess the effectiveness of these technologies and identify opportunities for further improvements in production processes.

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OBLIKOVANJE PROCESNEGA MODELA VSEŽIVLJENJSKE POVEZANOSTI ZDRAVSTVENE OBRAVNAVE PACIENTA

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Pacient v posameznem obdobju zdravljenja prihaja v stik z različnimi izvajalci zdravstvene dejavnosti na različnih ravneh zdravstvenega varstva. To povzroča vrzeli med različnimi zdravstvenimi obravnavami. Glede na izkušnje z drugih področij, npr. gospodarstva, bi lahko bil procesno usmerjen pogled na zdravstveno obravnavo eden od elementov uspešne rešitve. Glavna raziskovalna metoda bo Raziskovalna metodologija načrtovanja in razvoja. V raziskavi bomo raziskali presek med poslovnimi procesi, zdravstveno obravnavo in digitalno preobrazbo. Rezultat bo artefakt - konceptualni organizacijski procesni model vseživljenjske povezanosti zdravstvene obravnave pacienta. Nameravamo dokazati, da razumevanje zdravstvenih obravnav kot vseživljenjski organizacijski proces pomembno pozitivno vpliva na zmanjšanje organizacijskih in informacijskih vrzeli med različnimi obravnavami.

Ključne besede:

zdravstvena
obravnavo,
poslovni
proces,
organizacijski
proces,
organizacijska
vrzel,
informacijska
vrzel

DESIGNING A PROCESS MODEL FOR LIFELONG INTEGRATION OF PATIENT CARE

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During a period of lifelong treatments, patient is exposed to a variety of health providers at different levels of the health system. That leads to the gaps between different instances of treatment. According to experiences in other fields, such as industry, a process-oriented view of health treatment could be one of the components of a successful solution. The main research method will be the Design Science Research approach. In the research, we will explore the intersection between business processes, healthcare treatment and digital transformation. The outcome will be an artefact - a conceptual organizational process model of the lifelong integration of patient care. We would like to demonstrate that understanding health care as a lifelong organizational process has a significant positive impact on reducing the gaps between different treatments.

Keywords:

healthcare
treatment
business
process,
organizational
process,
organizational
gap,
informational
gap

1 Uvod

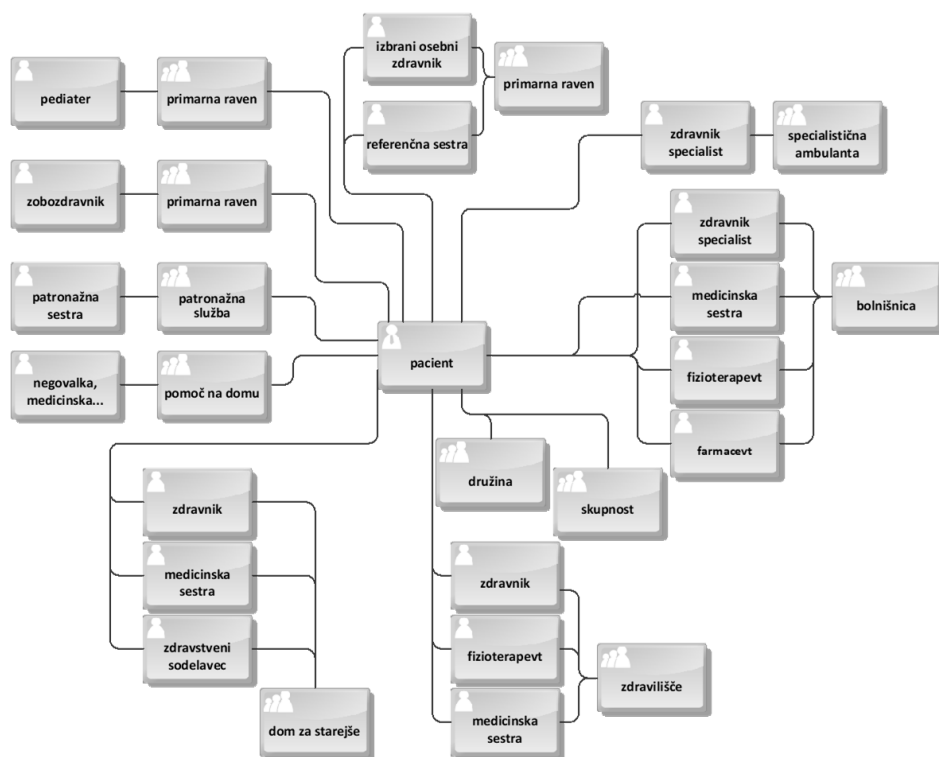
Zdravstveni sistem se je znašel v krizi. Po eni strani se populacija stara (Prebivalstvo - Slovenske regije in občine v številkah, 2023), s tem se povečuje tudi število pacientov, ki potrebujejo zdravstveno oskrbo. To zahteva vse več zdravstvenih obravnav. Novi načini zdravljenja in nova zdravila sicer omogočajo daljšo življenjsko dobo in boljše izide zdravljenja, hkrati pa zahtevajo vse več finančnih vložkov. Po drugi strani se srečujemo z omejitvami virov: človeških (pomanjkanje zdravnikov in drugih zdravstvenih delavcev), prostorskih in finančnih (Strategija razvoja zdravstvene dejavnosti na primarni ravni zdravstvenega varstva do leta 2031, 2024). Na zahteve in omejitve ne moremo bistveno vplivati. Potrebno je najti večjo učinkovitost zdravstvenega sistema.

Pacient v posameznem obdobju zdravljenja prihaja v stik z različnimi izvajalci zdravstvene dejavnosti na različnih ravneh zdravstvenega varstva.

Pacienta torej lahko za časa njegovega življenja obravnavajo (slika 1):

- na primarni ravni; osebni, družinski zdravnik ali pediater, zobozdravnik, ginekolog, fizioterapevt, patronažna služba,
- na sekundarni ravni; specialisti v specialističnih ambulantah in bolnišnicah (v bolnišnici lahko pacient prehaja med različnimi oddelki), zdravilišča,
- na terciarni ravni; Univerzitetni klinični centri (UKC) (pacient lahko prehaja med različnimi klinikami in oddelki), poleg tega tudi: pomoč na domu, dnevni centri za starejše, domovi za starejše, hospic.

Glede na naše predhodne raziskave (Rant, 2001) in druge vire (Dumas et al., 2018; Hammer, 2015; Hammer & Champy, 1995, 2003; Keen, 1997; Keen & Knapp, 1995; Kern, 2022; Vila, 1994, 2000; Vila & Kovač, 2006) v klasičnih funkcijskih organizacijah med zaporednimi aktivnostmi nastajajo organizacijske in informacijske vrzeli, ki jih procesna organiziranost lahko zmanjša ali celo odpravi. Podobnost in s tem priložnost vidimo tudi v zdravstvu.



Slika 1: Deležniki pri zdravstvenih obravnavah pacienta in njihove povezave

Vir: lasten

1.1 Cilji raziskave

Namen raziskave je prispevati k zmanjšanju organizacijskih in informacijskih vrzeli med različnimi zdravstvenimi obravnavami.

Z namenom, da bi proučili ali razumevanje vseživljenjske zdravstvene obravnave kot organizacijski proces lahko zmanjša organizacijske in informacijske vrzeli med zdravstvenimi obravnavami in s tem izboljša zdravstveno oskrbo pacienta, smo si zadali naslednje cilje:

1. povezati teoretična izhodišča s področja vseživljenjske povezanosti zdravstvene obravnave pacienta z izhodišči teorije obvladovanja poslovnih procesov,
2. izdelati posnetek trenutnega stanja na podlagi realnih podatkov,
3. raziskati probleme (izzive in težave), ki se pojavljajo pri zdravstvenih obravnavah (sistemska analiza, analiza problemskega stanja),
4. opazovati zdravstvene obravnave pacienta kot (organizacijski) proces, torej kot vseživljenjsko povezanost zdravstvene obravnave pacienta,
5. oblikovati konceptualni organizacijski procesni model vseživljenjske povezanosti zdravstvene obravnave pacienta.

1.2 Teza raziskave

Razumevanje zdravstvenih obravnav kot vseživljenjski organizacijski proces pomembno pozitivno vpliva na zmanjšanje organizacijskih in informacijskih vrzeli med različnimi obravnavami.

1.3 Predviden rezultat

Glavni rezultat raziskave bo artefakt: Konceptualni organizacijski procesni model vseživljenjske povezanosti zdravstvene obravnave pacienta.

Pri izgradnji artefakta smo postavili naslednja raziskovalna vprašanja (RV):

- RV 1 Ali med zdravstvenimi obravnavami pri različnih izvajalcih nastajajo organizacijske in informacijske vrzeli?
- RV 2 Kako organizacijske in informacijske vrzeli med zdravstvenimi obravnavami vplivajo na učinkovitost zdravstvene obravnave pacienta?
- RV 3 Kako organizacijske in informacijske vrzeli med zdravstvenimi obravnavami vplivajo na kakovost zdravstvene obravnave pacienta?
- RV 4 Kako procesno organiziranje vpliva na (organizacijske in informacijske) vrzeli med zdravstvenimi obravnavami?

1.3 Pričakovani izvirni znanstveni prispevki

Izvirni prispevek znanosti predstavlja nov celovit konceptualni organizacijski procesni model vseživljenjske povezanosti zdravstvene obravnave pacienta, ki predstavlja noviteto na področju organizacijskih znanosti, hkrati pa prispeva k poglobljenemu razumevanju vseživljenjske obravnave pacientov. Pričakovani izvirni znanstveni prispevek raziskave bo dokaz, da sprememba pogleda na vseživljenjsko zdravstveno obravnavo, kot proces, pomembno pozitivno vpliva na zmanjšanje ali odpravljanje organizacijskih in informacijskih vrzeli med različnimi obravnavami in posledično izboljša učinkovitost in kakovost zdravljenja, s tem pa tudi zdravstvenega sistema.

V literaturi smo zaznali organizacijske in informacijske vrzeli med različnimi zdravstvenimi obravnavami. Z raziskavo bomo te vrzeli analizirali in z razvojem konceptualnega modela bomo pokazali, kako je možno te vrzeli zmanjšati ali odpraviti.

Izsledke iz teorije poslovnih procesov, ki veljajo splošno, nameravamo prenesti na področje organiziranja zdravstvenih sistemov. Zdravljenje pacienta lahko opazujemo kot proces, posamezne zdravstvene obravnave pa kot faze in aktivnosti v tem procesu. Pri tem je potrebno definirati tudi lastnika procesa.

Dostop do podatkov in informacij o predhodnih obravnavah mora biti zagotovljen pri vsaki zdravstveni obravnavi. To tehnično omogoča vzpostavljena in delujoča informacijska infrastruktura in enoten ter ažuren repozitorij. Podatki in informacije morajo biti zagotovljeni s strani izvajalca vsakokratne zdravstvene obravnave. Razpoložljivi podatki in informacije pa morajo biti tudi uporabljeni s strani izvajalca naslednje zdravstvene obravnave.

V raziskavi bomo raziskali presek med poslovnimi procesi, zdravstveno obravnavo in digitalno preobrazbo (slika 2).



Slika 2: Presek med poslovnimi procesi, zdravstveno obravnavo in digitalno preobrazbo

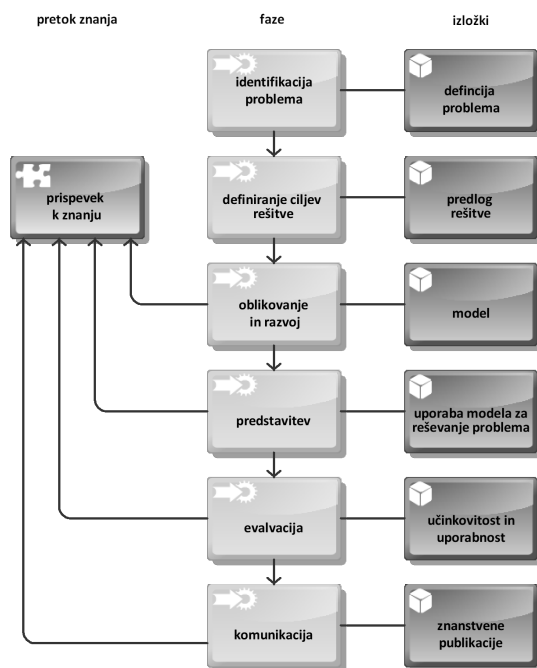
2 Metodologija

Osnovna metoda raziskovanja bo "Raziskovalna metodologija načrtovanja in razvoja" (angl. The design science research methodology - DSRM ali Design Science Research, DSR (Hevner, 2007, 2022; Hevner et al., 2004; Kljajić Borštnar, 2022; Kuechler & Vaishnavi, 2008; Peffers et al., 2007, 2007; vom Brocke et al., 2020a, 2020a)).

Rezultat raziskave bo artefakt – konceptualni organizacijski procesni model vseživljenjske povezanosti zdravstvene obravnave pacienta. Zato bomo na osnovi izsledkov navedenih teoretičnih virov v raziskavi sledili "Modelu raziskovalnega procesa načrtovanja in razvoja" (angl. The Design Science Research Process Model), prirejeno po (Peffers et al., 2007; vom Brocke et al., 2020b; Kuechler & Vaishnavi, 2008), slika 3.

V njem so naslednje faze:

- identifikacija problema in motivacija,
- definiranje ciljev rešitve,
- oblikovanje in razvoj,
- predstavitev,
- evalvacija,
- komunikacija.



Slika 3: Model raziskovalnega procesa načrtovanja in razvoja (angl. The Design Science Research Process Model), prirejeno po

(Peffer et al., 2007; vom Brocke et al., 2020b; Kuechler & Vaishnavi, 2008)

2.1 Identifikacija problema in motivacija

Najprej bomo pregledali relevantno literaturo in s tem proučili teoretična izhodišča. Tako bomo iz literature identificirali probleme. Povezali bomo izsledke s treh področij. Prvo je področje zdravstvene obravnave pacienta s procesnega vidika. Drugo področje je obvladovanje poslovnih procesov (angl. Business Process Management – BPM). Tretje področje je digitalna preobrazba (angl. Digital Transformation).

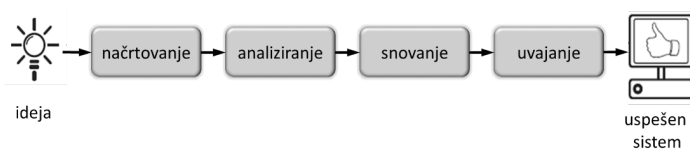
Identificirane probleme bomo obravnavali v slovenskem zdravstvenem sistemu. Uporabili bomo raziskovalno študijo primera (angl. Case Study Research Methodology – Yin, 2018; Kljajić Borštnar, 2021). Raziskali bomo dostopnost in uporabo podatkov o zdravstvenih obravnava in izhodnih dokumentov

zdravstvenih obravnav s pomočjo študija dokumentacije in z uporabo realnih podatkov v slovenskem zdravstvenem sistemu.

Pri raziskavi bomo uporabili realne anonimizirane podatke Nacionalnega inštituta za javno zdravje (NIJZ) o bolnišničnih obravnava, realne anonimizirane podatke o hospitalizacijah Zavoda za zdravstveno zavarovanje Slovenije (ZZZS) in realne anonimizirane podatke iz Centralnega registra podatkov o pacientu, katerega upravljavec je eZdravje NIJZ.

2.2 Definiranje ciljev in predlog rešitve

Pri izgradnji modela bomo uporabili metodologijo: »Življenjski cikel systemskega razvoja« (angl. The Systems Development Life Cycle; Dennis et al., 2014; Valacich et al., 2017), slika 4.



Slika 4: Življenjski cikel systemskega razvoja (angl. The Systems Development Life Cycle)
(Valacich et al., 2017)

Primerjali bomo število obravnav v bolnišnici s številom odpustnih pisem v Centralnem registru podatkov o pacientu (CRPP). Te podatke bomo nadalje primerjali s podatki o vpogledih v odpustna pisma. Primerjali bomo tudi podatke o receptih.

Predlagali bomo rešitve za identificirane probleme. Na ta način bomo dokazali, da za vseživljenjsko povezanost zdravstvenih obravnav veljajo principi teorije sistemov in upravljanja poslovnih procesov in pokazali kako.

2.3 Oblikovanje in razvoj

Na osnovi spoznanj iz prejšnjega koraka bomo kot ključni del raziskave razvili konceptualni organizacijski procesni model vseživljenjske povezanosti zdravstvene obravnave pacienta. Pri tem bomo uporabili »Raziskovalni pristop načrtovanja in razvoja« (angl. Design Science Research; (Hevner, 2007, 2022; Hevner et al., 2004; vom Brocke et al., 2020), slika 3.

2.4 Predstavitev

Predstavili bomo razviti model in odgovore na raziskovalna vprašanja. Pokazali bomo primer uporabe pri vrzeli med bolnišničnimi obravnavami in nadaljevanjem zdravljenja po odpustu iz bolnišnice.

2.5 Evalvacija

Model bomo evalvirali s potrditvijo modela s strani domenskih ekspertov. Pri tem bomo uporabili strukturirane intervjuje.

2.6 Komunikacija

Rezultate raziskave bomo objavili kot znanstveni članek v ugledni reviji, izvedli predstavitev na znanstvenih srečanjih in jih predstavili ključnim deležnikom.

3 Rezultati

V nadaljevanju predstavljamo dosedanje rezultate raziskave.

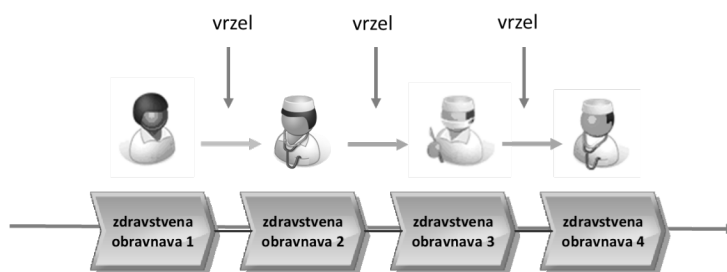
3.1 Identifikacija problema in motivacija

Pregledali smo relevantno literaturo s področij zdravstvene obravnave pacienta s procesnega vidika, obvladovanja poslovnih procesov in digitalna preobrazbe. Iz literature smo identificirali naslednje probleme:

P1 Med zdravstvenimi obravnavami pri različnih izvajalcih nastajajo organizacijske in informacijske vrzeli. (Amelung et al., 2021; Bürkle et al., 2017).

- P2 Lečeči zdravstveni delavci niso vedno seznanjeni z aktivnostmi predhodnih obravnav (Amelung et al., 2021, str. 11; Bürkle et al., 2017).
- P3 Lečeči zdravstveni delavci niso vedno seznanjeni s predpisanimi zdravili predhodnih obravnav in zdravili, ki jih pacient jemlje. (Bürkle et al., 2017; Žerovnik et al., 2018).
- P4 Razdrobljena oskrba spodbuja podvajanje in neučinkovito uporabo virov, kar povzroča vrzeli v oskrbi bolnikov z multimorbidnostmi in zmanjšuje splošno zmogljivost zdravstvenega sektorja, saj sili najboljše zdravstvene delavce, da se osredotočijo na posamezne bolezni (*WHO Global Strategy on People-Centred and Integrated Health Services Interim Report*, 2015).

Organizacijske vrzeli so medfunkcijski ali medoddelčni razkorak, ki nastane zaradi zapiranja organizacijskih enot v svoje meje in neupoštevanja povezav z drugimi enotami (Vila, 1994). Shema vrzeli v zdravstvu je prikazana na sliki 5.



Slika 5: Vrzeli v organizacijskem procesu v zdravstvu

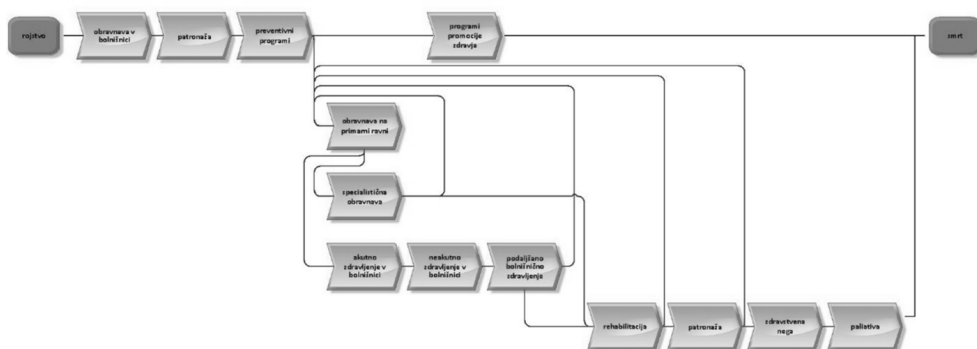
(Rant, 2007, 2008)

3.2 Definiranje ciljev in predlog rešitve

Za analizo problemskega stanja smo pridobili realne podatke slovenskega zdravstvenega sistema. Ugotovili smo, da bo zbranih podatkov o zdravstvenih obravnavah pomembno vplivala na dokazovanje vrzeli med obravnavami v praksi. Pridobili smo realne anonimizirane podatke, ki pa se niso zbirali z namenom raziskave, zato obstaja možnost, da nekateri podatki v raziskavi ne bodo uporabni in zato ne bodo uporabljeni.

3.3 Oblikovanje in razvoj

Na osnovi dosedanjih ugotovitev smo oblikovali osnutek modela. Model, kot ga razumemo sedaj, predstavlja prikaz želenega stanja (TO-BE) (slika 6).



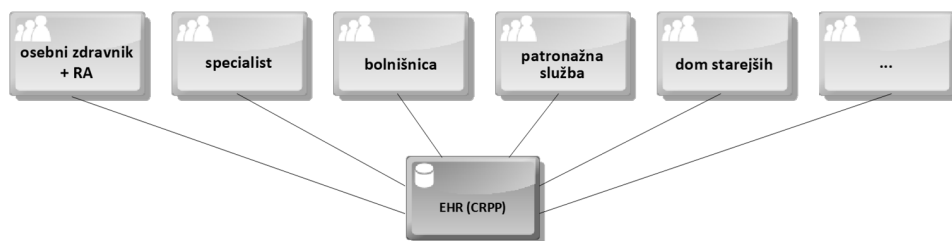
Slika 6: Konceptualni organizacijski procesni model vseživljenjske povezanosti zdravstvene obravnave pacienta

(Rant, 2020)

Pri raziskovanju smo ugotovili, da je za nov organizacijski model pomembno raziskati informacijskih sistem, povezan z njim. Pri tem ugotavljamo:

- Za uspešno izvajanje procesa zdravljenja je potreben dostop do podatkov in informacij o preteklih zdravstvenih obravnava.
- Dostop do podatkov in informacij predhodnih zdravstvenih obravnava mora biti zagotovljen tistim, ki opravljajo trenutno zdravstveno obravnava na katerikoli ravni.
- Potreben je enoten repozitorij = centralni EHR

Grafični prikaz je na sliki 7.



Slika 7: Povezanost in dostop do zdravstvenih podatkov v enotnem repozitoriju, centralnem EHR

V Sloveniji tak repozitorij že obstaja. To je Centralni register podatkov o pacientu (CRPP) v okviru eZdravja.

4 Zaključki

Zdravstvo se je znašlo v krizi. Potrebno je povečati učinkovitost zdravstvenega sistema. Raziskave kažejo, da v klasičnih funkcijskih organizacijah med zaporednimi aktivnostmi nastajajo organizacijske in informacijske vrzeli, ki jih procesna organiziranost lahko zmanjša ali celo odpravi. Nameravamo dokazati, da splošne izsledke iz teorije poslovnih procesov lahko prenesemo tudi na področje organiziranja zdravstvenih sistemov in s tem prispevamo k zmanjšanju ali odpravi organizacijskih in informacijskih vrzeli. V ta namen nameravamo izdelati artefakt: Konceptualni organizacijski procesni model vseživljenjske povezanosti zdravstvene obravnave pacienta.

Pričakovani izvirni znanstveni prispevek raziskave bo dokaz, da sprememba pogleda na vseživljenjsko zdravstveno obravnavo, kot proces, pomembno pozitivno vpliva na zmanjšanje ali odpravljanje organizacijskih in informacijskih vrzeli med različnimi obravnavami in posledično izboljša učinkovitost in kakovost zdravljenja, s tem pa tudi zdravstvenega sistema.

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ANALIZA RAZVOJNIH IN UPORABNIŠKIH VIDIKOV ERECEPTA V SLOVENIJI

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Slovenija ima dobro razvite rešitve eZdravja. Ena izmed njih je eRecept, ki omogoča predpisovanje elektronskih receptov in izdajo zdravil v lekarnah. Vsakodnevno delovanje zdravstvenega sistema se je razen nekaterih izjem med pandemijo covid-19 ustavilo. Delo zdravstvenih delavcev je bilo zaradi novih protokolov obravnave in nevarnosti okužbe izjemno težko. Pacienti so zaradi strahu pred okužbo in zaradi spremenjene prakse zdravstvene obravnave in različnih omejitev poskušali čim bolj zmanjšati število osebnih obiskov zdravstvenih ustanov. Zdravstveni delavci so zaradi izrednih okoliščin in drugih inherentnih dejavnikov, pa tudi zaradi pritiska pacientov, intenzivneje začeli uporabljati rešitve eZdravja. Rešitev eRecept je bila v tem času že v splošni uporabi in to se je izkazalo kot izredno pomembno za zagotavljanje predpisovanja zdravil. V prispevku bomo rešitev eRecept podrobneje opisali, prikazali njen razvoj in s pomočjo podatkov iz modulov za statistiko in poslovne inteligence analizirali njeno uporabo.

Ključne besede:

eRecept,
elektronski
recept,
e-recept,
eZdravje,
zdravstvena
informatika

ANALYSIS OF THE DEVELOPMENT AND USER ASPECTS OF ePRESCRIPTION IN SLOVENIA

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Slovenia has well-developed eHealth solutions. One of them is eReceipt, which enables electronic prescriptions and dispensing of medicines in pharmacies. With a few exceptions, the daily functioning of the healthcare system came to a standstill during the covid-19 pandemic. The work of healthcare workers was extremely difficult due to new treatment protocols and the risk of infection. Patients tried to minimise the number of personal visits to health facilities due to fear of infection and due to changed health care practices and various restrictions. Healthcare professionals have started to use eHealth solutions more intensively due to emergency circumstances and other inherent factors, as well as pressure from patients. The ePrescription solution was already in widespread use at this time and this proved to be extremely important for ensuring the prescription of medicines. In this paper we will describe the ePrescription solution in more detail, show its evolution and analyse its use using data from the statistics and business intelligence modules.

Keywords:

ePrescription,
electronic
prescription,
eHealth,
health
informatics

1 Uvod

Slovenija ima dobro razvite rešitve eZdravja. Ena izmed njih je eRecept. eRecept je nacionalna informacijska rešitev za elektronsko predpisovanje zdravil pri izvajalcih zdravstvene dejavnosti in izdajanje zdravil v lekarnah.

Danes je eRecept ena najbolj prepoznavnih, učinkovitih in uporabljenih rešitev, ki so bile razvite v okviru eZdravja. Njeno vrednost je prepoznalo Ministrstvo za javno upravo že leta 2020 v dokumentu *Evalvacija ukrepov iz enotne zbirke ukrepov, Vrednotenje učinkov implementacije projekta eZdravje: eRecept, eNaročanje* (Ministrstvo za javno upravo, 2020).

DESI Report 2019 (European Commission, 2019) uvršča Slovenijo na tretje mesto v EU pri uporabi elektronskih receptov.

eRecept je bil nagrajen tudi z nagrado *Informacijska jagoda* za najboljši dosežek na področju informacijske družbe leta 2017.

Cilji rešitve eRecept so bili naslednji (Stanimirovič & Matetič, 2018; Nacionalni inštitut za javno zdravje, 2020):

- Povečati varnost pacientov in zmanjšanje napak zaradi napačne uporabe zdravil z izboljšano berljivostjo receptov, manjšim številom administrativnih napak.
- Poenostaviti postopke za paciente v primerih, ko se recept z upoštevanjem medicinskih smernic lahko izda v odsotnosti pacienta, saj v tem primeru pacientu ni treba obiskati predpisovalca za prevzem recepta.
- Zagotoviti učinkovitejše predpisovanje in uporabo zdravil z upoštevanjem podatkov o predhodno predpisanih in izdanih zdravilih.
- Povečati učinkovitost procesa izdaje zdravil znotraj posameznih akterjev in med akterji v zdravstvu, predvsem z zmanjševanjem nepotrebnih stikov in poti.
- Zmanjšati administrativne stroške z odpravo uporabe papirnih obrazcev (nakup obrazcev, tiskanje v ambulantah, arhiv v lekarnah).

- Zagotoviti potrebne podatke za različne analize, vključno z različnimi raziskavami.

Še večjo vlogo pa je uporaba eRecepta prinesla v času epidemije covid-19. Vsakodnevno delovanje zdravstvenega sistema se je razen nekaterih izjem med pandemijo covid-19 ustavilo. Delo zdravstvenih delavcev je bilo zaradi novih protokolov obravnave in nevarnosti okužbe izjemno težko. Pacienti so zaradi strahu pred okužbo in zaradi spremenjene prakse zdravstvene obravnave in različnih omejitev poskušali čim bolj zmanjšati število osebnih obiskov zdravstvenih ustanov. Zdravstveni delavci so zaradi izrednih okoliščin in drugih inherentnih dejavnikov, pa tudi zaradi pritiska pacientov, intenzivneje začeli uporabljati rešitve eZdravja. V tem času je predpis zdravil na daljavo brez prisotnosti pacienta omogočil mnogim pacientom nemoteno pridobivanje zdravil in močno olajšal dostop do zdravil med epidemijo.

V prispevku opisujemo in analiziramo rešitev eRecept, podajamo podatke o njeni uporabi skozi leta in o tem razpravljamo.

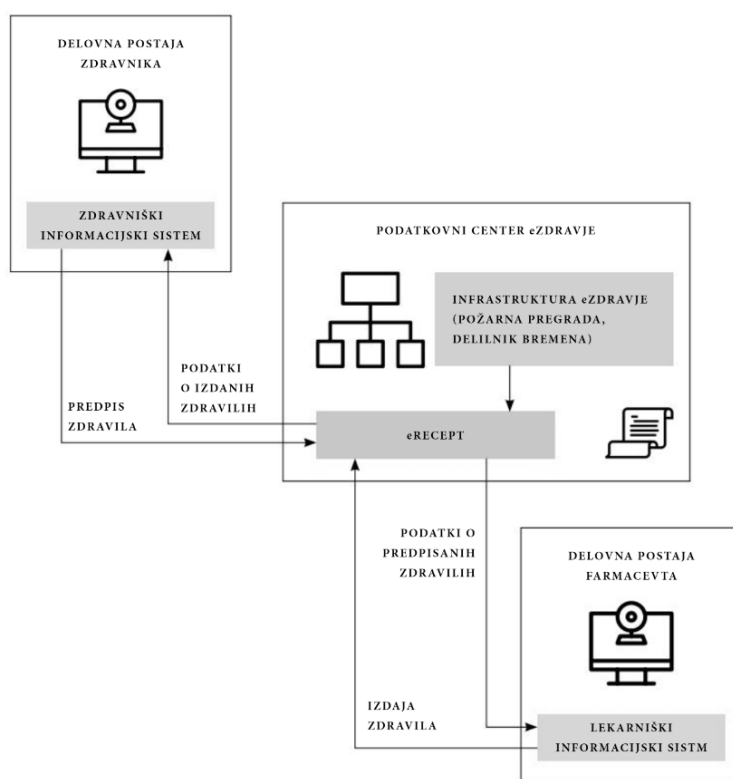
2 Metodologija

V prispevku predstavljamo analizo funkcionalnosti in uporabe rešitve eRecept v okviru eZdravja. Rešitev je bila uvedena na nacionalni ravni že leta 2015. Z raziskavo smo želeli odgovoriti na vprašanje, kakšna je rešitev eRecept, raziskati njen razvoj in uporabo skozi leta. Za raziskavo smo uporabili metodologijo študije primera (Kljajić Borštinar, 2021; Yin, 2018), ki je vključevala poglobljeno študijo področja in njeno analizo. Analiza je bila na eni strani izvedena na podlagi pregleda literature s tega področja (Rant et al., 2017; Rant et al., 2019; Stanimirović & Matetić, 2018; Stanimirović et al., 2022, Yang et al., 2022; Zidarn et al., 2018) ter projektne dokumentacije, navodil uporabnikom in tehničnih specifikacij rešitve, na drugi strani pa na podlagi opazovanj ter dejanskih statističnih podatkov o uporabi iz administratorskega modula rešitve.

Analiza funkcionalnosti in uporabe rešitve eRecept je bila izvedena v decembru 2023 in januarju 2024. Pridobitev statističnih podatkov iz poslovnih in administrativnih modulov je bila izvedena januarja 2024.

3 Rezultati

eRecept je nacionalna informacijska rešitev za varno elektronsko predpisovanje in elektronsko izdajo zdravil. Elektronski recepti (e-recepti) nastanejo v lokalnih informacijskih sistemih pri izvajalcih zdravstvenih dejavnosti (IZD) in se hranijo v centralni evidenci elektronskih receptov (ERR, slika 1). ERR je vir informacij za lekarne, kjer na podlagi predpisanih e-receptov pacientom izdajo zdravila (Ministrstvo za zdravje, 2013).



Slika 1: Shema rešitve eRecept

Vir: (Stanimirovič & Matetič, 2018; Nacionalni inštitut za javno zdravje, 2020)

Že sam razvoj te rešitve prikazuje primer dobre prakse, saj je pri razvoju v konzorciju sodelovalo sedem ponudnikov programske opreme. Rešitev je bila uvedena novembra 2015 na primarni ravni v celotni Sloveniji, na sekundarni in terciarni ravni pa februarja 2016. Dnevno se uporablja pri izvajalcih zdravstvene dejavnosti in v lekarnah.

Rešitev sestavljata dve komponenti – elektronsko predpisovanje in izdajanje zdravil. Pri predpisovanju zdravila se zdravnik identificira s svojo profesionalno kartico in kartico zdravstvenega zavarovanja pacienta oz. njeno številko. Zdravnik pregleda seznam zdravil, ki jih pacient jemlje. Iz seznama v preteklosti predpisanih zdravil ali iz Centralne baze zdravil izbere zdravilo, ki ga želi predpisati. Lahko predpiše tudi magistralno zdravilo. Pri tem ima možnost preveriti interakcije in kontraindikacije. Rešitev omogoča tudi preverjanje ustreznosti zdravila za športnike zaradi uvrstitve na listo prepovedanih snovi. Zdravnik tako pripravi podatke predpisa in preveri ustreznost. Paket podpiše z digitalnim potrdilom in ga pošlje v centralno bazo e-receptov.

V lekarni farmacevt s pomočjo kartice zdravstvenega zavarovanja pacienta in s svojo profesionalno kartico pridobi podatke pacienta, izbere recept in zdravilo za izdajo. Pripravi zdravilo in ga izda ter izdajo potrdi v centralni bazi e-receptov.

Vse te podatke pacient lahko spremlja preko portala za paciente zVEM (Nacionalni inštitut za javno zdravje, 2024). Lahko vidi, katera zdravila ima predpisana, kdo in kdaj mu jih je predpisal, izdaje zdravil in koliko izdaj je še na voljo pri obnovljivih receptih. Pacient lahko različne izdaje istega recepta dvigne v različnih lekarnah v Sloveniji. V portalu zVEM (Nacionalni inštitut za javno zdravje, 2024) pacient lahko tudi vidi kdo in kdaj je vpogledoval v njegove podatke o receptih.

Rešitev eRecept zdravniku omogoča vpogled v e-recepte pacienta, elektronsko predpisovanje zelenih in belih receptov, strukturiran predpis, prepis zdravila iz Centralne baze zdravil (CBZ) ali magistralnega pripravka, preverjanje interakcij, kontraindikacij in nedovoljenih snovi v športu, elektronsko podpisovanje paketa in pošiljanje v centralni nacionalni repozitorij elektronskih receptov. Na drugi strani pa v lekarnah omogoča vpogled e-receptov v centralnem repozitoriju, preverjanje interakcij, kontraindikacij in nedovoljenih snovi v športu, elektronsko podpisovanje in posredovanje podatkov o izdaji v centralni repozitorij.

eRecept je informacijska rešitev, ki se uporablja že od leta 2015. Kljub temu nenehno skrbimo za njen razvoj.

V letu 2023 smo dodali izdelavo in ažuriranje osebne kartice zdravil (OKZ; Nacionalni inštitut za javno zdravje, 2020b), ki jo izvajajo farmacevti s posebnimi znanji. Te aktivnosti se sicer izvajajo v drugi informacijski rešitvi eZdravja – zVEM plus, pri tem pa se kot osnova uporabljajo podatki o e-receptih.

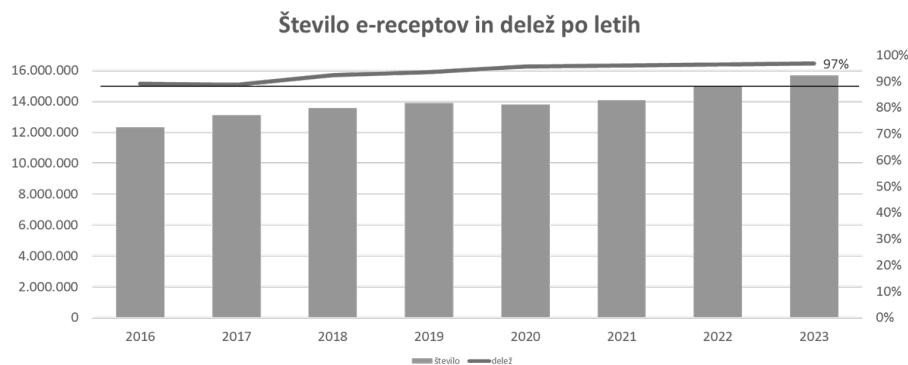
Pripravljamo povezavo s Slovensko Antidoping Organizacijo (SLOADO). V rešitev bomo vključili preverjanje zdravil na Listi prepovedanih snovi za športnike.

Dodajamo tudi vpogled v e-recepte za medicinske sestre.

2.1 Podatki o uporabi

V naši raziskavi smo raziskali tudi uporabo rešitve eRecept.

Podatki iz administrativnega modula rešitve eRecept kažejo, da se skupno število predpisanih e-receptov v letih 2018 do 2020 ni bistveno spreminjalo. Porast zaznavamo v letih 2021, 2022 in 2023. V letu 2022 je bilo predpisano že več kot 15.000.000 receptov, leta 2023 je skupno število predpisanih e-receptov preseгло 15.600.000 (slika 2). To pomeni, da je vsak prebivalec Slovenije dobil skoraj 8 receptov na leto.



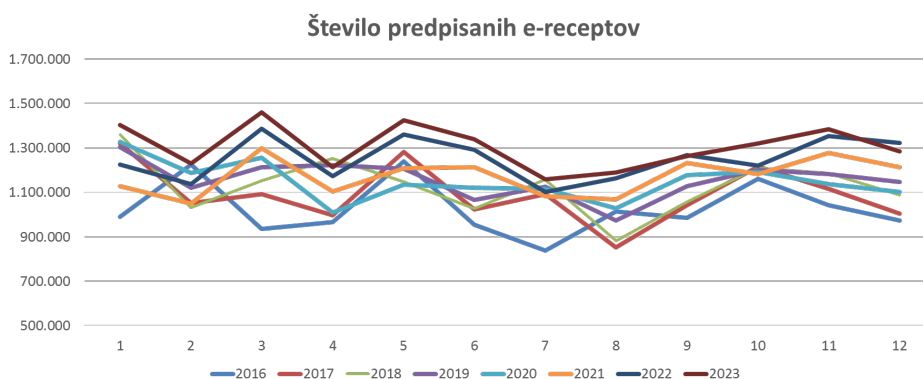
Slika 2: Prikaz števila in deleža izdanih elektronskih receptov po letih

Vir: lasten

Rešitev eRecept je uporabljalo 1500 izvajalcev zdravstvene dejavnosti. Od tega so e-recepte predpisovali v 1100 organizacijah, zdravila pa je izdajalo 360 lekarn.

Pogled na deleže elektronsko predpisanih receptov med vsemi predpisanimi recepti kaže, da je bilo od leta 2020 naprej več kot 96 % predpisanih receptov elektronskih, v letu 2023 celo 97 %. Naš cilj pri uvajanju eRecepta je bil, da dosežemo 90 % in ta cilj smo krepko presegli (slika 2). Pri tem je potrebno omeniti, da 100 % zaradi pravil nikoli ne bomo dosegli. Papirno se predpisujejo nekateri nujni recepti, recepti pri obisku na domu in osebni recepti zdravnikov za lastno uporabo.

Zanimiv je tudi pogled na predpise e-receptov po mesecih. Viden je upad prepisov v poletnih mesecih in več prepisov v zimskem času (slika 3).



Slika 3: Število predpisanih elektronskih receptov po mesecih v različnih letih

Vir: lasten

4 Diskusija

Neodvisno poročilo Evalvacija ukrepov iz enotne zbirke ukrepov, Vrednotenje učinkov implementacije projekta eZdravje: eRecept, eNaročanje (Ministrstvo za javno upravo, 2020) navaja ključne pozitivne spremembe.

Za zdravnike poudarjajo boljši nadzor in pregled nad že izdanimi recepti, bolj strukturirane predpise zdravil, lažje in hitrejšje preverjanje interakcij med zdravili zaradi dodatnih funkcionalnosti, učinkovitejšo kontrolo za posamezne rizične skupine, manj administrativnega dela ter dostopnejše in hitrejšje analize podatkov.

Za farmacevte so to izboljšana možnost preverjanja interakcij med zdravili, brez možnosti izdaje napačnega zdravila zaradi nečitljivosti pisave, manj administrativnega dela in večja varnost, dostopnejše in hitrejšje analize podatkov.

Pri pacientih so ključne pozitivne spremembe zmanjšana možnost neželenih učinkov jemanja zdravil, varno shranjeni podatki o predpisanem zdravilu, pregled nad statusi receptov, omogočen postopek izdaje zdravil stalne terapije oziroma predpisovanje na daljavo.

Za leta 2016, 2017 in 2018 to poročilo navaja od 2.000.000 do 3.000.000 EUR prihrankov letno.

Poleg teh ima rešitev še druge prednosti: možnost predpisovanja receptov na daljavo, brez fizične prisotnosti pacienta pri zdravniku; odpravo napak, posledic napačnega zapisa ali slabo berljive pisave in s tem povečanje varnosti pacientov; za obnovljive recepte pacientu ni potrebno obiskati vedno iste lekarne; možno je tudi preverjanje zdravila glede na prisotnost na listi prepovedanih snovi za športnike. Poenostavljeno je tudi spremljanje porabe zdravil in večja zanesljivost podatkov.

4 Zaključki

Rešitev eRecept je primer dobre prakse digitalizacije zdravstva v Sloveniji. V času epidemije covid-19 je marsikateremu pacientu omogočila uporabo zdravil, saj je bilo možno, da je zdravnik predpisal recept za zdravilo na daljavo in ga je pacient s svojo kartico zdravstvenega zavarovanja samo dvignil v katerikoli lekarni v Sloveniji. To kaže tudi uspešna uporaba te rešitve, saj je več kot 96 odstotkov receptov predpisanih elektronsko. To nas uvršča v sam svetovni vrh. Pomembna je tudi povezava s portalom za paciente zVEM, ki omogoča pacientom spremljanje uporabe zdravil. V letu 2023 se je uporaba še nadgradila, saj na osnovi podatkov o receptih farmacevte s posebnimi znanji v bolnišnicah in lekarnah lahko pripravijo osebno kartico zdravil. Čeprav je bila rešitev eRecept razvita in uvedena že leta 2015, še

vedno odlično služi svojemu namenu in jo nenehno nadgrajujemo glede na nove zahteve in potrebe. Rešitev je bila prva izmed rešitev eZdravja v Sloveniji, ki je bila uvedena na nacionalni ravni. Uporabljajo jo vsakodnevno zdravstveni delavci pri izvajalcih zdravstvene dejavnosti in farmacevti v lekarnah, v veliki meri pa tudi pacienti preko portala zVEM. Dandanes si marsikdo ne more predstavljati slovenskega zdravstvenega sistema brez elektronskega predpisovanja receptov. Omogočiti je potrebno tako kadrovske, kot tudi finančne vire za zagotavljanje vzdrževanja rešitve eRecept, kot tudi za potrebne nadgradnje in dopolnitve.

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THE ROLE OF SOCIAL NETWORKS IN THE SPREAD OF FAKE NEWS

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Crises in human society have been accompanied by the deliberate and unintentional spread of false news since the time of ancient Egypt. However, the spread of misinformation has taken entirely new dimensions with the emergence of online social networks. According to the World Economic Forum, fake news represents one of the main threats to human society. The scope and speed of the dissemination of fake news and misinformation in today's world significantly negatively affect democratic processes. In this contribution, we present an overview of research on the spread of fake news on social networks, focusing on major global crises in recent times, such as the U.S. elections, the Covid-19 pandemic, and the war in Ukraine, and present the state of our ongoing research project in this field.

Keywords:
misinformation,
fake
news,
social
networks,
network
diffusion,
Agent
Based
Modelling

1 Introduction

The rapid growth of social media has revolutionized our methods of communication and information sharing. Social media platforms have simplified the process of connecting with people and accessing a wealth of information across various subjects. Nevertheless, this newfound ease of access has also paved the way for the rampant spread of misinformation, which refers to deliberately or unintentionally disseminated false or deceptive information.

The spread of misinformation on social networks is a growing concern, with serious consequences for individuals, communities, and societies. The rampant proliferation of digital misinformation has reached such alarming levels that the World Economic Forum (Tedeneke, 2018) classifies it as one of the primary threats to human society. The sheer magnitude and speed of fake news and misinformation sharing are impacting democratic processes. False news can lead to the improper allocation of resources during terrorist attacks and natural disasters, the misdirection of business investments, and can mislead elections (Vosoughi et al., 2018).

The research focus on the fake news phenomenon intensified following the prominent role of fake news factories during the 2016 US presidential election, as extensively reported (Bovet & Makse, 2019). Fresh theories regarding the dynamics of fake news dissemination have emerged, primarily derived from the analysis of historical media publications, tweets, and posts on social networks and blogs (Pei & Makse, 2013; Zheng et al., 2018). Nonetheless, research into the psychological mechanisms that influence the spread of fake news by individuals, including cognitive biases, actually began as far back as the 1970s (Haselton et al., 2015).

This contribution reviews a selection of research on the factors that contribute to the spread of misinformation, with focus on research utilizing agent-based modeling (ABM) and network modeling to study this phenomenon and presents the state of our ongoing research project in this field.

2 Review of Research

2.1 Social influence

Research by Bond et al. (Bond et al., 2012) shows that results the relationship to the source of political mobilization messages directly influenced political self-expression, information seeking and real world voting behaviour of millions of people. Furthermore, the messages not only influenced the users who received them but also the users' friends, and friends of friends. According to the authors, strong ties are instrumental for spreading both online and real-world behaviour in human social network. A method for quantitatively measuring social influence in mobile social networks is presented by (Peng et al., 2017). Authors propose an evaluation model on social influence by using information entropy to reveal the relationship between social interactions and the strength of social influence. Aston (Aston, 2022) has analysed 2018 Twitter data to study the broader tendencies in collective cognition that compels individuals to spread misinformation. Their conclusion was that those that spread misinformation were highly sensitive to social reward.

2.2 Cognitive Biases

Personal traits, such as cognitive ability (Ahmed & Tan, 2022) and cognitive biases, e.g. confirmation bias, motivated reasoning, and the illusion of validity, can lead individuals to interpret information in a way that confirms their existing beliefs, making them more susceptible to misinformation. This can lead individuals to dismiss contradictory evidence and accept misinformation that aligns with their preconceived notions. Individuals with strong political beliefs, i.e. partisans are particularly more likely to consume and share misinformation that confirms their existing worldview. Concepcion and Sy (Concepcion & Sy, 2023) present a rumor propagation model based on epidemiological models, which incorporates the cognitive process of users when encountering false news, the platform in which the false news spreads, and the relationship of false news with online users. Their results showed that Confirmation Bias, Sharing of Posts, and Algorithmic Ranking are the three main factors affecting the spread of fake news. Geschke et al. (Geschke et al., 2019) have also demonstrated that cognitive biases lead to the formation of echo chambers (see also 2.4).

2.3 Polarization and Echo Chambers

Social media algorithms, which prioritize content based on user engagement, tend to favor information that aligns with users' existing beliefs, leading to the creation of echo chambers. Within these echo chambers, individuals are exposed primarily to information that confirms their existing worldview, reinforcing their biases, resulting in group polarization, and making them more susceptible to misinformation. Fränken and Pilditch (Fränken & Pilditch, 2021) report that positive credibility perceptions of a communicating source can facilitate the growth of a single cascade to produce echo chambers. Similar results are reported by Sasahara et al. (Sasahara et al., 2021), where even with minimal amounts of influence and unfriending, the social network rapidly devolves into segregated, homogeneous communities. Del Vicario et al. (Del Vicario et al., 2016) have demonstrated that information related to distinct narratives such as conspiracy theories and scientific news generates homogeneous and polarized communities (i.e., echo chambers) having similar information consumption patterns. They further show that homogeneity and polarization are the main determinants for predicting the size of information cascades. Garimela et al. (Garimella et al., 2018) have studied the phenomenon of political echo chambers on social media and attempted to identify the users in one of two roles within an echo chamber: partisans and gatekeepers, from social and content features. Geschke et al. (Geschke et al., 2019) have demonstrated that echo chambers emerge due to cognitive mechanisms, such as confirmation bias, under conditions of central information propagation through channels reaching a large part of the population. When social and technological filtering mechanisms were added to the model, polarization of society into even more distinct and less interconnected echo chambers was observed. Echo chambers and the resulting polarization are visualized in Figure 1, showing two distinct communities, where most nodes have connections only within their (echo chamber) community, while the connections between the communities are weak.

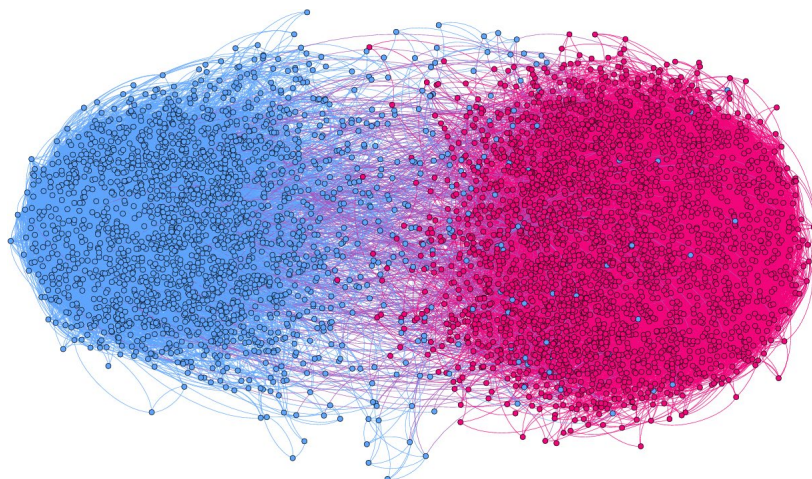


Figure 1: A representation of an echo chamber

Source: (Sasahara et al., 2021)

2.4 Covid-19 Infodemic

The global epidemic of coronavirus (COVID-19) has been almost immediately followed by a global infodemic of misinformation on the source of the virus, virus spread containment methods, treatments and eventually the vaccines. This misinformation originated from social media accounts and websites with no credible evidence to support their claims (Mian & Khan, 2020). The spread of misinformation was fostered by uncritical and uninformed dissemination of misinformation by influential users of social networks (Harff et al., 2022; Shrivastava et al., 2020; Wasike, 2022), including the then US president Donald Trump. Kauk et al. (Kauk et al., 2021) demonstrated a novel approach to characterize the propagation of conspiracy theories through social networks by applying epidemiological models to Twitter data. Author have presented three extended SIR models which include deletion of tweets, fact-checking and both countermeasures combined.

2.5 Russia and War in Ukraine

European Digital Media Observatory task force on Ukraine has detected that approximately 30% of Twitter accounts spreading pro-Russian information within the EU since the beginning of the war on Ukraine are very likely to be bots (Blasi &

Javadi, Mahmoud, 2022). EDMO's survey of the detected pro-Russian accounts shows that 73% of the analyzed accounts produced their first tweet after the start the Russian invasion, suggesting they might be accounts created or activated specifically for the purpose of supporting the Russian narrative on the war in Ukraine. EDMO's recommendations for tackling the fake news epidemic include the call to “Build an EU-wide pipeline of researchers, university centers, journalists, fact-checkers and other civil society groups with the necessary technical, linguistic and subject-matter knowledge to respond quickly to future information challenges.”

The presence of pro-Russian bots on social media, and on Twitter in particular, is however not a new phenomenon. Polarized online communities are fertile ground for misinformation operations such as the one Russia conducted to influence the 2016 US election. Instead of trying to force their messages into the mainstream, actors such as the Internet Research Agency (DiResta et al., 2019; Howard et al., 2019) target polarized communities and embed fake accounts within them. Polarized, emotional messages gain traction in an existing echo chamber easier than in a neutral, non-polarized community. Once the influence of fake accounts has been established, they can introduce new viewpoints and amplify divisive and inflammatory narratives that are already circulating.

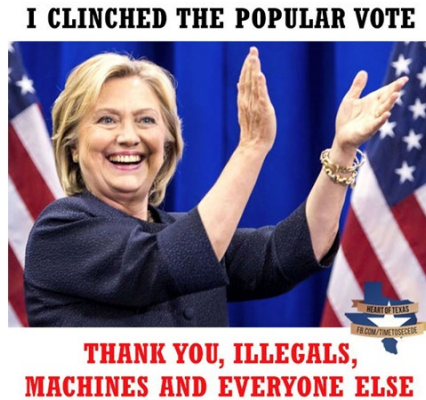


Figure 2: An example of a meme by the Internet Research Agency that spreads misinformation

Source: (DiResta et al., 2019)

2.6 Artificial Intelligence in Production and Detection of Fake News

The field of Artificial Intelligence (AI) has gained tremendous attention in the last few years due to the proliferation of deep learning models, first in the development of autonomous vehicles, and recently in the field of language models such as ChatGPT. However, AI has been used to develop fake news detection methods much earlier. An overview of AI related methods with focus on Machine Learning (ML) used in fake news detection is provided in (Khan et al., 2021). Large language models (LLM) have polarized the scientific and educational community, as they promise to automate several aspects of writing, as well as plagiarism. However, a bigger societal danger of LLMs may be their use in the generation of misinformation. Chen and Shu (Chen & Shu, 2023) present a taxonomy of LLM-generated misinformation and categorize and validate the potential real-world methods for generating misinformation with LLMs. Their findings are worrying: LLMs can be instructed to generate misinformation in different types, domains, and errors; LLM-generated misinformation can be harder for humans and misinformation detectors to detect, making it both easier to produce and more dangerous.

3 State of ongoing research project

In this section we present the current state of the simulation model from the ongoing research project »Modelling the influence of individuals' and network characteristics on dissemination of fake news in a social network.« An social network is modelled from the aspect of an agent in the news dissemination process, and its decision-making model is to integrate representations of the relevant cognitive biases. The model allows us to vary the agent behaviour parameters, news generation and processing parameters as well as agent network type and layout in order to examine the influence of these parameters on the dynamics of message diffusion as well as visualize the diffusion of messages through the network. We have so far noticed that the increased frequency of messages can produce non-linear behaviour through network congestion. Currently we are implementing several ideas on the influence of network neighbourhood (three degrees of influence) and the mental well-being of the agent (e.g. generalized anxiety level) on the emergence of polarization.

The simulation interface with animation of agent communication is shown in Figure 3.

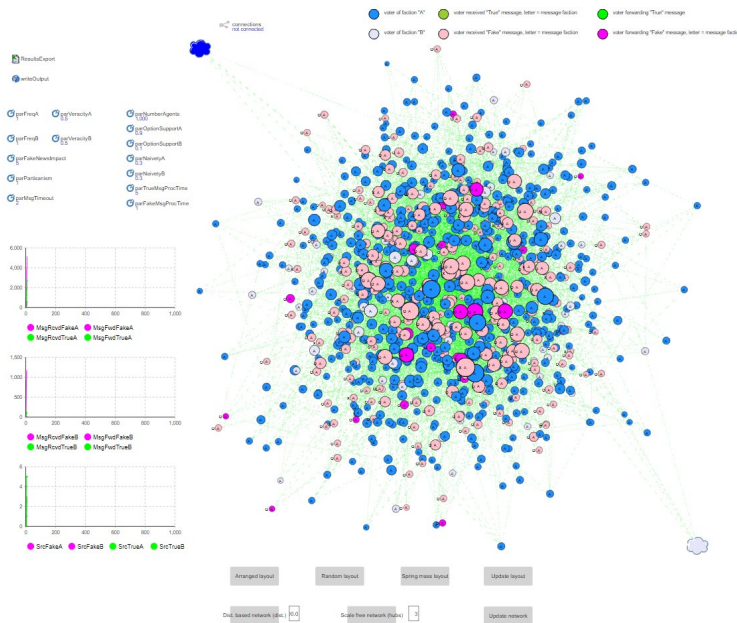


Figure 3: Simulation interface within the current model prototype

Source: own

4 Conclusion

We can summarize our review of research on the diffusion of misinformation in social networks in the following points:

- Misinformation can have a significant impact on individuals' beliefs, attitudes, and behaviors.
- Network structure plays a significant role in the spread of misinformation. Networks with high clustering and low average path length are more susceptible to misinformation outbreaks.
- Several factors lead to the creation of echo chambers, which accelerate polarization:
 - social media algorithms, which create filter bubbles;
 - homophily, the tendency for individuals to connect with others who share similar beliefs and interests;
 - cognitive biases, such as confirmation bias or motivated reasoning, further homophily;

- social reinforcement, i.e. the fact that individuals are more likely to adopt or share information that has been shared by “close friends”, even if they have not independently verified its accuracy, can also create positive feedback loops, resulting in echo chambers that make it difficult to control the spread of misinformation.
- Trust in traditional media outlets and other sources of information can influence an individual's willingness to believe and share misinformation. When individuals lack trust in these sources, they may be more likely to turn to less credible sources for information, increasing their risk of encountering misinformation.
- The rapid pace of information consumption: There is so much information being shared online that it can be difficult to keep up with it all. This can lead to people not taking the time to verify the accuracy of information before they share it.
- Demographics: Certain demographic factors, such as age, education, and socioeconomic status, have been associated with differences in susceptibility to misinformation. For example, older adults and individuals with lower levels of education are more likely to believe in misinformation. (Lewandowsky et al., 2017)
- Media literacy: Media literacy refers to an individual's ability to critically evaluate information and identify misinformation. Individuals with higher levels of media literacy are better equipped to discern credible sources from misinformation.
- Counteracting misinformation requires a multi-pronged approach that includes promoting the availability of credible information, educating individuals about the dangers of misinformation, and developing algorithms to detect and remove false information from social media platforms.

Individuals as well as corporate and government actors exploit a range of network structure related and psychological factors to promote disinformation and drown out facts in social networks. Understanding these factors is crucial for developing effective strategies to combat the spread of misinformation and promote informed decision-making in the digital age.

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CANINE CO-WORKERS: UNRAVELING THE CHALLENGES, BENEFITS, AND BRANDING DIMENSIONS OF DOGS IN THE WORKPLACE

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Nowadays organizations struggle with staff shortages, so the concept of internal marketing or its modern variant, employer branding (EB), is taking on importance in organizations. The concept is based on the effort to attract, engage and retain employees by satisfying their needs. On the other hand, many people (i.e. potential employees) own a pet and their bond is usually very strong. Accordingly, a new practice has emerged among employers, which allows or even encourages employees to bring dogs into the workplace. In the current research, a multiple case study analysis was performed to determine if organizations nurture this practice only to attract employees (EB activity) or if a positive attitude to pets is part of their identity. Moreover, the conducted research pointed out the specificities of this practice, the benefits derived from it and the challenges of having dogs at the workplace.

Keywords:
dogs in
workplace,
employer
branding,
canine,
challenges,
benefits

1 Introduction

Nowadays, there is a shortage of workforce in many developed countries. At the same time, people i.e. employees are crucial for companies' growth and success. In fact, people still make the difference, despite artificial intelligence (AI), technology, digitalization etc. Accordingly, companies use all known approaches to creating an attractive work environment that will, in turn, attract, engage and retain employees, especially the talented ones. On the other hand, not only economies but also society changes as a whole. For example, the number of pets, especially dogs, increases year after year. According to Statista (2022), the number of people (Gen Z members) who have a pet increased from 16% in 2020 to 26% in 2021. Accordingly, the needs of people change because the circumstances change.

Due to all of the above, an old concept - the internal marketing concept - is gaining importance again. The term internal marketing was coined in the 1970s by Berry (Rafiq & Ahmed, 2000) and basically meant application of external marketing practices within an organization. As known, the primary external marketing goal is to satisfy customer needs (Kotler et al., 2014). Similarly, the primary internal marketing goal is to satisfy the needs of internal customers (i.e. employees). A contemporary extension of the old internal marketing concept is the notion of employer branding (EB) (Ružić & Benazić, 2021). The core goal of EB is to differentiate from other employers, in order to attract the best talents in the market. Behind a brand, i.e. the pillars of employer branding, are the organizational attractiveness factors and an employee value proposition (EVP). The EVP should, clearly, be in line with current and prospective employees' needs. So, given that more and more people own, like and are strongly bonded to their dogs, their need for affection and contact with their dogs can be satisfied if companies apply internal marketing and highlight their strive in employer branding activities.

At first glance, the pet-friendly policy is likely to require organizations to provide appropriate conditions for co-living of people and pets, but at the same time it might bring positive (and maybe some negative) outcomes. It can also be applied only for promotion purposes.

In the light of the above, the main aim of this paper was to identify the prerequisites for organizations, dogs and dog owners for a successful inclusion of dogs in the workplace, as well as the challenges and benefits of dogs in the workplace. Moreover, the goal was to investigate if this practice is underpinned by organizations with the purpose to develop an attractive employer brand (exclusively promotion) or whether it is a real value to them, a part of their identity.

The research can be helpful for organizations whose culture and brand may be reinforced by this practice and for managers who are insecure or even scared of introducing a pet-friendly policy, by outlining its prerequisites, challenges and benefits. The current research will also bring new insights on this contemporary, yet insufficiently studied, phenomenon.

2 Theoretical background

2.1 Internal Marketing and Employer Branding

The term internal marketing was coined in the 70's by Berry (Rafiq & Ahmed, 2000). It was seen as a remedy for low service quality or, more precisely, for service quality heterogeneity. Basically, internal marketing (IM) encompasses the use of the marketing approach within an organization. Similarly, as in external marketing, everything starts with the needs and wants of every single employee, based on the idea that by meeting their needs and wants, employees become more satisfied and motivated, which eventually brings to better service quality, customer satisfaction and loyalty and, in general, better company performance and results (i.e. higher profit) (Rafiq & Ahmed, 2003). Accordingly, the first step in internal marketing planning is the employee needs assessment (e.g. nowadays, the need to be close to their dog companion). Among the many available definitions of internal marketing, Bekkers and Van Haastrecht (1993, in Brooks et al., 1999, p. 5) stated that »IM is considered to be the process of creating market conditions within the organization to ensure that internal customer wants and needs are met«. Despite the fact that the notion of internal marketing has been present in theory and practice for a long time, the concept has not been fully implemented in organizations (Rafiq & Ahmed, 2000). There are many different approaches to the concept, different authors have provided different definitions and also different guidelines as to what it is, how it

should work and how it should be implemented and used within companies (Varey, 1995).

However, as a contemporary extension or derivation of the concept, a new approach has emerged - Employer Branding (EB). Ambler and Narrow (1996), the authors who coined the term, stated that an employer brand has a personality and represents the whole package of psychological, functional and economic benefits provided by a specific employer. Lievens and Slaughter (2016, p. 410) highlighted that »employer branding is considered to be a synonym for employer image management«.

In today's environment with the ongoing "war for talents" (Van Hoye & Lievens, 2007) and personnel shortages in many developed countries, employer branding is gaining importance. EB showed many potential benefits for employers such as developing an image of a "great place to work", reducing acquisition costs, improving employee retention, facilitating recruitment, improving commitment and attraction of talents and positively influencing job seeker attitudes (Ružić & Benazić, 2023). The employer brand should at first instance attract new employees, especially talented employees, but also engage and retain the existing ones. Organizational attractiveness factors and employee value proposition (EVP) are tightly connected with the term EB. An EVP is the unique set of benefits that an employee receives from a company in return for his/her skills, capabilities and experience (Pawar & Charak, 2015). Each brand is based on the company's identity, but as well on attractiveness factors that are important for its employees and potential employees. Therefore, every company should know what their current and prospective employees deem important and based on this (and on its own value and identity) it should shape a unique value proposition that should be clearly communicated to the audience (at first instance, employees and potential employees). The communicated brand impacts the company's perceived image and can generate attractiveness and desirability. Being aware of this, more and more companies build their image by carefully researching the market needs (i.e. customers' and internal customers' needs) and developing their brand in line with the identified needs.

2.2 Dogs in the workplace - what we know so far

Despite the fact that nowadays the number of pets is increasing worldwide, the bond between owners and their pets, due to different reasons, is getting stronger, and some of the most successful companies (like Google and Amazon) allow their employees to bring pets to work, research on the impacts of pet-friendly practices is scarce (Junca-Silva, 2022). Most research about dogs' impact on people was conducted outside organization settings. Studies showed a positive impact of dogs on children's activity and obesity (Gadomski et al., 2016). In their research, Lakestani et al. (2014) demonstrated that young children cannot adequately interpret dogs' behavior, hence they can be more at risk for dog bites. Pali-Scholl, Dale, Viraniy (2023) argued about the positive effects of pets (dogs) in prevention of asthma and allergies (if dogs live with children during infancy, the impact is positive), social interactions and mental health. Arhant et al. (2017) in their research focused on children and dog interactions, argued about the importance of promoting dog bite prevention activities directed toward caregivers very early in the child-dog relationship. In their research on changes in oxytocin level before and after interaction with dog, While, Miller et al. (2009) showed that the oxytocin level while the owner interacts with dog is similar to the level of oxytocin produced when receiving a massage.

Charles and Wolkowitz (2023) argued about the impact of dogs on university students and vice versa. Namely, the practice of bringing dogs to work and school is getting more popular nowadays (Pali-Scholl et al., 2023). Bringing dogs into the workplace is a contemporary practice, so most of the research on the topic is quite recent. Dogs-in-the-workplace policies and practices show potential to positively impact employee satisfaction and wellbeing and, by doing this, to improve performance and financial and/or overall results of organizations. According to Hall and Mills (2019), employees who brought their dogs to work were more engaged (vigor, dedication, absorption, total) than employees who sometimes or never took their dogs to work. Moreover, people who often take their dogs to work score higher in general wellbeing, job satisfaction, home-work interface, working conditions, control and overall work quality of life (Hall, Mills, 2019). Furthermore, Hall and Mills (2019) in their paper highlighted that it can be beneficial for organizations to include dog demographics in their "bring the dog into the office" policies, such as weight, size, breed type, and experienced training. Junca-Silva et al. (2022) in their

research highlighted the positive effects of dogs on teleworkers, because employees who owned a dog perceived their work more positively and reported higher self-perceived performance. Moreover, companies with pet-friendly practices achieve higher employee organizational identification which in turn influences employee well-being and even life satisfaction (Junca-Silva, 2022). Junca-Silva (2022) in their research showed further positive effects for individuals, like reduced stress and better work-life balance. At the same time, pet-friendly practices show potential to positively impact organizational outcomes such as to improve employer brand, improve talents attraction, offer a healthier work environment and better integration with the community (Junca-Silva, 2022). Krause-Parello et al. (2019) highlighted the role of pets in facilitating interactions, boosting positive emotions, improving job satisfaction and perception of organizational support. Hall and Mills (2019) stated that pets-at-work policies enhance work engagement, decrease turnover intentions and increase friendship within organizations. Applebaum et al. (2021) in their research showed that the presence of a dog in a group enhances positive emotions and positively impacts emotional climate. Barker et al. (2012) suggested that dogs at work positively impact the stress level of their owners during working hours and also contribute to higher job satisfaction of all employees in the organization (not only pet owners).

Along with many benefits, there are many challenges too connected with the dogs-at-work policies (Foreman et al., 2017). In order to reduce the possibility of negative effects (interference with job duties, bites or fear felt by colleagues), preparation of the workplace, instructions to employees and dog training courses are advisable (Pali-Scholl et al., 2023). In their paper, Foreman et al. (2017) analyzed the existing literature about dogs in the workplace and provided very useful guidelines for organizations that allow dogs at workplace, such as the need to establish a procedure for assessing employee attitudes concerning dogs in the workplace, to develop procedures that will take into consideration employees with special concerns (i.e. cultural beliefs, fears, phobias) and policies regarding owners' responsibilities in the workplace, to establish a "Dog Committee" forum as a place for discussion between employees and management about questions regarding dogs in the work environment, to establish dogs' temperament/behavioral requirements (e.g. passing the Good Dog Citizen course for dogs and owners), to establish procedures for continuous assessment of the impact of dogs on well-being, productivity etc., to continuously improve the process to address concerns and to improve the

cohabitation of dogs and employees, to develop policies to prevent slips, falls and similar in the dog area, to develop training materials for dog owners to educate them about their responsibilities in maintaining a safe environment, to establish eligible criteria for dogs and their owners (e.g. the need for special training based on breed requirements), and to understand and follow the law (law regarding individuals with disabilities or law regarding vaccination etc.).

However, as stated at the beginning, despite the number of dogs in the workplace is increasing and the practice of “bringing dogs to work” is gaining in application, there is limited evidence on this practice (Hall & Mills, 2019; Foreman et al., 2017).

3 Investigating the effects of dogs in the workplace – multiple case studies

3.1 Methodology

‘Dogs in the workplace’ policies are nowadays gaining interest, yet the number of dog-friendly organizations is low. In order to gain more extensive knowledge on this contemporary phenomenon, a multiple case study analysis was conducted. Case studies and interviews were chosen to collect empirical data, because the focus of the research was on phenomena that are infrequent (Wagner & Cunha, 2021). The main goal of the research was to identify the prerequisites for organizations, dogs and dog owners for a successful inclusion of dogs in the workplace, as well as the negative and positive effects of dogs in the workplace. Moreover, one of the aims was to realize if the “dogs in the workplace” practice is solely an employer branding activity or a genuine part of their identity.

The case study method was chosen because the “dogs in the workplace” phenomenon was studied in a real life context. The presented case study is exploratory and descriptive. Five organizations were included in the multiple case study analysis, all of them from Croatia in order to minimize cultural differences. The author did an online research to identify which organizations in Croatia allow dogs in the workplace. The online research was conducted via Google (using key words) and Adorio (a job search/offer app listing all the benefits offered by a specific employer). Moreover, the author’s previous knowledge about an organization that applies this practice was used to establish contact. After compiling a list of

organizations with this policy in Croatia, each of them was contacted by the author via email, phone or LinkedIn. Five out of seven companies answered positively about the interview request. In the email or during the phone call, the scope and type of research was explained and the anonymity of the interviewees and their organizations was guaranteed. Moreover, the author kindly asked in the email to be connected to someone within the organization who is familiar with the practice; HR manager was suggested.

A total of 5 persons were interviewed. All informants were highly knowledgeable about the topic (dogs at the workplace) in their organizations. The interviews were conducted in October and November, 2023. One interview was conducted face-to-face and the other four interviews were conducted online via Zoom. All the interviews were recorded (with the permission of the interviewees). In order to protect their anonymity, the organizations' names were replaced with names of Croatian dog breeds.

Table 1: Companies overview

	Croatian Sheepdog	Dalmatian	Posavac Hound	Istrian Hound	Tornjak
Interviewee's position within organization	People & Culture Director	Executive Director	Business Development Manager	CEO, HR Director	HR Manager
Organization's main activity	Digital marketing	Youth projects (non-profit)	Digital agency	Marketing	Creative agency
Year of incorporation	2002	2001	1995	2009	1995
"Dogs in the workplace" policy in place	for more than 10 years	for more than 3 years	for more than 2 years	since 2009	for more than 5 years
No. of employees	100<	1	25	140	51
Market	International	International	International	International	International

Source: Author

The interviews lasted from 25 to 35 minutes. All interviews were held in Croatian and then translated into English for the purpose of the research. The interviews were semi-structured (with 12 basic questions). The questions were about specificities connected with the practice, about culture, empowerment, rules, pros and cons of such practice, and they were also directed to determine whether the policy was more of a marketing initiative or a genuine, internally-felt action.

3.2 Research results

In order to achieve the research goals and to answer the posited research questions, the interview transcripts were analyzed. Moreover, informants' quotes were collected, clustered and compared.

RQ 1: What are appropriate organizational settings for a pet-friendly policy?

In all the analyzed companies, all employees, regardless of position, are allowed to bring their pets to work (from a student to the CEO position). Moreover, the analyzed organizations have from 1 to 140 employees, so the number of employees does not impact the application of this policy. It was further realized that companies that have this policy in place have an open, relaxed, friendly, respectful, inclusive and pleasant culture. Even though their cultures promote mutual respect and good relationships among employees and the strive to understand the holistic needs of a person, an informant stated that the organization's culture did not fit to all people (i.e. employees), but they were trying to attract people with a similar mindset. One informant stated that their business was similar as their culture (informal, relaxed, inclusive). Moreover, all the interviewees pointed out that their employees were empowered and had freedom (to a certain degree) to decide on their own and their attitudes were listened to and included in company's policies.

Although all employees - no matter the type of office they work in (open space, closed office, office with colleagues) - can bring their pets to work, most of the informants said that the space should be adequate for the pet-friendly policy, e.g. no carpets, pets allowed in elevators, a park or a meadow nearby, or a dog waste bin available on-site.

Regarding formal policies, regulations or procedures, most organizations have formal policies in place. However, two of the analyzed organizations do not have a formal regulation for the “dog in the workplace” policy. Based on their statement, the practice is part of their culture (i.e. the respective cultures define accepted attitudes, beliefs and behavior) and the practice relies on employees’ “common sense” behavior.

Table 2: Quotes leading to the above conclusion

You can't have a “dog in the workplace” policy if you work in a rigid environment.
We are all on first-name terms.
...we are open and flexible.
....we co-create company policies.
...for something that is “business as usual” we do not have to ask for permission every time ... in this sense both I and my colleagues are independent.
There is a park nearby, so this is how we solve it...
When we had to move and were looking for a new office...we look for spaces that are dog-friendly; when we had to relocate the office, there was one place that did not allow dogs in the elevator, meaning that it was not the right place for us...
There are specific rules in place, because anything can happen if we don't follow a certain structure...

Source: Author

RQ2: What are the challenges of a pet-friendly policy?

Although all the interviewees were aware of the possibility of employees’ or customers’ allergies, only one of them actually faced a situation where an external associate was allergic (they solved the problem by putting the dog in a nearby office while the associate was there). One of the interviewees stated that a crucial condition to allow dogs at work is that none of the employees is allergic to dog hair (they asked all of them). Moreover, another interviewee stated that there were a really small number of allergic people and the space was pretty big, so if the allergy was not too severe there shouldn't be any problem. One of the informants had an employee with a “bad experience” with dogs and in this case all other people knew about it and did not bring their dogs near the colleague.

Almost all the interviewees experienced some kind of challenging situation related to pets in the workplace, e.g. a puppy peed in the office; a dog, in only one situation,

had diarrhea; there were few chewed cables, barking, hair on the floor, but nothing more than this. A lot of responsibilities are put on the dog's owner such as the owner is responsible for dog walking or defecation, damages done by dogs, for informing other people if the dog likes to be touched, petted and the like. Moreover, many interviewees highlighted that they had specified in their handbooks the duties of pet owners and what is expected of them, but if there was not a written policy, employees would act in accordance with common sense rules (as in many other areas within a company).

The interviewees were aware of the fact that someone might avoid choosing their company, especially if he or she is afraid of dogs or does not like dogs/pets, but they were sure that they would find a solution (remote work, distant office or even respectful coworkers). The same applies if they knew a customer is allergic, then they would react promptly and the dog owner would stay to work from home when there is a meeting with this customer.

Table 3: Quotes leading to the above conclusion

There are very few people allergic to dogs; it is more likely that someone is allergic to peanuts and then you mustn't have peanuts anywhere in the premises.
Every dog owner is responsible for taking it out for a walk so the dog can do its business...
The handbook says that you are liable for your dog and any damages that may be done by the dog.
Dogs are tied up if necessary, people use their common sense; it's like when talking on the phone – I don't talk loud and long in an open space because that would bother my coworkers; the same goes for dogs, people have to use their common sense...

Source: Author

RQ3: What are the benefits of a pet-friendly policy?

The interviewees stressed out that apart from some minor challenges, in their opinion and from their experience there are many benefits.

First, among others, a satisfied employee. Secondly, a better work-life balance (you do not have to hurry home to feed the pet), and also employees stand up a few times a day to pet the dog or take it for a short pee walk. Moreover, petting a dog helps people feel better and the atmosphere is more relaxed, employees socialize more

thanks to dogs, they are willing to talk about pets and their stories, dogs bring positive energy and “warmth”.

On the other hand, customers usually react positively, some of them even ask before the meeting if the dog would be there (if he/she met the pet before). But in case employees know the client is allergic to hair/dogs, they act accordingly, e.g. the colleague who brings the dog to office will stay at home on the day of the agreed meeting.

Table 4: Quotes leading to the above conclusion

...the point is the dog is satisfied and the employee as well.
...it is in your interest (as employer) that the employee feels good in order to do their job to the best of their ability.
It is about accepting that you don't only have a job, but also a life outside of the workplace – you have to pick up your child from kindergarten early because he or she got sick, or you have to go home early because you've got a handyman coming over or because you have a dog – these are all parts of the work-life balance.
When I need a five-minute break from work, I go and pet my dogs...or I use my one-hour lunch break to take my dogs out for a walk and I completely reset myself.
One of the benefits of bringing the dog to work is that you have to get up and stretch your legs now and then...
When there is a dog in the office, people will get up and go pet it at least a few times a day.
People socialize more...they have a story about the dog and want to share it ...you know, I got my dog from a rescue..
The atmosphere is more pleasant and relaxed even if the dog just lays there without reaction throughout the entire working hours.
Dogs bring great energy.
Our clients are international so this is normal for them and they mostly see it as a plus, unless they are allergic, but in that case we find an ad hoc solution (e.g. the employee with the dog stays to work from home when the client is coming).

Source: Author

RQ4: Is the implementation of a pet-friendly policy mostly an employer branding activity or does it represent a real value for organizations?

Based on the interviewees’ answers, it can be concluded that the practice is underpinned with the aim of meeting today’s employee needs and the practice reflects their identity and culture. They communicate to their potential employees that they have a “pet friendly” policy and the reactions of job candidates are mostly positive, but the practice is not a game changer based on which potential employees decide to join the company. They are aware of the possibility that they could miss a quality candidate because of this practice, but they are flexible and able to arrange things to satisfy the needs of an employee who is not a pet lover. It can be concluded that this policy is a real organizational value which is particularly important for young employees and it is, as well, communicated to potential employees, but it is an important value and part of company culture for the companies that implement the policy.

Table 5: Quotes leading to the above conclusion

With this policy we communicate who we are; the question is whether somebody will find it more or less attractive.
People who come for a job interview often mention it (dog friendliness) as something that attracted them to us, even the candidates that don’t have a dog, because they would like to work in a dog-friendly environment.
I think that potential employees see it as a plus, but probably it is not something that makes a difference in deciding about the job, it’s not crucial, but it is a part of our culture. ...we blazed the trail, long before all this buzz about employer branding..
Doing something just for show is not a smart thing to do.
We communicate it publicly, in our job ads it is always mentioned that dogs are welcome.
I think that’s written in our company’s DNA...most people have a dog..
EB is just a presentation of what you’ve got.

Source: Author

4 Discussion

Research results showed that organizations that allow this practice really promote an open, inclusive and warm culture, based on the strive to satisfy employee needs. And precisely this strive is at the basis of the Internal Marketing and Employer Branding concepts. Only a satisfied employee can achieve customer satisfaction and, similarly, only an attractive organization can more successfully attract young talented people

(i.e. employees). The conducted research showed that the implementation of the internal marketing philosophy is still alive and kicking, more than ever before.

Junca-Silva (2022) suggested that the dogs-in-the-workplace policy can improve the employer brand and talent attraction. The current research reinforced, for the most part, these findings, as the analyzed organizations communicate their pet-friendly policy through their communication channels and employees (even on interviews) highlight this policy as extremely interesting and positive for the employer perception. Nevertheless, organizations are aware that said practice could be an unattractive factor for some potential employees. In line with the previously mentioned Junca-Silva's (2022) »integration with the community« factor, the research confirmed the analyzed organizations strive to inclusivity. Moreover, the positive impacts of dogs and dog petting on the owners' feelings were pointed out, which is in line with Miller et al. (2009), even though they analyzed the dog – owner relationship and impact outside organizations. Furthermore, the results highlighted many perceived benefits such as general wellbeing and an improved work-life balance, which is in line with Hall and Mills (2019) and Junca-Silva (2022). However, although most of the analyzed organizations have policy guidelines about the practice, they do not specify the weight, size, breed type and trainings for dogs in order to be allowed in office, which is not in line with suggestions given by Hall and Mills (2019). The conducted research partially confirmed the findings of Krause-Parello et al. (2019); namely, pets facilitate interactions among employees and boost positive emotions, as also stated by Applebaum et al. (2021). In order to avoid negative effects and enable implementation of the policy, workplaces are slightly adjusted (removed carpet, required pet-friendly commercial buildings to rent), there are handbooks with instructions for employees and even sessions with the HR manager for those who want to bring their pets to work, which is in line with Pali-Scholl et al.'s (2023) suggestions.

Based on the research results, HR managers and CEOs can plan to allow or even promote the dogs-in-the-workplace practice, but only if in line with their identity and culture. The benefits of the practice are many, but at the same time it requires some degree of flexibility and adjustment. There may also be some challenges and even the possibility of a negative potential employee reaction, but only from candidates that do not share the same values as the organization, so maybe the policy can be seen as a filter for the ones who do not fit the organizational culture. The practice, which is particularly attractive for young employees, can be used within the

scope of employer branding activities in order to attract people with same shared values, no matter how many employees the employer employs. The current research expanded the body of knowledge about this insufficiently studied practice with new insights. It can be seen as the first step in further study of the phenomenon.

5 Conclusion

Staff shortage and war for talents are among the most important challenges in today's business world. In these settings, only an employer that is focused on employees' and potential employees' needs and wants can be seen as attractive and eventually increase its prospects to attract employees in general, and especially the talented ones. At the same time, human and societal needs are changing. In order to satisfy the changing needs, organizations should offer practices that align with these needs. A policy allowing the presence of pets can be one of the responses to the modern employee needs, but it should not be viewed solely as a means of attraction. It should be aligned with the genuine values and identity of the company. Only if the values and needs of employees correspond to the values and offerings of the organization (i.e. employee value proposition), the final outcome will be positive. Besides several challenges, a pet-friendly policy brings many positive effects such as positive mood, support to employees, a kind of stress release, stronger bonds between employees, better work-life balance, increased activity and the like.

The current research has several limitations that could be a basis for future research. One of the limitations is based on the fact that only five companies were studied and most of them were in the same industry. Furthermore, the interview was conducted only with the organization's manager. Future research should encompass interviews with employees and specifically with the employees who bring their dogs to work and with the ones who don't bring their dogs or do not have a dog, within the same company. Moreover, quantitative research can be conducted among potential employees to determine the impact of »dogs in the workplace« policy on their perception about the attractiveness of the organization. Finally, differences based on demographics should also be analyzed.

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PROBLEMATIKA UVAJANJA EMISIJSKEGA STANDARDA EURO 7

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Novi emisijski standard Euro 7 v primerjavi z dosedanjimi standardi serije Euro predstavlja kar nekaj novosti. Standardi serije Euro, ki določajo največje dovoljene emisije posameznih onesnažil (polutantov) za novo registrirane avtomobile v državah Evropske unije, so v veljavi od leta 1992, a so bili do sedaj ločeni za osebna in lahka tovorna vozila (Euro 1-6) ter za tovorna vozila in avtobuse (Euro I-VI). Standard Euro 7 pa obravnava vsa vozila enotno. Poleg tega je pomembno, da Euro 7 ne obravnava le emisij iz izpušne cevi motorja, ampak tudi emisije, ki nastanejo zaradi obrabe zavornih oblog in pnevmatik. Tako so poleg vozil, ki jih poganja motor z notranjim izgorevanjem, vključeni tudi električni avtomobili. Na začetku precej zaostrene zahteve standarda so povzročile kar precej nasprotovanj pri proizvajalcih vozil. Nesoglasja pa so nato presegli in dosegli rešitev, sprejemljivo za obe strani. Prispevek prikazuje predvsem okoljske vidike standarda Euro 7 in primerjavo s prejšnjimi standardi serije Euro.

Ključne besede:

standard
Euro 7,
nadzor
emisij,
onesnažila,
kakovost
zraka,
emisije

ISSUES RELATED TO THE INTRODUCTION OF THE EURO 7 STANDARD

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The new emission standard Euro 7 brings some important new features compared to the previous Euro standards. Euro standards set maximum permissible emissions of certain pollutants for new registered vehicles in the EU countries. These standards are in force since 1992, but until now they have treated cars and light duty vehicles (Euro 1-6) and trucks and buses (EURO I-VI) separately. The Euro 7 standard applies to all vehicles. In addition, the Euro 7 does not include only tailpipe emissions but also emissions generated by wear on brake linings and tyres. So, in addition to cars with internal combustion engines, electric cars are also included. Initially, the standard's rather stringent requirements caused a lot of opposition from vehicle manufacturers. Disagreements were subsequently resolved and a mutually acceptable solution was reached. The paper presents mainly the environmental aspects of the Euro 7 standard and compares it with the previous Euro standards.

Keywords:

standard
Euro 7,
emission
control,
pollutants,
air quality,
emissions

1 Uvod

Slaba kakovost zraka, ki je posledica emisij onesnažil (polutantov), pomembno znižuje kakovost življenja, še posebno v mestnih okoljih. Onesnažen zrak povečuje tveganje za nastanek različnih obolenj in je vzrok za precejšnje število prezgodnjih smrti (Cohen in sod., 2017; Curry Brown, 2013; GBD, 2016). Še posebej izpostavljenost zraku s povejšano koncentracijo onesnažil vpliva na dihala in srce ter ožilje (Brook in sod., 2010, Schwartz, 2001; Atkinson in sod., 2014; Peters in sod., 2004). Med sektorji, ki pomembno prispevajo k obremenjevanju ozračja, je vsekakor promet.

V izpušnih plinih avtomobilov, ki jih poganja motor z notranjim izgorevanjem, so poleg vodne pare in ogljikovega dioksida prisotni naslednji polutanti: ogljikov monoksid (CO), ogljikovodiki (HC), trdni delci (PM) in dušikovi oksidi (NO_x). Posredno pa emisije avtomobilskih motorjev vplivajo tudi k zvišanju koncentracij prizemnega ozona (O₃), ki sicer ni sestavina izpušnih plinov (Mondt, 2000).

Tako bencin kot dizelsko gorivo sta zmes različnih ogljikovodikov. Ob popolnem izgorevanju goriva bi nastala le vodna para (H₂O) in ogljikov dioksid (CO₂). Ker pa procesi v motorju potekajo hitro in popolnega zgorevanja ni mogoče zagotoviti, so posledica tega emisije onesnažil v ozračje. Ogljikovodiki (HC) so prisotni, ker del gorivne zmesi zapusti motor, preden sploh pride do zgorevanja. Sajasti oziroma trdni delci (PM) ter ogljikov monoksid (CO) so prisotni zaradi nepopolnega izgorevanja. Dušikovi oksidi (označeni s skupno kot NO_x, gre pa za dve spojini, NO in NO₂) pa nastanejo zaradi visokih temperatur v motorju iz zračnega dušika in kisika (Mondt, 2000).

Med onesnažili je potrebno omeniti še prizemni ali troposferski ozon (O₃). Ta ni sestavina izpušnih plinov, ampak nastane v onesnaženem ozračju kot eden izmed produktov fotokemičnih reakcij med ogljikovodiki in dušikovimi oksidi. Gre za reakcije, ki potekajo pod vplivom sončne svetlobe in so predvsem intenzivne v vročih poletnih dneh z veliko sončnega sevanja.

Potrebno je posebej omeniti še problem ogljikovega dioksida (CO₂), ki ga v javnosti pogosto zmotno uvrščajo med onesnažila (polutante). Polutanti so snovi, ki so strupene ali na kakšen drug način neposredno škodljive za človeško zdravje ter

okolje (npr. rastline, živali). Ogljikov dioksid v koncentracijah, v kakršnih je prisoten v zraku, nima nikakršnih neposrednih škodljivih vplivov na človekovo zdravje. Težava je, ker koncentracija ogljikovega dioksida v zraku narašča in to prispeva k čedalje bolj intenzivnemu segrevanju ozračja. Ogljikov dioksid je najbolj problematičen toplogredni plin. Vendar so pri toplogrednih plinih škodljive posledice na okolje posredno, ker povzročajo globalno segrevanje. Zato so tudi emisije ogljikovega dioksida nezaželeni, a je to problematiko potrebno obravnavati ločeno od problematike onesnažil. Pri motorjih z notranjim izgorevanjem je možno emisije onesnažil zelo učinkovito zmanjšati s katalitičnimi pretvorniki (ogljikovodiki, ogljikov monoksid, dušikovi oksidi) in filtri (trdni delci), vendar pa ti nimajo nobenega učinka na emisije ogljikovega dioksida. Emisije ogljikovega dioksida je možno znižati le z manjšo porabo goriva ali pa z uporabo alternativnih pogonov avtomobila.

Evropska unija seveda posveča pozornost tudi zmanjšanju emisij ogljikovega dioksida iz avtomobilskih motorjev, vendar so temu namenjeni drugi regulatorni mehanizmi. Euro standardi pa se nanašajo le na emisije onesnažil (polutantov) (Autovista 24, 2023).

2 Kratak zgodovinski pregled obvladovanja avtomobilskih emisij

Poslabšano kakovost zraka v urbanem okolju zaradi avtomobilskih izpušnih plinov so najprej opazili v Združenih državah Amerike, kar ni presenetljivo, saj se je tam najprej razširila množična uporaba avtomobilov. Poročila o težavah zaradi onesnaženega zraka in iskanju rešitev so se pojavila že kmalu po koncu druge svetovne vojne. Posebno velike probleme s smogom so imeli v Los Angelesu, tako zaradi velike gostote prometa kot tudi specifičnih vremenskih pogojev. Težave so se nato stopnjevale in v šestdesetih letih preteklega stoletja so že začeli izvajati sistematične ukrepe za zmanjšanje emisij onesnažil iz avtomobilskih motorjev. Za to obdobje je bilo značilno, da so večkrat ukrepe najprej sprejeli v Kaliforniji, kmalu zatem pa so bile zelo podobne zaostritve dovoljenih emisij uvedene tudi na ameriškem zveznem nivoju. V tem obdobju so proizvajalci motorjev poostrene emisijske zahteve izpolnjevali s prilagoditvami motorjev. Leta 1970 pa so na ameriškem zveznem nivoju sprejeli dopolnila k Zakonu o varovanju zraka (Clean Air Act Amendment), ki pa jih ni bilo več mogoče doseči samo s posegi v delovanje motorjev, ampak je bilo izpušne sisteme vozil potrebno opremiti s katalitičnimi

pretvorniki. Zakonska dopolnila so stopila v veljavo leta 1975 in od takrat so vsi novo registrirani avtomobili v ZDA opremljeni s katalitičnimi pretvorniki. Najprej so bili to samo oksidacijski (imenovani tudi dvostezni) katalizatorji, ki omogočajo znižanje emisij ogljikovodikov in ogljikovega monoksida. Kasneje pa so zaostri tudi merila glede emisij dušikovih oksidov in od leta 1981 so v uporabi tristezni katalizatorji, ki poleg ogljikovodikov in ogljikovega monoksida pospešijo tudi razgradnjo dušikovih oksidov. Katalitične pretvornike so nato postopno še izpopolnjevali, kar je omogočilo čedalje bolj učinkovito obvladovanje emisij. Tako je na primer povprečni avtomobil, proizveden leta 2000 v ozračje emitiral le okrog 5 % emisij onesnažil kot pa avtomobil, izdelan leta 1970 (Mondt, 2000),

Tudi v Evropi so posvečali vedno več pozornosti skrbi za zmanjšanje škodljivih emisij iz avtomobilskih motorjev. Prvi emisijski standardi za osebne avtomobile v Evropi so bili uvedeni leta 1970. Predvsem pa je k enotni in sistematični ureditvi obvladovanja emisij iz avtomobilskih motorjev prispevala uvedba Euro standardov v letu 1992. Z implementacijo Euro standardov in poostrenih emisijskih meril je tudi v Evropi postala neizogibna uporaba katalitičnih pretvornikov in s tem tudi neosvinčenega bencina (Automobile Association Developments, 2024).

Pri motorjih s prisilnim vžigom (Ottovi ali bencinski motorji) so za delovanje motorja precej moteči samovžigi gorivne zmesi, ki povzročajo tako imenovano klenkanje motorja. Zelo učinkovit in cenovno ugoden način za preprečevanje klenkanja motorja je dodatek svinčevega tetrametila ali svinčevega tetraetila (Sharp, 1990). Slaba stran dodajanja svinčevih spojin bencinu je bila prisotnost svinca v izpušnih plinih, ki ima škodljive posledice za zdravje. Predvsem je škodljiva za živčni sistem pri otrocih in mladostnikih. Pri avtomobilih s katalizatorjem pa se osvinčeni bencin ne sme uporabljati, ker svinec prekrije aktivno površino katalizatorja in ga s tem deaktivira. Tako bi že po enem ali dveh polnjenjih goriva uničili katalizator, ki sicer ob pravilni uporabi zdrži okrog 150.000 km. Zato se za vozila s katalizatorjem lahko uporablja izključno neosvinčeni bencin. S tem je odpravljen tudi problem emisij svinca v ozračje. Je pa preprečevanje klenkanja potrebno odpraviti na drug način, kar dosežejo z dodajanjem aromatskih spojin. Tu se pojavijo problemi, ker so tudi mnoge aromatske spojine (predvsem benzen) strupene in celo kancerogene. Ob učinkovitem delovanju katalitičnega pretvornika je sicer mogoče emisije aromatskih spojin zmanjšati na minimum.

3 Standardi serij EURO 1-6

V letu 1992 so bili uvedeni prvi standardi za sistematično uravnavanje največjih dovoljenih emisij, ki jih morajo izpolnjevati vsa nova vozila, registrirana v državah Evropske unije. Standardi ločeno obravnavajo osebne avtomobile in lahka dostavna vozila ter posebej tovorna vozila in avtobuse. Pri osebnih avtomobilih so emisije določene tako za bencinske motorje (motorje s prisilnim vžigom ali Ottove motorje) kot za dizelske motorje (motorje s kompresijskim vžigom).

Za Euro emisijske standarde je značilno, da se stalno posodablajo, zahteve se poostrijo vsakih nekaj let. Pri zakonski regulaciji emisij motorjev je seveda nujno potrebno upoštevati tehnične možnosti. Razvoj novih motorjev, ki omogočajo nižje emisije, zahteva precej raziskav in razvojnega dela, za kar pa je potreben določen čas. Tako ni mogoče naenkrat doseči velikega znižanja emisij čez noč, ampak je to postopen proces. Tako vsakih nekaj let v veljavo pride nova serija standardov, ki določa največje dovoljene emisije posameznih polutantov (Automobile Association Developments, 2024; Girteka, 2023). Za osebne avtomobile in lahka dostavna vozila so emisije izražene v g na kilometer vožnje, serije standardov pa so označene z arabskimi številkami. Za tovornjake in avtobuse pa so emisije izražene v g na kWh opravljenega dela motorja, serije standardov pa so označene z rimskimi številkami (Girteka, 2023).

Kratek, nekoliko poenostavljen, pregled časovnega poteka veljavnosti posameznih Euro standardov prikazuje Tabela 1. Pri posameznih standardih obstajajo tudi podvariante, a so zaradi enostavnosti prikaza v Tabeli 1 izpuščene. Dodan pa je standard Euro 7, ki prvič obravnava skupaj tako osebne avtomobile in lahka dostavna vozila kot tudi tovornjake in avtobuse, ter bo tako nadomestil tako standard Euro 6 kot tudi standard Euro VI. (Automobile Association Developments, 2024; Girteka, 2023).

Tabela 1: Okvirni datumi uvedbe posameznih Euro standardov

Osebni avtomobili in lahka dostavna vozila		Tovornjaki in avtobusi	
Standard	Datum veljavnosti	Standard	Datum veljavnosti
Euro 1	Julij 1992	Euro I	Julij 1992
Euro 2	Januar 1996	Euro II	Oktober 1996
Euro 3	Januar 2000	Euro III	Oktober 2000
Euro 4	Januar 2005	Euro IV	Oktober 2005
Euro 5	Januar 2009	Euro V	Oktober 2008
Euro 6	September 2014	Euro VI	Januar 2013
Euro 7	Julij 2025	Euro 7	Julij 2027

Vir: Automobile Association Developments, 2024; Girteka, 2023

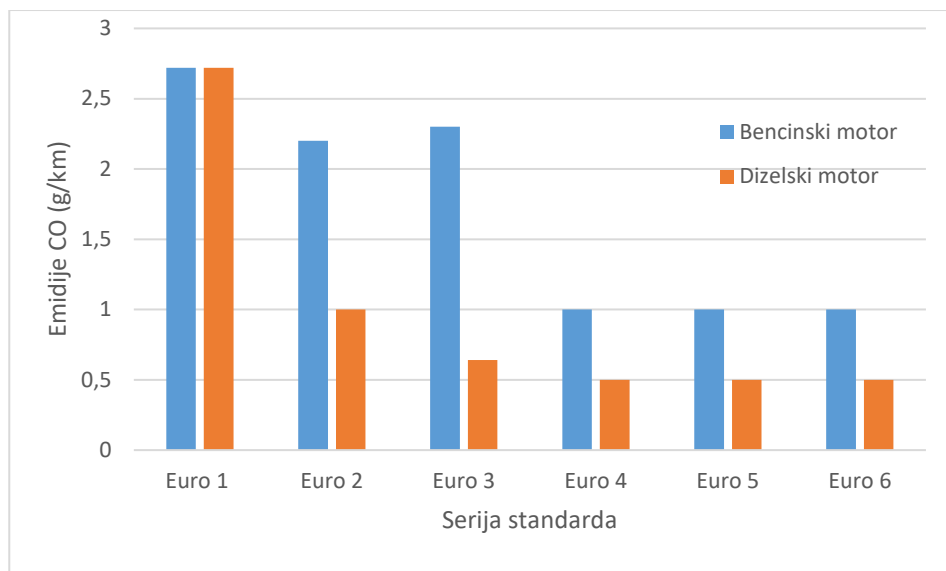
Emisijski standardi veljajo za nova vozila. Vendar pa emisijski standard Euro 6 določa, da morajo avtomobili ustrezati mejnim vrednostim emisij za obdobje 5 let oziroma do 100.000 prevoženih kilometrov.

Posamezne vrste onesnažil, ki jih obravnavajo serije standardov Euro 1-6 so navedene v nadaljnjem pregledu.

3.1 Ogljikov monoksid (CO)

Ogljikov monoksid nastaja ob nepopolnem izgorevanju goriv, ki vsebujejo ogljik. Je zelo strupen plin, ki se veže na hemoglobin v krvi močneje od kisika in tako povzroča zadušitev. Posebno nevaren je, ker je plin brez barve, vonja in okusa. Že ob 0,3 volumskih % CO v zraku nastopi smrt po 15 minutah. Na srečo v zunanjem zraku koncentracije niso tako visoke, kljub temu pa se lahko povišajo dovolj, da se pri bolj občutljivih delih populacije (starejše osebe, bolniki z respiratornimi ali srčno-žilnimi obolenji) pojavijo zdravstveni problemi (Bettelheim in March, 1998; Lazarini in Brenčič, 1984).

Slika 1 prikazuje največje dovoljene emisije ogljikovega monoksida za osebne avtomobile za standarde serij Euro 1 do Euro 6 (Automobile Association Developments, 2024).



Slika 1: Mejne emisije ogljikovega monoksida za standarde serij Euro 1-6 za avtomobile z bencinskim in dizelskim motorjem

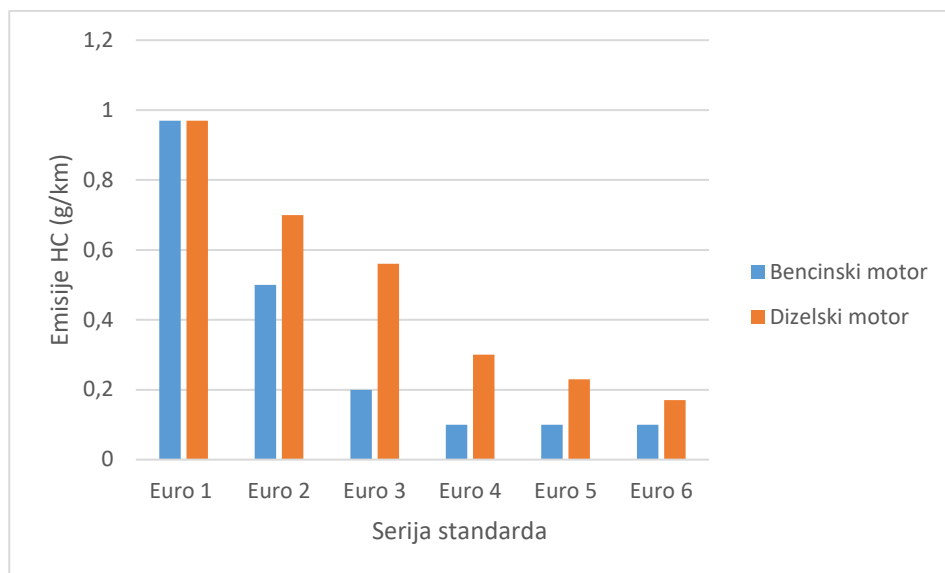
Vir: Automobile Associations Development (2024) <https://www.theaa.com/driving-advice/fuels-environment/euro-emissions-standards>

3.2 Ogljikovodiki (HC)

Pri ogljikovodikih gre za veliko skupino organskih spojin. Goriva za avtomobile so sestavljena iz zmesi ogljikovodikov. Bencin vsebuje večinoma alkane, ki imajo v verigi od 4 do 8 ogljikovih atomov, dizelsko gorivo pa alkane z 14 do 18 ogljikovimi atomi. Zaradi hitrih procesov v motorju del komponent goriva v motorju ne zgore, ampak preide v izpušni sistem v nespremenjeni ali pa le nekoliko modificirani obliki. Pri analizi avtomobilskih izpušnih plinov so identificirali več kot 100 različnih spojin iz skupine ogljikovodikov. Ogljikovodiki dražijo sluznico in oči, nekatere spojine iz te skupine so tudi strupene in kancerogene (npr. benzen) (Bettelheim in March, 1998; Schäfer in van Basshuysen, 1995).

Slika 2 prikazuje največje dovoljene emisije ogljikovodikov za osebne avtomobile za standarde serij Euro 1 do Euro 6. Pri tem je potrebno omeniti, da so pri dizelskih motorjih upoštevane skupne emisije ogljikovodikov in dušikovih oksidov za vse serije (Euro 1 do Euro 6). Pri bencinskih motorjih pa so ogljikovodiki šteti skupaj z

dušikovimi oksidi pri standardih Euro 1 in Euro 2, od vključno standarda Euro 3 naprej pa so ogljikovodiki obravnavani ločeno (Automobile Association Developments, 2024).



Slika 2: Mejne emisije ogljikovodikov za standarde serij Euro 1-6 za avtomobile z bencinskim in dizelskim motorjem

Vir: Automobile Associations Development (2024) <https://www.theaa.com/driving-advice/fuels-environment/euro-emissions-standards>

3.3 Dušikovi oksidi (NO_x)

Za razliko od ostalih onesnažil, ki so v izpušnih plinih prisotni zaradi nepopolnega izgorevanja, dušikov oksid nastane pri visokih temperaturah v motorju (nad 1000 °C) iz zračnega dušika in kisika. Dušik in kisik sestavljata več različnih spojin, kot onesnažili ali polutanta v izpušnih plinih pa sta prisotni dve izmed njih: dušikov oksid (NO) in dušikov dioksid (NO₂). Pri reakciji med dušikom in kisikom nastane dušikov oksid. To je brezbarven plin, ki ima v človeškem organizmu sicer vrsto pomembnih funkcij, a praviloma nastaja v samem organizmu. Pri visokih koncentracijah v zraku je dušikov oksid škodljiv (Cotton in Wilkinson, 1972; Hudgens, 2023).

S kisikom se v zraku dušikov oksid (NO) oksidira do dušikovega dioksida (NO₂). To je strupen plin rjavkaste barve, ki je predvsem nevaren za dihalni sistem. Povzroča vnetja dihalnih poti, zmanjšanje pljučne funkcije, kašelj in piskanje, pogostejše astmatične napade ter pri otrocih lahko sproži nastanek astme. Novejše raziskave kažejo, da poleg pljuč lahko prizadane tudi srce ter škoduje nosečnicam in poveča nevarnost težav pri porodu. Obstaja verjetnost, da povzroča tudi obolenja ledvic in živčnega sistema, avtoimuna obolenja ter celo raka (Cotton in Wilkinson, 1972; American Lung Association, 2023).

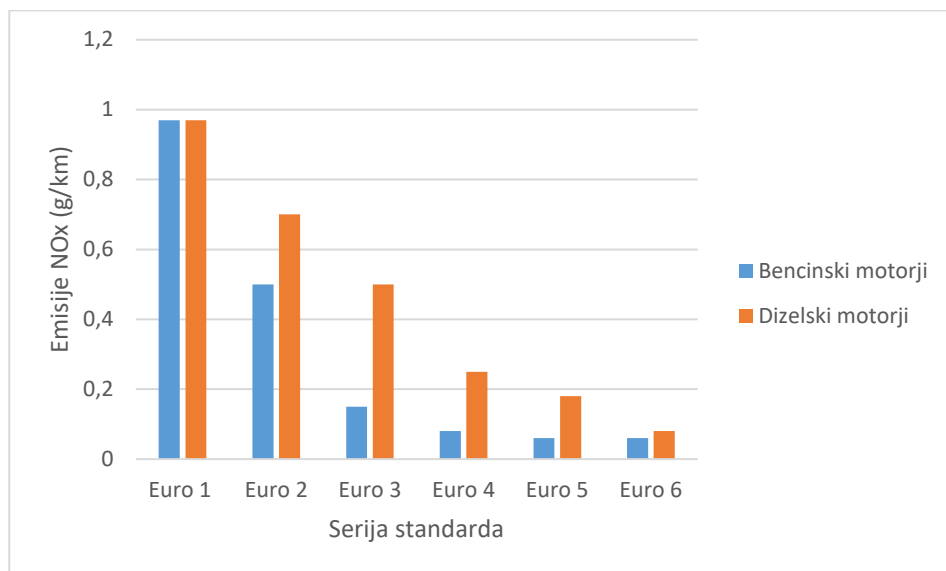
Oba dušikova oksida pogosto skupaj označujemo s formulo NO_x. Pri reakcijah z ogljikovodiki pod vplivom sončne svetlobe povzročata nastanek prizemnega ozona (O₃), ki je tudi škodljiv za dihala. Dušikove okside in ogljikovodike imenujemo prekursorje ozona. Dušikovi oksidi so poleg žveplovega dioksida tudi povzročitelji kislega dežja.

Potrebno je omeniti, da so pri dušikovitih oksidih za dizelske motorje večje tolerance, torej so dovoljene višje emisije, kot za bencinske motorje (ravno obratno je pri ogljikovem monoksidu, kot je razvidno iz slike 1). Pri bencinskih motorjih je izpuh opremljen s tristeznim katalitičnim pretvornikom, ki hkrati pospeši razgradnjo treh onesnažil – oksidaciji ogljikovodikov in ogljikovega monoksida ter redukcijo dušikovitih oksidov. Da pa je to možno doseči, mora biti razmerje med zrakom in gorivom v motorju skoraj idealno (teoretično). To je izvedljivo pri bencinskih motorjih, ne pa tudi pri dizelskih, ki imajo v gorivni mešanici velik prebitek zraka. Zato so bili dizelski motorji dolgo časa opremljeni le z oksidacijskimi katalizatorji, ki pospešijo razgradnjo ogljikovodikov in ogljikovega monoksida, na dušikove okside pa nimajo vpliva (Mondt, 2000).

Standard Euro 4, predvsem pa nato Euro 5 in 6 pa sta precej zaostрила merila za dušikove okside tudi pri dizelskih motorjih. Zato so za doseganje standarda Euro 5 pri dizelskih motorjih uvedli povratno vodenje izpušnih plinov (EGR – exhaust gas recirculation), kjer del izpušnih plinov vodijo ponovno v motor, z njim nadomestijo del zraka v gorivni zmesi in tako zmanjšajo množino dušika, ki se lahko oksidira v dušikove okside. Za doseganje zahtev standarda Euro 6 pa so potem dodali še ali (Automobile Association Developments, 2024):

- past za dušikove okside (LNT Lean NO_x trap), adsorbent, ki shrani dušikove okside, ki se nato katalitično razgradijo ali
- selektivno katalitično redukcijo (SCR – selective catalytic reduction), kjer se v izpušne pline vbrizga raztopina sečnine (znana pod komercialnim imenom AdBlue), ki nato ob prisotnosti katalizatorja reagira z dušikovimi oksidi ter pri tem nastane dušik in vodna para.

Slika 3 prikazuje največje dovoljene emisije dušikovih oksidov za osebne avtomobile za standarde serij Euro 1 do Euro 6. Pri tem je potrebno omeniti, da so tako pri bencinskih in pri dizelskih motorjih upoštevane skupne emisije ogljikovodikov in dušikovih oksidov za seriji Euro 1 in Euro 2, od vključno standarda Euro 3 naprej pa so dušikovi oksidi obravnavani ločeno (Automobile Association Developments, 2024).



Slika 3: Mejne emisije dušikovih oksidov za standarde serij Euro 1-6 za avtomobile z bencinskim in dizelskim motorjem

Vir: Automobile Associations Development (2024) <https://www.theaa.com/driving-advice/fuels-environment/euro-emissions-standards>

3.4 Trdni delci (PM)

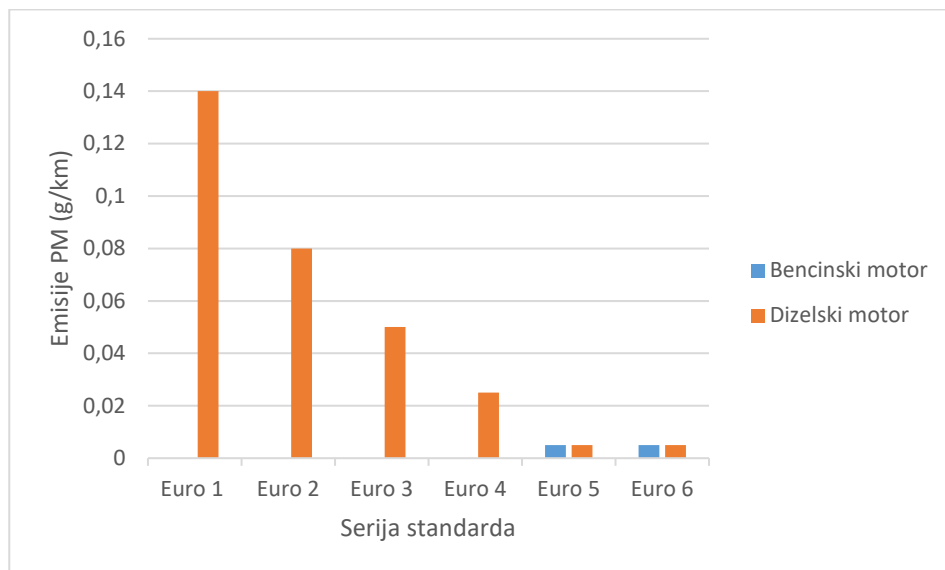
Trdne delce označujemo običajno z oznako PM, ki izvira iz začetnice angleškega izraza particulate matter. Med trdne delce uvrščamo vse trdne delce in tudi kapljice, ki so prisotne v zraku. Ti delci so lahko tako po izvoru kot tudi po kemijski sestavi zelo različni. Imajo vrsto škodljivih učinkov na zdravje, predvsem na dihala in srčno-žilni sistem (Brook, 2010).

V izpušnih plinih iz avtomobilskih motorjev so trdni delci koščki elementarnega ogljika (saj), ki nastanejo zaradi nepopolnega izgorevanja goriva. Vrsto let je bil problem emisij trdnih delcev prisoten le pri dizelskih motorjih. Klasični bencinski motorji s posrednim vbrizgom goriva, imajo v primerjavi z dizelskimi motorji zanemarljivo majhne emisije trdnih delcev in zato pri teh motorjih trdni delci sploh niso bili predmet nadzora. V zadnjem obdobju (predvsem po letu 2010) pa so se uveljavili bencinski motorji z neposrednim vbrizgom goriva (DI – direct injection motorji). Ti imajo boljši izkoristek in se po porabi goriva približajo dizelskim motorjem, žal pa imajo tudi podobne ali pa celo še nekoliko višje emisije trdnih delcev. Standarda Euro 5 in Euro 6 predvidevata zato nadzor emisij trdnih delcev tudi za bencinske motorje z neposrednim vbrizgom goriva.

Zaradi zaostritve emisij pri dizelskih motorjih so že mnogi dizelski avtomobili, ki ustrezajo standardu Euro 4 opremljeni s filtrom trdnih delcev, kar velja tudi tako za dizelske kot za bencinske avtomobile z neposrednim vbrizgom goriva, ki ustrezajo standardoma Euro 5 in 6 (Automobile Association Developments, 2024).

Vsi standardi do Euro 6 predvidevajo meritve emisij trdnih delcev s premerom nad 23 μm .

Slika 4 prikazuje največje dovoljene emisije trdnih delcev za osebne avtomobile za standarde serij Euro 1 do Euro 6. Za dizelske motorje je nadzor emisij trdnih delcev obvezen že vse od standarda Euro 1, pri avtomobilih z bencinskimi motorji pa le za tiste z neposrednim vbrizgom goriva (DI motorje) pri standardih Euro 5 in 6 (Automobile Association Developments, 2024).



Slika 4: Mejne emisije trdnih delcev za standarde serij Euro 1-6 za avtomobile z bencinskim in dizelskim motorjem

Vir: Automobile Associations Development (2024) <https://www.theaa.com/driving-advice/fuels-environment/euro-emissions-standards>

4 Standard Euro 7

Medtem ko so bili v predhodnih verzijah standardov osebni avtomobili obravnavani ločeno od tovornjakov in avtobusov, standard Euro 7 združuje vse pod eno streho. Na ta način nadomešča tako standard Euro 6 za osebne avtomobile kot tudi standard Euro VI za tovorna vozila in avtobuse (Insight, 2023).

Za vse pretekle verzije Euro standardov je bilo značilno, da je nova verzija standarda zaostрила mejne vrednosti emisij za posamezno vrsto onesnažila. Tako je bilo predvideno tudi za standard Euro 7. Vendar je bilo tako s strani proizvajalcev avtomobilov kot tudi nekaterih držav članic Evropske unije to deležno precejšnjega nasprotovanja. Glavni razlog za to je bilo dejstvo, da je v državah Evropske unije po letu 2035 predvidena ukinitve proizvodnje avtomobilov z motorji z notranjim izgorevanjem in prehod na električne avtomobile. Izdelovalci so zato nasprotovanje argumentirali s tem, da bi morali precej naporov in finančnih sredstev vložiti v nadaljnji razvoj in izpopolnjevanje naprav za nadzor emisij, ki pa bi nato imele le relativno kratek rok uporabe. To bi jih precej oviralo pri razvoju električnih

avtomobilov. Zato je bil sprejet kompromis. Za osebne avtomobile in lahka dostavna vozila so tako obveljala merila standarda Euro 6, a so poenotena za avtomobile z bencinskim in dizelskim motorjem. Poostrila pa so se merila za tovornjake in avtobuse (Evropski svet, 2024; Automotive News Europe, 2024; Girtelka, 2023).

Pri emisijskih standardih so za osebne avtomobile povzeta najstrožja merila standarda Euro 6, kot je razvidno iz Tabele 2. Za ogljikov monoksid je standard Euro 6 imel strožja merila (nižjo mejno vrednost) za dizelske motorje kot za bencinske, pri dušikovih oksidih pa je bilo obratno. Standard Euro 7 za obe vrsti motorjev sedaj postavlja nižjo mejo. Se pa od prejšnjih verzij standardov Euro 7 razlikuje po tem, da poleg prejšnjih štirih vrst onesnažil vključuje še amonijak (NH₃). Primerjava mejnih vrednosti emisij za posamezne vrste onesnažil med standardoma Euro 6 in Euro 7 je prikazana v Tabeli 2 (Insight, 2023).

Tabela 2: Primerjava mejnih vrednosti emisij v izpušnih plinih motorjev osebnih avtomobilov za standarda Euro 6 in Euro 7

Vrsta onesnažila	Standard Euro 6 (bencinski motor)	Standard Euro 6 (dizelski motor)	Standard Euro 7
Ogljikov monoksid (CO) (g/km)	1,0	0,5	0,5
Dušikovi oksidi (NO _x) (g/km)	0,06	0,08	0,06
Celotni ogljikovodiki (HC) (g/km)	100	-	100
Nemetanski ogljikovodiki (NMHC) (g/km)	0,068	-	0,068
Trdni delci (PM) (g/km)	0,045	0,045	0,045
Število trdnih delcev (PN) (#/km)	$6,0 \cdot 10^{11}$ ($d \geq 0,023 \mu\text{m}$)	$6,0 \cdot 10^{11}$ ($d \geq 0,023 \mu\text{m}$)	$6,0 \cdot 10^{11}$ ($d \geq 0,010 \mu\text{m}$)
Amonijak (NH ₃) (g/km)	-	-	0,02

Vir: Insight, 2023

Pri trdnih delcih se upoštevajo trdni delci s premerom nad 10 μm , prej je bila meja 23 μm . V primerjavi s standardom Euro 6 se je tudi podaljšalo obdobje, ki morajo emisije ustrezati predpisanim mejnim vrednostim, in sicer na obdobje 10 let oziroma 200.000 prevoženih kilometrov (Evropski svet, 2024).

Pri tovornjakih in avtobusih pa so se mejne vrednosti emisij v primerjavi z Euro VI standardom znižale, poleg amonijaka pa je vključen še nadzor nekaterih drugih spojin, kot sta didušikov oksid (N_2O) in formaldehid (HCHO) (Insight. 2023).

Po letu 2035 je za osebne avtomobile in lahka dostavna vozila predvideno prenehanje proizvodnje vozil z notranjim izgorevanjem, ampak le še avtomobili z alternativnimi načini pogona, predvsem gre za električne avtomobile. Pri tovornjakih in avtobusih pa je predvidena še nadaljnja uporaba motorjev z notranjim izgorevanjem. Tako bodo osebni avtomobili sodili v kategorijo vozil z ničelnimi emisijami, označenih s kratico ZEV (iz angleškega izraza zero emission vehicle). Vendar velja to samo za emisije iz motorja. Še vedno pa prihaja do emisij trdnih delcev, ki nastanejo pri obrabi zavornih oblog in pnevmatik, obrabi cestne površine ter resuspenziji prahu. Tovrstne emisije pa so sorazmerne s težo vozila. Ker imajo električna vozila v povprečju skoraj 25 % večjo maso kot primerljiva vozila z bencinskimi motorji, je tovrstnih emisij pri električnih avtomobilih zato sorazmerno več. Ker so se po drugi strani zaradi zelo izpopolnjenih filtrov trdnih delcev emisije le teh v izpuhu zelo zmanjšale, so sedaj razlike v emisijah trdnih delcev med električnimi vozili in vozili na motor z notranjim izgorevanjem praktično zanemarljive (Timmers in Achten, 2016).

Zato je zelo pomembno, da standard Euro 7 uvaja poleg izpušnih plinov tudi nadzor emisij, nastalih pri obrabi zavornih oblog in pnevmatik. To je bistvena razlika v primerjavi s prejšnjimi verzijami standardov Euro. Merjenje emisij iz obrabe pnevmatik in zavornih oblog je seveda predvideno za vse vrste avtomobilov ne glede na pogon. Res je, da so tudi emisije iz zavornih oblog pri električnih avtomobilih nizke zaradi rekuperacije pri zaviranju, emisije pri obrabi pnevmatik pa so zaradi večje mase višje kot pri avtomobilih z bencinskim ali dizelskim motorjem (Timmers in Achten, 2016).

5 Zaključek

Euro standardi že od leta 1992 sistematično uravnavajo emisije onesnažil v izpušnih plinih osebnih avtomobilov, lahkih dostavnih vozil, tovornjakov in avtobusov. Značilnost Euro standardov je, da ima vsaka novejša verzija ostrejša merila in zniža največje dovoljene emisije posameznih vrst onesnažil. Pomembno je, da se upoštevajo tehnične možnosti in, da zakonske zahteve sledijo tehnološkemu razvoju. Postopoma je bil tako po korakih dosežen velik napredek.

Pri standardu Euro 7 je potrebno izpostaviti nekaj specifičnosti. Prvič so v okviru enega standarda združene vse vrste cestnih motornih vozil, kar povečuje transparentnost. Poleg tega uvedba tega standarda sovпада z odločitvijo o prenehanju izdelave osebnih avtomobilov z motorji z notranjim izgorevanjem po letu 2035. Vse do vključno standarda Euro 6 so bili standardi namenjeni izključno nadzoru emisij onesnažil iz izpušnih plinov motorja. V primeru električnih avtomobilov je postalo to brezpredmetno. Vendar pa je postalo jasno, da avtomobili povzročajo določene emisije tudi iz drugih virov, kot so zavorne obloge, pnevmatike itd. Tako bo tudi v primeru, če bodo na cestah prevladovala vozila na električni ali vodikov pogon, še vedno potreben sistematičen nadzor emisij.

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CONCEPTUAL FRAMEWORK FOR UTILIZING CHATBOTS AS DOMAIN EXPERTS IN ORGANIZATIONS

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This paper articulates conceptual framework for investigating the deployment of Large Language Models (LLMs) in the capacity of expert-level chatbot interfaces within organizational settings. Commencing with an exhaustive review of the pertinent literature, this study delineates the landscape of LLM application in corporate environments. The challenges encompass the heterogeneity of human-LLM interactions, the propensity for inadvertent errors, and the consequential effects on employee engagement and motivation. Foremost among these is the examination of the intricacies involved in the symbiosis of LLMs with extant business information systems, particularly evaluating the utility of LLMs as dynamic, bi-directional communicative interfaces. Moreover, the study anticipates the prospective impacts that LLMs may exert on prevailing human-machine interfaces within such information systems. Conclusively, this paper introduces high-level theoretical model for the integration of LLM-driven chatbots into business information systems, setting a platform for future investigations. This model is advancing the understanding of the transformative role of LLMs in augmenting and refining organizational information processing and decision-making paradigms.

Keywords:

chatbots,
AI domain
experts,
artificial
intelligence,
framework,
organizations

1 Introduction

In the waning days of November 2022, OpenAI unveiled ChatGPT, a groundbreaking development in the realm of conversational artificial intelligence. By January 2023, a mere two-month post-launch, ChatGPT had amassed an unprecedented user base exceeding 100 million individuals. This rapid and widespread adoption not only marked ChatGPT as the fastest growing consumer application in recorded history but also catalysed a significant surge in the AI sector, heralding what many have termed an "Artificial Intelligence Boom" (ChatGPT – Wikipedia, n.d.).

Prior to this juncture, consumer-facing AI chatbots were not an unfamiliar concept. Notable among them was Bank of America's AI-driven virtual assistant, Erica, which had been successfully integrated into the banking ecosystem, servicing millions of customers with banking-specific inquiries. Furthermore, in the finance sector, BlackRock's Robo-Advisor 4.0 stood as a testament to the amalgamation of AI and Machine Learning capabilities. This sophisticated system demonstrated a proficiency in advising clients on financial matters, showcasing a performance that could potentially surpass traditional human stock-pickers (Pal, A., Gopi, S., and Lee, K., 2023).

The primary distinguishing characteristic of chatbots powered by the Generative Pre-trained Transformer (GPT) model lies in their exceptional contextual understanding capabilities. This feature marks a significant advancement over previous generations of chatbots, which, despite incorporating some level of Natural Language Processing (NLP), often lacked the depth and nuance necessary for truly natural conversation flow. GPT-based chatbots transcend these limitations through their advanced and sophisticated NLP capabilities, ensuring interactions that are remarkably fluid and human-like.

A critical aspect of the GPT model is its generative nature. Unlike traditional chatbots that primarily rely on pre-defined responses, GPT-based systems have the unique ability to generate original content. This capability extends beyond simple response formulation. The model can synthesize or summarize inputs or combine its extensive trained knowledge (Radford, A., Wu, J., Child, R., Luan, D., Amodei, D., Sutskever, I., 2019) to create entirely original content. Such a feature is pivotal in

providing bespoke interactions, as it allows the chatbot to tailor its responses to individual users dynamically, considering the specific context of each interaction.

Moreover, the voluminous and diverse training material that forms the foundation of the GPT model endows it with a broad understanding of language, context, and subject matter. This extensive training enables the chatbot to engage in a wide array of topics, further enhancing the naturalness and relevance of its conversations (Roumeliotis, K., Tselikas, N., 2023).

In essence, chatbots built on the GPT framework offer a more human-like interaction experience than their predecessors. This is not merely in terms of the sophistication of the responses but also in the overall conversational quality, where the chatbot can adapt, respond, and even anticipate user needs in a manner reminiscent of human interaction. The GPT innovative approach to NLP represents a paradigm shift in the field of chatbot technology, setting a new benchmark for what is achievable in AI-driven conversational agents.

This paper aims to provide a comprehensive literature review of GPT-driven chatbots within organizational settings.

1.1 Understanding the Scope of Research

The emergence of chatbots has primarily been researched and analysed from the perspective of business-to-consumer (B2C) engagement. Recent advancements in generative chatbot technology, exemplified by systems such as ChatGPT, present a multitude of robust use-cases within various business domains (Fui-Hoon Nah, F., Zheng, R., Cai, J., Siau, K., Chen, L., 2023). Their usage extends to critical business functions including marketing, information technology/engineering, as well as legal and healthcare sectors. Within these domains, the capabilities of generative AI for content creation, data summarization, and language translation are of paramount importance. The efficacy of generative AI in these areas has demonstrated remarkable potential, offering significant advancements in operational efficiencies and strategic capabilities.

Chatbot utilization in direct integrations with business information systems for the purpose of supporting employees in executing business processes remains an under-explored and under-utilized area. This research proposes to fill this gap by examining the role of chatbots as domain experts in information systems such as Financial Management, Human Resources Management (HRM), Supply Chain Management (SCM), Manufacturing, Inventory Management, Purchasing/procurement, Project Management, Order Processing and Business Intelligence (BI). The aim is to outline how to implement integrations and to understand how employees can effectively utilize AI driven chatbots to optimize internal process workflows, enhance data analytics and decision making, and improve overall operational efficiency.

While acknowledging the complex and intricate nature of Large Language Models (LLM) on which ChatGPT is based on, this study will limit its examination to a comprehensive understanding of the capabilities and limitations inherent in these models. The research does not delve deeply into the intricate technical mechanics and algorithmic foundations of LLMs. Instead, it will appreciate their practical applicability and existing constraints.

This approach ensures a balanced perspective, concentrating on the pragmatic aspects of LLM implementation in business environments while maintaining an informed awareness of the underlying technological principles. The goal is to offer valuable insights into how LLMs can be strategically integrated into business systems to optimize decision-making efficacy, process efficiency and facilitating a more human-like interaction with information systems. The latter is also viable from the perspective of user preference as analysed by research studies (Sakirin, T., Ben Said, R., 2023).

1.2 Challenges of Implementing Chatbots in Organizational Environments

A suite of large language model (LLM)-based chatbot systems are currently accessible via the internet for public utilization. Prominent examples of these systems include OpenAI ChatGPT, Microsoft Bing Copilot, Google Gemini, etc. These chatbots are particularly suitable for scenarios that do not require extensive integration with business-specific contexts. In most cases, uploading files for building an indexed knowledge base, writing prompts and copy-pasting text back is

sufficient. This research does not delve into this context as we target more advanced automated integrations with business information systems.

A major challenge with Large Language Models (LLMs) is their tendency to produce "hallucinations" or outputs that, despite being presented confidently, may include partially fictional content. This issue is compounded by the risk of LLMs relying on outdated information. Such drawbacks pose significant obstacles in business contexts where LLMs are used for knowledge acquisition, data processing, and decision-making (Alkaissi, H., McFarlane, S., 2023). This article aims to address these challenges by presenting strategies to not only reduce instances of hallucinations but also to ensure the currency and accuracy of the information provided by chatbots, thereby significantly improving their reliability and credibility.

Further challenge lies in bridging the gap between structured data in information systems and the unstructured text generated by Large Language Models (LLMs), as well as the reverse process of translating unstructured LLM outputs into structured data for actionable insights within targeted information systems. This interoperability is critical, as it enables chatbots to not only access data from existing business information systems but also to initiate and execute business-related events within these systems. Developing an efficient model to facilitate this seamless integration and interaction is essential for the effective utilization of chatbots in business environments.

To facilitate the integration of business information systems and their respective data and interfaces with these chatbots, two primary LLM deployment methods are employed: utilization of cloud-based LLM APIs or on-premises LLM installations. To choose the viable approach consideration of data security, accessibility, performance, privacy, latency, technical expertise, and cost is needed.

Data protection and authorization are of paramount importance in the utilization of chatbots within organizations. Regulating access to specific segments of business information is essential for maintaining organizational coherence, ensuring continuous operations, and safeguarding security. However, this issue assumes comparatively lesser significance in the context of smaller businesses. These smaller entities often have more straightforward operational structures and reduced data complexities, which may result in a lower risk profile for data breaches or

unauthorized access. As such, the stringent measures required for larger organizations may not be as critical for smaller businesses, though they should still maintain a basic level of data protection and access control.

The following key research questions in the scope of this topic have been identified:

- How to integrate chatbot into business information systems and what are the challenges of this integration?
- What are the advantages of using chatbots as bi-directional interfaces to business information systems compared to existing methods?
- How do LLMs affect the accuracy and reliability of structured data in business information systems?
- What are the possible security, privacy and intellectual property concerns when using LLMs to access sensitive business data?
- What are the expected impacts of using chatbots as interfaces for structured data on productivity and competitiveness of businesses?

1.3 Literature Review

Comprehensive analysis of scholarly publications reveals a substantial dedication of research resources towards the deployment of chatbots in Business-to-Consumer (B2C) communication. These studies focus on chatbot applications in customer support, eCommerce, advisory services, education, healthcare, and interactions between citizens and government (Luo, B., Lau, R., Li, C., Si, Y., 2022). The increasing adoption of chatbots in these domains, alongside the corresponding escalation in research activities, can be attributed in part to the principle of economies of scale. Chatbots operating within the B2C sector benefit from a broader user base and heightened levels of utilization. This expansive reach typically results in a more favourable return on investment (ROI), underlining clear business incentives for their implementation. These types of chatbots are not targeted in this research.

In comparison, chatbots deployed within internal business systems primarily for employee usage face a notably smaller user base. This reduced scale of interaction significantly impacts the economic justification for investing in the development and

implementation of chatbots in these scenarios. The limited number of users often results in a lower return on investment, making the economic case for their development in such internal contexts less compelling and more challenging to validate.

With the introduction of Large Language Model (LLM) based chatbots, there is a paradigm shift in this perspective. This paper posits that LLM-based chatbots are set to revolutionize and justify their application within business systems. This evolution is expected to redefine the economic viability and functional relevance of chatbots in these internal business environments, overcoming the constraints posed by smaller user base.

Since the breakthrough of ChatGPT and similar LLMs occurred only two years ago, specific literature on their application in this context is scarce. Existing research related to LLMs tends to concentrate on assessing the extent of employees utilizing publicly available LLMs which are not directly integrated with information systems. Other studies (Eloundou, T., Manning, S., Mishkin, P., and Rock, D. 2023), explore the potential long-term effects of LLMs on the labour market. These studies generally agree on the expected impact of LLMs, yet they do not delve into chatbots enhanced with specific business domain knowledge tailored for use by employees within their organizations. This gap indicates an emerging area of research, focusing on the integration of domain-specific knowledge into LLM-based chatbots to optimize their utility in internal business settings.

2 Methodology

The literature review for this study was meticulously conducted following the established guidelines outlined by Snyder (Snyder, H., 2019). The search for pertinent articles was methodically carried out across several renowned academic databases, including Web of Science, Scopus (Elsevier), ProQuest, and Google Scholar. This process began with a strategic keyword search, followed by a refinement of the results using specific keyword combinations.

To evaluate the gathered articles, an initial review was conducted, focusing on abstracts and skim reads to ascertain the relevance and depth of the content. This approach facilitated the selection of the most pertinent articles, which were crucial

for acquiring a comprehensive understanding of previous research findings in the domain of Large Language Models (LLMs).

Given the rapid and recent evolving nature of LLM, a key criterion for the relevance of these articles was their publication year. This study prioritized recent publications, recognizing that the field of LLM (GPT) research has a relatively short history, spanning no more than two years. Additionally, the selection process placed significant emphasis on the number of references in each article. This measure served as an indicator of the article's impact and the extent to which it has contributed to the field, ensuring that the most influential and informative works were included in this review.

3 Intermediate Research Results

3.1 Deciding Between Cloud-Based and On-Premises Solutions

Utilizing a cloud-based API offers a cost-effective solution, primarily due to the distributed cost allocation among multiple API consumers and the adoption of pay-per-use pricing models. However, this approach raises concerns regarding on-premises IS integration, data privacy and security. In contrast, implementing an LLM on-premises is feasible but incurs substantial costs related to computing power, maintenance effort and environmental impact (Doo, F., Kulkarni, P., Siegel, E., Toland, M., Yi, P., Carlos, R., Parekh, V., 2023). Additionally, this approach necessitates ongoing maintenance and potential further training of the LLM models.

Notably, there are highly capable open-source LLMs available, such as Llama 2 from Meta and Falcon 180B from Technology Innovation Institute of the UAE. They can be leveraged for on-premises deployments, however, not without significant running costs (Wodecki, B., 2023).

In the context of research, the cloud-based Azure OpenAI API, has been selected due to its accessibility and robust capabilities. This choice allows for a balance between resource availability and the need for advanced language processing functionalities. Further thought will be given also to questions of privacy and security in such environments.

3.2 Model of LLM Integration with Business Information Systems

Incorporating actual business data into Large Language Models (LLMs) can be effectively achieved through Retrieval-Augmented Generation (RAG), as explained by Shuster, K., Poff, S., Chen, M., Kiela, D., and Weston, J. in 2021. The conceptual model of integration is presented on Fig 1.

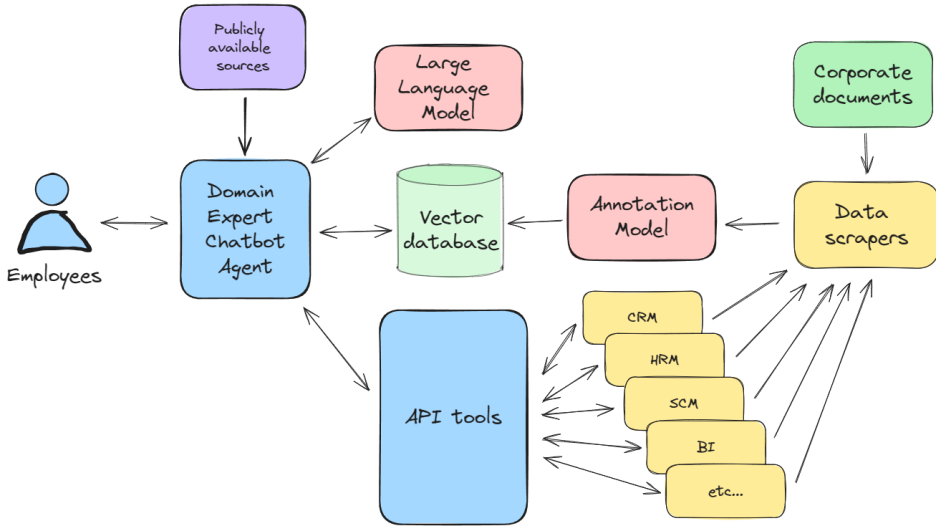


Figure 1: Conceptual model for LLM chatbot integration with information systems
Source: Own

This process necessitates the integration of data from business information systems into an indexed vector database. The data undergoes a transformation into vector embeddings, which are then stored in a searchable vector database. This database is subsequently queried on-demand through a chain-of-thought mechanism employed by agents. These agents execute transient chat threads that perform a series of operations. Such operations include interactions with LLMs itself, utilizing various tools such as web searches, business information system queries, vector database searches, and even human interactions. The determination of the steps necessary to address a user's request and the point at which to deliver the final response are governed by the internal LLM's reasoning capabilities. This framework allows chatbots to become a potent interface within specific business domains in a business environment.

Current research efforts have culminated in the development of a chatbot prototype on top of cloud based LLM API. It is capable of harnessing above mentioned tools through autonomous reasoning. Future developments are directed towards integrating this prototype into a real-world business setting. Implementation of user feedback mechanism will be implemented. Further research in data privacy, data access authorization will follow. After substantial active user base has been established a survey type of research will be executed to establish chatbot usage, efficacy, performance, and limitations.

4 Conclusions

Despite its potential, the integration of LLM based chatbots in internal business processes remains underutilized, presenting a novel area of exploration and research for enhancing business information systems and decision-making processes. A major challenge for LLMs in business contexts is ensuring the accuracy and currency of information, as well as effectively managing the translation between structured data in information systems and unstructured data in human like communication. The research identifies a gap in the literature regarding the application of LLMs in internal business contexts, suggesting an emerging area of research focused on integrating domain-specific knowledge into LLM-based chatbots.

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PROPENSITY TO USE DIGITAL INNOVATION: CASE OF CONTACTLESS PAYMENTS IN THE CZECH REPUBLIC

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While credit and debit cards have been used since mid-20th century, the first contactless credit card was available only since late 2007. Major supermarket chains in the Czech Republic were equipped for contactless payment since around 2015. Nowadays, also smartphones, smartwatches, and similar wearables facilitate contactless payments. The aim of the research was to analyze the impact of gender, age, education, and wealth on propensity to conduct a contactless payment when the context allows for it. The somewhat surprising finding was that the education level increases contactless payment propensity.

Keywords:
contactless
cards,
demographic
factors,
digital
payments,
usage
intention

1 Introduction

In recent years, there has been a significant shift towards digital innovation in the financial industry, with contactless payments emerging as one of the prominent trends. The other frontiers for digital innovation in this space include the integration of biometric authentication on mobile phones, perhaps the use of blockchain technology to enhance security and streamline the payment process, among others. (Türkmen & Değerli, 2015) However, as the digital landscape continues to evolve, contactless payments are poised to play an even larger role in shaping the future of finance and commerce. An interesting question remains - how the propensity to adopt digital innovation reflects on the velocity and comprehensiveness of innovation spread within the financial sector.

Propensity to use digital innovations

Muhammet Demirbilek (2014) in his article 'Digital Natives' Debate: An Investigation of the Digital Propensities of University Students assess the digital inclinations of 409 post-secondary Turkish students. He investigates whether gender, chosen academic program, socioeconomic status, type of education, the number of family members, and the quantity of computers per household exert influence on the utilization of Information and Communication Technologies (ICT). He comes to conclusion, that male students exhibit a higher propensity for using Information and Communication Technologies in comparison to their female counterparts. Furthermore, the results indicate that factors such as the attended faculty, type of education program, family income, the quantity of computers available, and the number of children in the household are significant contributors to a higher digital propensity index.

Liviu et al. (2021) also studied academics and their propensity towards utilization of digital resources in the post-pandemic era. They identified that this unique transformation gave rise to a situation of "compelled innovation," characterized by a thorough reconsideration and reconstruction of educational approaches. Their findings indicate that university members exhibit a moderate level of digital propensity, displaying a genuine interest in and taking initiatives to embrace. This study can serve as an initial step in the development of a digital propensity index that can be applied within the academic domain.

Cetindamar et al. (2021) looks into propensity to use digital innovation, particularly whether digital technologies play a significant role in business transformation. They develop Theory of Planned Behavior (TPB) to analyze empirical data of Australian employees regarding their intentions and behaviors related to technology usage, finding a positive correlation between employees' digital literacy and the adoption of cloud technology within companies. Additionally, it extends the TPB framework by introducing digital literacy as a perceived behavior control factor that sheds light on employees' roles in digital transformation.

Contactless payments

Contactless payments have revolutionized the way people make transactions, offering a convenient and secure alternative to traditional payment methods. (Camara, 2021) With the widespread adoption of mobile devices and the development of digital wallets, consumers now have the ability to make purchases with a simple tap or wave of their smartphone or contactless card.

Furthermore, the COVID-19 pandemic has accelerated the adoption of contactless payments (CVV, 2020), as it offers a hygienic way to pay without physical contact. Merchants and businesses are also adapting to this trend by embracing contactless payment terminals to provide a safer and more seamless experience for their customers.

While contactless payments have certainly gained popularity and offer convenience, there are some valid concerns and opposing arguments about their widespread adoption (Cyber Security Intelligence, 2020) (Security Risks of Contactless Payments - Security Intelligence, 2018). One of the primary concerns is the potential for increased vulnerability to fraud and security breaches. With the reliance on digital technology and wireless communication, there is an inherent risk of unauthorized access and fraudulent activities. (Traynor et al., 2017).

Additionally, there are concerns about the exclusion of individuals who may not have access to the necessary technology or prefer to use traditional payment methods (Johnson et al., 2018). As contactless payments become more prevalent, there is a risk of marginalizing a portion of the population who are not equipped to participate in this digital financial ecosystem (Akana & Ke, 2020).

Furthermore, the convenience of contactless payments may lead to overspending and a lack of conscious decision-making when it comes to financial transactions. The ease of tapping a card or waving a smartphone to make a purchase could potentially contribute to impulsive spending behaviors and a disconnect from the tangible aspect of money (Yang et al., 2015).

As we consider the broader implications of contactless payments, it's important to address these concerns and strike a balance between embracing technological advancements and ensuring inclusivity and security for all members of society.

An extensive study conducted by Mastercard (MasterCard, 2020) <https://www.mastercard.com/news/press/press-releases/2020/april/mastercard-study-shows-consumers-globally-make-the-move-to-contactless-payments-for-everyday-purchases-seeking-touch-free-payment-experiences/> examines the evolving consumer behaviors across 19 countries worldwide, shedding light on the widespread adoption of contactless payments for everyday purchases. In a 2020 survey involving 17,000 participants, a significant 79 percent of respondents reported their use of contactless payments, primarily motivated by safety and hygiene concerns. The research highlights a notable shift in consumer preferences, with 46 percent globally and 52 percent among those under 35 years old, replacing their traditional wallet cards with contactless options.

One striking finding is the growing confidence in contactless payments, driven by the global disruptions of 2020. An overwhelming 82 percent of respondents perceive contactless payments as a cleaner and more secure way to transact, contributing to its increasing popularity. Furthermore, contactless payments are reported to be up to 10 times faster than other in-person payment methods, offering added convenience for customers and reducing in-store transaction times.

Mastercard's data analysis revealed a remarkable 40 percent growth in contactless transactions worldwide during the first quarter of 2020. Surprisingly, 80 percent of these contactless transactions involve amounts under \$25, traditionally dominated by cash payments.

This Mastercard's comprehensive study was conducted through online interviews with 17,000 consumers across the globe, unfortunately not covering the Czech Republic. This is why we decided to fill this gap by conducting similar research in Prague.

In our paper, we will explore propensity to make contactless payments according to the various aspects and characteristics, such as gender, age or education level in the Czech Republic.

2 Methodology

The survey was conducted using an anonymous online questionnaire. There was no monetary incentive for respondents. There were 146 respondents (of whom seven reported a non-binary gender or decided not to answer; and will be treated as missing values in the full model but will be included in the streamlined model). Age data were collected as intervals, and the middle value of the interval will be used for the analysis. Education was divided into primary school, high school, university, and PhD education (coded as 1, 2, 3, and 4 respectively). In order to avoid non-response in estimating income and/or wealth, a percentage of income one saves was used; it was measured in intervals, and the middle value of the interval will be used for the analysis (eventually, eight decided not to answer). Propensity to make a contactless payment when possible was measured on a 1-5 Likert scale where 5 meant high propensity. A linear regression will be used for the analysis of the impact of gender, age, education, and savings on propensity to make contactless payments. A variance inflation factor (VIF) will be used as a measure of the amount of multicollinearity in the linear regression analysis.

3 Results

Propensity to make contactless payments according to the selected independent variables is provided in the following Tables 1-4.

Table 1: Propensity to make contactless payments according to gender

	Average	Standard Deviation
Male	4.0661	1.32750
Female	4.3889	0.84984

Source: own calculation

Table 2: Propensity to make contactless payments according to age

	Average	Standard Deviation
18-24	4.0172	1.31778
25-39	4.2609	1.19622
40-54	3.6923	1.49358
55-76	3.6667	1.15470
77+	2.0000	0.00000

Source: own calculation

Table 3: Propensity to make contactless payments according to education

	Average	Standard Deviation
Primary	3.0000	1.65831
High school	3.9571	1.37720
University	4.3607	1.01707
PhD	4.5000	1.00000

Source: own calculation

Table 4: Propensity to make contactless payments according to savings

	Average	Standard Deviation
0%	3.2857	1.70434
1-10%	4.1364	1.08213
11-21%	4.3478	1.11227
21-30%	3.8889	1.42325
31-50%	4.5161	1.09151
51-75%	4.2105	1.18223
76%+	3.2222	1.56347

Source: own calculation

The linear regression model with propensity to make contactless payments as a dependent variable and aforementioned four independent variables is provided in Table 5. VIF was lower than 1.1, therefore, collinearity is not a problem.

Table 5: Full linear regression model

	B	Std. Error	Beta	t	Sig.
Constant	3.421	0.545		6.278	0.000
Gender	-0.272	0.325	-0.072	-0.838	0.404
Age	-0.007	0.012	-0.051	-0.573	0.568
Education	0.520	0.170	0.268	3.049	0.003
Savings	-0.003	0.005	-0.056	-0.653	0.515

Source: own calculation

With regards to the explanatory power of the full model, the coefficient of determination is 0.073 and the adjusted coefficient of determination is 0.044, and its significance is 0.044. Logarithm of age instead of age per se was tested as well, significance worsened from 0.568 to 0.734.

The linear regression model with propensity to make contactless payments as a dependent variable and education as an independent variable is provided in Table 6.

Table 6: Streamlined linear regression model

	B	Std. Error	Beta	t	Sig.
Constant	2.895	0.399		7.254	0.000
Education	0.492	0.159	0.251	3.084	0.002

Source: own calculation

With regards to the explanatory power of the streamlined model, the coefficient of determination is 0.063 and the adjusted coefficient of determination is 0.056, and its significance is 0.002. If the coding of education was changed from 1, 2, 3, 4 to 1, 2.9142, 3.7214, 4 (i.e. the optimal coding), then the coefficient of determination would be 0.073 and the adjusted coefficient of determination would be 0.066, and its significance would be 0.001.

Although education was an ordinal variable, it was the only one from the tested independent variables which explained propensity to make contactless payments.

4 Conclusion

The aim of the study was to identify what influences propensity to make contactless payments. Adoption literature suggests that early adopters of a new technology are typically younger people, and men. Our respondents varied in age, but age was not found to be a significant explanatory variable, neither was gender. This could be because contactless payments are not so new anymore, and it is also a widely spread technology. Self-help financial advisors push an idea stemming from mental accounting that it is better to pay cash to have a better understanding of one's own spending habits. In the sample at hand, respondents who are not able to save anything and respondents who can save over three quarters of their income both reported similar propensities to make contactless payments that are lower than propensities of respondents in between the two ends of the scale. This phenomenon should be studied in a more focused future research. The analysis identified a significant relationship between achieved education and propensity to make contactless payments, the higher the education the high the propensity. Further research should aim to explain the mechanism behind this relationship.

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STAREJŠI ZAPOSLENI V KORAKU Z NOVO TEHNOLOGIJO

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V prispevku proučujemo, kako nove tehnologije vplivajo na starejše zaposlene. V ta namen smo opravili raziskavo med starejšimi zaposlenimi in ugotavljali, kako se starejši zaposleni soočajo z uporabo novih tehnologij in ali starejši zaposleni menijo, da bi se bolje in lažje prilagodili vplivu novih tehnologij, če bi delodajalec prilagodil delovne procese. Ugotovili smo, da imajo nove tehnologije pozitiven vpliv na starejše zaposlene, da imajo starejši zaposleni dovolj spretnosti in znanj za njihovo uporabo ter da nove tehnologije starejšim zaposlenim ne predstavljajo niti težav niti stresa. Ugotovili smo tudi, da starejši zaposleni občutijo vrzel na področju prilagajanja delovnih procesov s strani delodajalcev. S prispevkom smo odprli pomembna vprašanja, npr. kako se prilagoditi starejšim zaposlenim in izboljšati interakcijo med njimi in novo tehnologijo ter kako prilagoditi delovna okolja za drugačen način opravljanja del in nalog, da bi se starejši zaposleni počutili dobro oziroma da bi jih čim bolj opolnomočili z znanjem uporabe novih tehnologij.

Ključne besede:

nove tehnologije, starejši zaposleni, delodajalci, delovni proces, delovne naloge

OLDER EMPLOYEES KEEPING PACE WITH NEW TECHNOLOGY

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In the article, we examine how new technologies impact older employees. To achieve this, we conducted a survey among older workers, exploring how they navigate the use of new technologies and whether they believe that adapting work processes would facilitate their adjustment to the impact of new technologies. Our findings indicate that new technologies have a positive impact on older employees, who possess sufficient skills and knowledge for their utilization, experiencing neither difficulty nor stress. Additionally, we discovered that older workers perceive a gap in the adaptation of work processes by employers. The article raises critical questions, such as how to accommodate older employees and enhance their interaction with new technology, as well as how to adapt work environments to accommodate different ways of performing tasks and duties, ensuring that older employees feel empowered and well-equipped with the knowledge of using new technologies.

Keywords:
new
technologies,
older
employees,
employers,
working
process,
work
tasks

1 Uvod

V današnjem času se organizacije srečujejo s tehnološkimi spremembami in hitrim razvojem, pa tudi z izzivi, ki jih prinaša staranje prebivalstva. Še posebej hitro se soočamo z vpeljavo novih tehnologij, ki močno vplivajo na delovni proces, predvsem pa na starejše zaposlene. Proces staranja je namreč povezan s spremembami v sposobnostih in delovni uspešnosti posameznika, pa tudi v samih poklicnih trendih. Kot navajajo različni avtorji (npr. Flynn, 2014; Standing, 2018) se starejši zaposleni lahko znajdejo v stresu, saj je znano, da se težje prilagajajo na novitete. Po drugi strani pa National Research Council (2004) omenja, da so nove tehnologije lahko starejšim zaposlenim v veliko pomoč, da ohranijo in nadgradijo svoje spretnosti pri delu, da lahko hitreje opravijo svoje delo in ostanejo zaposleni.

Staranje prebivalstva bo imelo posebej velik vpliv tudi na družbeno dinamiko, saj se bo v nekaj letih dokončno upokojila najštevilčnejša generacija – baby boomerji. Že sedaj se srečujemo z izzivi usklajevanja delovno aktivnega prebivalstva in neaktivne populacije, zaradi nevdržnosti pokojninskega sistema pa se razmišlja o podaljševanju delovne dobe, kar vodi v izzive, s katerimi se bodo srečevali delodajalci. Kot pravi Novakova (2023) je treba razmišljati transparentno in se spopasti s težavami v delovnem okolju, upoštevati zmožnosti starejših zaposlenih in se pripraviti na drugačne, starejšim bolj prilagojene in primerne oblike dela. To pa je močno olajšano z uvajanjem novih tehnologij.

Tudi Macuh (2019) poudarja vpliv novih informacijskih tehnologij na starejše zaposlene - predstavljajo izziv, vendar hkrati lahko izboljšajo produktivnost in učinkovitost. Redkova (2020) pa izpostavlja pomen vlaganja v delovno silo, zlasti v povezavi z uporabo novih tehnologij, ključno za dolgoročno uspešnost organizacij. Ker starejši zaposleni stremijo k uravnoteženju med poklicnim in zasebnim življenjem, je ključno zagotoviti podporo in usposabljanje za uporabo novih tehnologij.

Zavedamo se heterogenosti starejših zaposlenih, saj imajo različne sposobnosti, spretnosti in izkušnje, razlikujejo pa se tudi po vedenjskih značilnostih. Glede na hitro uvajanje novih tehnologij je ključno razviti strategije za pripravo starejših zaposlenih na spremembe, ki jih prinaša nov način dela, ter za uporabo sodobnih tehnologij in drugačnih delovnih sredstev. Priprava in usposabljanje starejših

zaposlenih za novosti tako postajata nujna za njihovo uspešno integracijo v delovno okolje.

Opisana problematika nas je vodila v raziskavo vpliva novih tehnologij na starejše zaposlene. Sledili smo razmišljanju, kako se starejšim zaposlenim prilagoditi, kako izboljšati interakcije med njimi in novo tehnologijo ter kako prilagoditi delovno okolje za učinkovito opravljanje nalog. Zavedamo se, da je treba poskrbeti, da starejši zaposleni ohranijo in nadgradijo svoje spretnosti ter da se uspešno prilagodijo za uporabo novih tehnologij.

2 Starejši zaposleni in tehnologija

2.1 Opredelitev starejših zaposlenih

Na vprašanje, kdaj smo stari, je težko odgovoriti. Čeprav starost lahko opredelimo kot statičen pojem, v resnici predstavlja dinamičen proces, ki se s časom spreminja. Slovar gerontologije (Staranje, 2022) opredeljuje staranje posameznika kot "fiziološki proces, ki se začne z oploditvijo in ga ne moremo preprečiti". Razlikujemo kronološko staranje, biološko staranje in doživljajsko staranje. Na prvega ne moremo vplivati, saj je povezan z datumom rojstva, medtem ko lahko na biološko in doživljajsko staranje vplivamo s kakovostnim življenjem, ki vključuje zdrav način življenja, dovolj gibanja in duševno stabilnost. Cilj je, da človek z doživljajskega vidika ohranja mladosten pogled skozi vsa starostna obdobja ter svoje izkušnje in spoznanja deli z drugimi.

Ko govorimo o starejših zaposlenih, stroka različno obravnava starostno obdobje, v katero jih uvrščamo. V skladu s 197. členom Zakona o delovnih razmerjih (ZDR-1, 2013) v Sloveniji starejše delavce opredeljujemo kot osebe nad 55. letom, ki imajo po zakonu določene posebne pravice in varstvo. Tudi raziskave se pogosto osredotočajo na to starostno skupino (npr. Novak, 2023; Munell in Wettstein, 2020; Voss et al., 2020; Lazazzara in Bombelli, 2011). Pogosto se za starejše aktivne osebe štejejo že tisti, ki so stari 50 let ali več. Zavod RS za zaposlovanje, na primer, v okviru ukrepov Aktivne politike zaposlovanja (MDDSM, 2021) določa starostno mejo 50 let. Tudi različni projekti in raziskave (npr. van Dalen in Henkens, 2020; SHARE, 2013; ZDS, 2010.) se v svojih raziskavah osredotočajo na starostno skupino od 50 do 64 let. Prav tako kolektivne pogodbe za posamezne dejavnosti delavcem že pri

starosti 50 let zagotovijo določene dodatne pravice oz. večji obseg pravic, kot jih določa ZDR-1, na primer pravico do dodatnih dni letnega dopusta. Nekateri avtorji pa izraz starejši zaposleni uporabljajo že pri starosti 40 let ali 45 let (Planko et al., 2021; Ybema et al., 2016; Bayl-Smith in Griffin, 2014). Glede na obširnost raziskav, predvsem pa zaradi ukrepov Aktivne politike zaposlovanja, smo se odločili, da bomo pri pojmovanju starejših zaposlenih sledili starosti 50 let in več.

2.2 Starejši zaposleni v delovnem okolju

Staranje prebivalstva ima pomemben vpliv na delovanje in razmišljanje managementa, ki se mora zavedati potrebe po pravočasnem razmišljanju o rešitvah za uspešno vključevanje starejših zaposlenih v spremenjen delovni proces. Poleg tega je ključno ohranjati motiviranost starejših delavcev in prepoznati koristi, ki jih podjetje lahko pridobi iz njihovega dela.

Čeprav se v podjetjih včasih pojavljajo zastareli pogledi na starejše zaposlene, ki temeljijo na negativnih vidikih staranja, je ključno razumeti, da so posledice staranja neizogibne. Delodajalci bi morali prilagoditi delovno okolje in delo posamezniku z ustrezno ergonomijo ter razumevanjem kompleksnega procesa staranja. Raziskave (npr. Diamond, 2016, Van Dalen et al., 2010) namreč kažejo, da starejši delavci prinašajo izkušnje, odgovornost in vodstvene veščine in imajo visoko storilnost v poklicih, ki zahtevajo natančnost in premišljenost. Nenadomestljivi so tudi pri mentoriranju mlajših. Avtorji omenjajo tudi slabosti, med katerimi pogosto navajajo slabše poznavanje tehnologij, delo pod pritiskom in manjšo pripravljenost na izobraževanje. Zato je ključno, da se podjetja na nove tehnologije pravočasno pripravijo in poskrbijo, da bo delo tudi med starejšimi zaposlenimi potekalo nemoteno.

Pogosto se napačno verjame, da se storilnost s starostjo zmanjšuje. Raziskave so pokazale, da je to odvisno od vrste dela. Starejši delavci se lahko odlikujejo z visoko storilnostjo v poklicih, ki zahtevajo znanje, natančnost in premišljenost, kljub morebitnim omejitvam, kot so manjša telesna moč ali omejena sposobnost hitre prilagoditve. Zadnje raziskave (npr. Bogataj et al., 2019) pa celo kažejo, da nove tehnologije uspešno nadomeščajo potrebno fizično moč, ki s starostjo znatno upade.

2.3 Vpliv novih tehnologij na starejše zaposlene

Spremembe, ki jih prinašajo nove tehnologije vplivajo na intenzivnost in kompleksnost delovnih procesov, hkrati pa usmerjajo delovno okolje v digitalizacijo in povečujejo hitrost. Uporaba novih tehnologij prinaša poenostavitve, večjo učinkovitost, dostopnost ter finančno ugodnost delovnih procesov, pri čemer je pomembna razvitost kompetenc posameznikov.

Pričakovanja ljudi do sebe in drugih se lahko spremenijo s staranjem, kar predstavlja oviro za sprejemanje novih tehnologij. Starejši odrasli pogosto stereotipizirajo sami sebe, kar lahko negativno vpliva na njihovo motivacijo in uspešnost pri uporabi novih tehnologij. Individualne razlike so velike, vendar vsak posameznik prinaša edinstvena pričakovanja glede uspešnosti tehnologije na podlagi znanja, prepričan in izkušenj. Starejši zaposleni s svojimi delovnimi izkušnjami prispevajo k delovnemu timu in okolju (Šinigoj, 2022).

Centa (2011) je ugotovil, da se starejši zaposleni pri uporabi novih tehnologij soočajo z različnimi izzivi, kar vpliva na njihovo motivacijo in pripravljenost za preizkus ali uporabo novih tehnologij. Za starejše zaposlene predstavljajo nove tehnologije izziv, ki ga je treba premagovati tako, da v največji meri izkoristijo uporabnost novitet. Zato je pomembno, da so aplikacije novih tehnologij, kot pravi National Research Council (2004), zasnovane tako, da ne zmedejo uporabnikov, temveč omogočajo starejšim zaposlenim, da ohranijo in nadgradijo svoje znanje ter spretnosti pri delu. V nasprotnem primeru lahko uvedba novih tehnologij pri starejših zaposlenih privede do stresnih situacij in s tem do zmanjšane delovne zmožnosti ter storilnosti.

3 Raziskava

3.1 Namen in cilji raziskave

Namen raziskave je bil proučiti, kakšen vpliv ima nova tehnologija na starejše zaposlene. Glavni cilji so bili ugotoviti, kakšno je mnenje starejših zaposleni o uporabi novih tehnologij na delovnem mestu, ali se pri uporabi novih tehnologij soočajo s težavami in stresom, ali imajo dovolj znanj in spretnosti za uporabo informacijskih tehnologij, ter ali ima uporaba novih tehnologij pozitiven učinek na delovno uspešnost in produktivnost pri opravljanju dela.

3.2 Potek raziskave in opis vzorca

Raziskavo smo opravili s pomočjo anketnega vprašalnika, ki smo ga oblikovali s pomočjo aplikacije 1KA. Dostopen je bil na posredovani povezavi od 30. 4. 2023 do 30. 7. 2023. Pri izbiri vzorca smo uporabili metodo snežne kepe, zato pridobljene informacije ne veljajo za celotno populacijo ali širše območje. Na anketni vprašalnik se je odzvalo 122 anketirancev, ki so ustrezali pogoju, da so zaposleni v privatnem sektorju, da so stari več kot 50 let in da pri delu uporabljajo nove informacijske tehnologije. Naš vzorec predstavlja 49,2 % žensk in 50,8 % moških. Glede na izobrazbo je imelo 60,7 % anketiranih terciarno izobrazbo, 39,3 % pa srednješolsko izobrazbo ali manj.

3.3 Rezultati

3.3.1 Nova tehnologija na delovnem mestu

Trditve o novi informacijski tehnologiji na delovnem mestu in njeni uporabi« so anketiranci ocenili s stopnjo strinjanja na Likertovi lestvici od 1 do 5. Ocena 1 je pomenila, da se s trditvijo sploh ne strinjajo, ocena 5 pa, da se popolnoma strinjajo. Iz tabele 1 je razvidno najpogostejše strinjanje s trditvijo »vpliv novih informacijskih tehnologij na delovno mesto vidim kot pozitivno in dobrodošlo« (povprečna ocena je 4,01). V povprečju so se anketiranci najmanj strinjali s trditvijo »ker imam premalo znanja o uporabi novih tehnologij, je moja zaposlitev ogrožena« (povprečna ocena je 2,28).

Z enostranskim t – testom za en vzorec (pri stopnji značilnosti 0,05 in testni vrednosti 3,5), smo preverili dve hipotezi: »Starejši zaposleni se v povprečju strinjajo, da imajo pri uporabi novih tehnologij težave« ($t=-8,758$; $p=1,000$) in »Starejši zaposleni se v povprečju strinjajo, da jim uporaba novih tehnologij na delovnem mestu povzroča stres« ($t=-9,167$; $p=1,000$). V obeh primerih je vzorčno povprečje nižje od testne vrednosti in p-vrednost enostranskega testa je $1 > 0,05$, zato obe hipotezi zavrnamo. Ne moremo trditi, da se starejši zaposleni v povprečju strinjajo, da imajo pri uporabi novih tehnologij težave, niti da jim uporaba novih tehnologij na delovnem mestu povzroča stres.

Tabela 1: Mnenje anketirancev o uporabi novih tehnologij

Ocenite trditve, ki se nanašajo na vaše mnenje o novi tehnologiji na delovnem mestu in njeni uporabi (bojazni, soočanje s problemi, težave, pozitivna dejstva).	Aritmetična sredina	Standardni odklon
Vpliv novih tehnologij na delovno mesto vidim kot pozitivno in dobrodošlo.	4,01	0,787
Z uporabo novih tehnologij se je spremenil moj način dela.	3,75	0,958
Pri uporabi novih tehnologij imam težave.	2,65	1,075
Ko uporabljam novo tehnologijo, se počutim dobro.	3,68	0,938
Za uporabo novih tehnologij bi se moral dodatno usposablјati in izobraževati.	3,85	0,840
Uporaba novih tehnologij na delovnem mestu mi povzroča stres.	2,56	1,136
Uporaba novih tehnologij na delovnem mestu me obremenjuje.	2,51	1,115
Z uporabo novih tehnologij sem lahko učinkovitejši in produktivnejši pri opravljanju svojega dela.	3,91	0,704
V zadnjem času sem se udeležil usposablјanj ali izobraževanj s področja uporabe novih tehnologij.	2,68	1,261
Ker imam premalo znanja o uporabi novih tehnologij, je moja zaposlitev ogrožena.	2,28	0,964

Vir: lasten

3.3.2 Znanje in spretnosti za uporabo novih tehnologij

V tabeli 2 so prikazane samoocene anketiranih glede njihovega znanja in spretnosti pri uporabi tehnologij. 48,4 % anketirancev ocenjuje, da imajo dovolj znanj in spretnosti pri uporabi tehnologij, 38,5 %, da so njihova znanja in spretnosti pomanjkljivi, 13,1 % anketirancev pa ocenjuje, da nima dovolj znanj in spretnosti.

Tabela 2: Ocena znanja in spretnosti pri uporabi tehnologij

Kako ocenjujete svoje znanje in spretnosti za uporabo tehnologij?	Frekvenca	Delež (%)
Nimam dovolj znanj in spretnosti.	16	13,1
Moja znanja in spretnosti so pomanjkljivi.	47	38,5
Imam dovolj znanj in spretnosti.	59	48,4

Vir: lasten

Preverili smo hipotezo »več kot 50 % starejših zaposlenih ocenjuje, da nima dovolj znanj in spretnosti za uporabo informacijskih tehnologij oziroma so le ta pomanjkljiva«. Odgovora, »nimam dovolj znanj in spretnosti« ter »moja znanja in spretnosti so pomanjkljiva«, smo združili. Hipotezo smo testirali s testom deleža pri stopnji značilnosti 0,05 s testno vrednostjo 0,5. V našem primeru hipoteze ne moremo potrditi ($p = 0,107 > 0,05$).

3.3.3 Vpliv novih tehnologij na delovno uspešnost starejših

Anketirance smo prosili, da ocenijo trditve, ki se nanašajo na vaše mnenje o vplivu novih informacijskih tehnologij na delovno uspešnost starejših«, so anketiranci trditve ocenili na Likertovi lestvici z ocenami od 1 do 5, pri čemer ocena 1 pomeni se sploh ne strinjam, ocena 5 se popolnoma strinjam. Iz tabele 3 lahko razberemo, da so se v povprečju anketiranci najbolj strinjali s trditvijo »uporaba novih informacijskih tehnologij je za starejše zaposlene pomembna tudi izven delovnega okolja« (povprečna ocena 4,11), najmanj pa s trditvijo »delovna uspešnost se zaradi vpliva in uporabe novih informacijskih tehnologij zmanjšuje« (povprečna ocena 2,66).

Tabela 3: Vpliv novih tehnologij na delovno uspešnost starejših

Ocenite strinjanje s trditvami o vplivu novih tehnologij na delovno uspešnost starejših:	Aritmetična sredina	Standardni odklon
Uporaba novih informacijskih tehnologij ima pozitiven učinek na delovno uspešnost in produktivnost pri opravljanju dela.	3,89	0,759
Delovna uspešnost se zaradi vpliva in uporabe novih informacijskih tehnologij zmanjšuje.	2,66	1,096
Novi informacijske tehnologije bi lahko izboljšale mojo delovno uspešnost, če bi bil boljše usposobljen za njihovo uporabo.	3,80	0,897
Uporaba novih informacijskih tehnologij je za starejše zaposlene pomembna tudi izven delovnega okolja.	4,11	0,741

Vir: lasten

S pomočjo t-testa pri stopnji značilnosti 0,05 in testni vrednosti 3,5 smo preverili hipotezo »starejši zaposleni se v povprečju strinjajo, da ima uporaba novih tehnologij pozitiven učinek na delovno uspešnost in produktivnost pri opravljanju dela«. Rezultat t-testa za en vzorec je naslednji: $t = 5,729$; $p = 0,000$. Vzorčno povprečje (3,8) je višje od testne vrednosti, p-vrednost enostranskega testa je $0,000 < 0,05$. Hipotezo lahko sprejmemo.

3.3.4 Ukrepanje delodajalcev glede novih tehnologij

Iz tabele 4 so razvidni odgovori anketirancev, ki so postavljene trditve glede ukrepanja delodajalcev glede novih tehnologij ocenjevali z Likertovo lestvico strinjanja od 1 - sploh ne strinjam do 5 - se popolnoma strinjam. Anketiranci se v povprečju najbolj strinjajo s trditvijo »delodajalci bi morali uporabo novih informacijskih tehnologij na delovnem mestu prilagoditi starejšim zaposlenim« s povprečno oceno 3,57, najmanj pa so se anketiranci strinjali s trditvijo »delodajalec prilagaja delovne procese, da bi starejšim zaposlenim omogočil, da se čim bolje in lažje prilagodijo novim informacijskim tehnologijam« s povprečno oceno 3,05.

Tabela 4: Mnenje o ukrepanju delodajalcev

Ocenite strinjanje s trditvami, ki se nanašajo na vaše mnenje o ukrepanju delodajalcev pri uporabi/vplivu novih tehnologij na delovnem mestu:	Aritmetična sredina	Standardni odklon
Delodajalec spodbuja uporabo novih informacijskih tehnologij med starejšimi zaposlenimi.	3,40	0,933
Delodajalec prilagaja delovne procese, da bi starejšim zaposlenim omogočil, da se čim bolje in lažje prilagodijo novim informacijskim tehnologijam.	3,05	1,027
Delodajalci bi morali uporabo novih informacijskih tehnologij na delovnem mestu prilagoditi starejšim zaposlenim.	3,57	0,891

Vir: lasten

S pomočjo enostranskega t-testa za en vzorec pri stopnji značilnosti 0,05 in testni vrednosti 3,5 smo preverili hipotezo »starejši zaposleni se v povprečju strinjajo, da jim delodajalec prilagaja delovne procese za čim boljše in lažjo prilagoditev novim tehnologijam« ($t = - 4,847$; $p = 1,000$). Vzorčno povprečje je nižje od testne

vrednosti, p-vrednost enostranskega t-testa je $1 > 0,05$. Zato ne moremo trditi, da se starejši zaposleni v povprečju strinjajo, da delodajalec prilagaja delovne procese, da bi starejšim zaposlenim omogočil, da se čim bolje in lažje prilagodijo novim tehnologijam. Hipotezo zavrnamo.

4 Razprava

Da bi proučili vpliv novih tehnologij na starejše zaposlene, smo se v raziskavi osredotočili na razumevanje, kako starejši zaposleni dojemajo in uporabljajo nove tehnologije ter kako delodajalci prilagajajo delovne procese tem tehnološkim spremembam. Omeniti moramo, da je pandemija covid-19 pospešila uporabo novih tehnologij (Tams et al., 2021), saj so se morali zaposleni prilagoditi delu od doma. Tudi McAllister in drugi (2022) omenjajo, da se je povečala fleksibilnost dela, predvsem zaradi dela od doma, zagotovljena pa je bila tudi pomoč pri opravljanju zahtev za uspešno in učinkovito opravljanje dela na daljavo.

Z našo raziskavo smo ugotovili, da anketiranci doživljajo nove tehnologije kot dobrodošle, saj so trditve anketiranci ocenili z najvišjo povprečno oceno (4,01). Skupaj z drugimi ocenjenimi trditvami v tabeli 1 rezultati kažejo na pozitiven odnos starejših zaposlenih do novih tehnologij. To lahko odraža tudi spremembe v družbi, kjer se vse več ljudi zaveda pomembnosti nenehnega učenja in prilagajanja novim tehnološkim trendom. Zanimivo je tudi dejstvo, da smo hipotezi »starejši zaposleni se v povprečju strinjajo, da imajo pri uporabi novih tehnologij težave«, in »starejši zaposleni se v povprečju strinjajo, da jim uporaba novih tehnologij na delovnem mestu povzroča stres«, zavrnil. Naše ugotovitve se ujemajo z navedbo Virokannasa in drugih (2000), da staranje samo po sebi ne pomeni preprečevanje sprejemanja in uporabe novih tehnologij in z njimi povezanih aplikacij, kljub dejstvu, da se kognitivni procesi in motorične funkcije starejših zaposlenih upočasnijo. Tudi Tams in drugi (2021) navajajo, da so starejši zaposleni mogoče res bistveno bolj dovzetni za negativne posledice vpliva in uporabe novih tehnologij, pa vendar uporabo nove tehnologije doživljajo kot pozitivno, s pozitivnim učinkom na njihovo delovno uspešnost in produktivnost pri opravljanju dela.

Poudarjanje pozitivnega odnosa starejših zaposlenih do novih tehnologij lahko pomaga razbijati mit, da starejši posamezniki niso sposobni ali niso pripravljeni sprejemati tehnoloških sprememb. Raziskave, ki kažejo, da so starejši zaposleni

pripravljene in sposobne uporabljati nove tehnologije, so lahko koristne za oblikovalce politik in delodajalce, saj spodbujajo vključevanje in usposabljanje starejših delavcev za uspešno sodelovanje v sodobnih delovnih okoljih.

Glede ocen znanja in spretnosti za uporabo novih tehnologij smo ugotovili, da večina anketirancev (48,4 %) ocenjuje, da imajo dovolj znanj in spretnosti. Samo 13,1 % anketirancev meni, da nima dovolj znanj, drugi pa ocenjujejo, da so njihova znanja pomanjkljiva. Hipotezo »več kot 50 % starejših zaposlenih ocenjuje, da nima dovolj znanj in spretnosti za uporabo informacijskih tehnologij oziroma so le ta pomanjkljiva«, smo zavrnili. To se ujema z navedbo Novakove (2023), da se starejši vedno bolj navdušujejo nad novimi tehnologijami in vsemi storitvami, ki jih nova tehnologija omogoča, zato njihovo zanimanje za usposabljanje in pridobivanje znanj na področju novih tehnologij narašča.

Glede na rezultat naše raziskave, da 38,5 % anketirancev meni, da so njihova znanja in spretnosti pomanjkljiva, se nam zdi pomembno raziskati, katera področja starejši zaposleni identificirajo kot problematična in nato oblikovati ciljno usmerjena usposabljanja, ki naslavlja te specifične izzive. Tako bi lahko prispevali k razumevanju potreb starejših zaposlenih po razvoju kompetenc in podpirali prizadevanja za izboljšanje teh kompetenc v delovnem okolju. Menimo, da se starejši posamezniki tako ne ponotranjijo s starostnimi stereotipi in ne dvomijo v sebe in svoje veščine in sposobnosti.

Tudi rezultati naše raziskave glede mnenja anketirancev o vplivu novih tehnologij na delovno uspešnost starejših zaposlenih, vodijo do zanimivih ugotovitev. Hipotezo »starejši zaposleni se v povprečju strinjajo, da ima uporaba novih tehnologij pozitiven učinek na delovno uspešnost in produktivnost pri opravljanju dela«, smo potrdili. Ugotovili smo, da večina anketirancev verjame, da imajo te tehnologije pozitiven učinek na delovno uspešnost in produktivnost (povprečna ocena je 3,89). To podpira tudi ugotovitve drugih študij, ki poudarjajo, da imajo večine novih tehnologij pozitiven vpliv na delo starejših zaposlenih. Tako npr. Tams in drugi (2021) navajajo, da so starejši zaposleni, ki so bolj usposobljeni za opravljanje dela s pomočjo novih tehnologij, bolj so tudi uspešni pri opravljanju svojega dela. Lee in drugi (2022) pa so dokazali, da imajo prav večine za uporabo novih tehnologij na starejše zaposlene pozitiven vpliv, saj tako ostanejo dalj časa aktivni in produktivni.

Raziskavo smo zaključili s proučevanjem stališč anketirancev do ukrepanja delodajalcev pri uporabi/vpeljavi novih tehnologij s strani starejših zaposlenih. Ugotovili smo, da se anketiranci v povprečju strinjajo z idejo, da bi se morali delodajalci prilagoditi uporabo novih informacijskih tehnologij starejšim zaposlenim. Vendar pa se zdi, da anketiranci niso enako prepričani o tem, ali njihovi delodajalci dejansko spodbujajo uporabo novih tehnologij med starejšimi zaposlenimi. Hipotezo »starejši zaposleni se v povprečju strinjajo, da jim delodajalec prilagaja delovne procese za čim boljšo in lažjo prilagoditev novim tehnologijam«, smo zavrnili. To kaže na morebitno neprepoznavanje potreb po prilagajanju delovnega okolja, da bi bila integracija novih tehnologij med starejše zaposlene čim lažja. Tudi v raziskavi Tams-a in drugih (2021) se je izkazalo, da delodajalcem ni uspelo prilagoditi obstoječih delovnih procesov novim tehnologijam in znanju ter veščinam delavcev. To je povzročilo neuskkljenost med potrebami podjetja in spretnostmi zaposlenih, kar bi lahko vplivalo na učinkovitost dela in poslovanja. Glede na naše ugotovitve menimo, da se odpira možnost dodatnih raziskav glede prepoznavanja potreb po ukrepih, ki bi lahko omogočile boljšo prilagoditev delovnih procesov za sprejemanje in uporabo novih tehnologij pri starejših zaposlenih.

5 Zaključek

Za razvoj družbe je glede na staranje prebivalstva in hitre tehnološke spremembe razumevanje vloge starejših zaposlenih v odnosu do novih tehnologij ključnega pomena. Ugotovili smo, da starejši zaposleni že v večji meri aktivno uporabljajo nove tehnologije, kar kaže na njihovo pripravljenost in sposobnost prilagajanja delovnim spremembam. Kljub morebitnim izzivom, povezanim s staranjem, se zdi, da starejši zaposleni dojemajo nove tehnologije kot pozitivne in njihovo uporabo ne povezujejo s težavami ali stresom. Starejši zaposleni prepoznavajo čas hitrih sprememb in pomen razvoja tehnologije, kar poudarja njihovo zavedanje na prilagajanje in učenje. Zavedajo se tudi, da nove tehnologije pozitivno vplivajo na produktivnost in delovno uspešnost posameznika. Vodilo pri tem je prav gotovo navedba Gonzalez-Gomez-a in Hudson-a (2023), ki pravita, da je ključ do uporabe tehnologije vztrajnost in to starejši zaposleni zagotovo imajo.

Zaključimo lahko, da so starejši zaposleni sposobni sprejeti in uporabljati nove tehnologije, če so ustrezno usposobljeni in če delodajalci ustvarijo delovno okolje, ki podpira prilagajanje na nove tehnologije. Prav slednje pa odpira nove priložnosti

za raziskave na področju ustvarjanja inkluzivnega delovnega okolja za vse zaposlene, ne glede na starost. Pomembnosti dobro zasnovanih in načrtovanih novih tehnologij namreč ponuja jasno usmeritev za izboljšanje delovnega okolja in spodbujanje vključenosti starejših zaposlenih v digitalno dobo.

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MANAGING WORKPLACE STRESS IN BUSINESSES IN THE PRISHTINA REGION TO ENHANCE PERFORMANCE

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Effective stress management in the workplace is key to improving the performance of employees and the entire company. Focusing on measures to manage stress and create a supportive work environment not only benefits employee health and productivity but also acts as a catalyst for fundamental changes in the corporate response to various problems. This promotes a healthy work culture that supports user happiness and long-term organizational success. The study analyzed stress management approaches and their relationship with employee performance in the Prishtina region, including a total of 60 participants who answered a survey questionnaire. The results were processed with the SPSS program, using correlation analysis to confirm the hypotheses. Workplace stress, which is influenced by various factors, requires a comprehensive management approach for employee well-being and organizational effectiveness. The complex relationship between stress and performance highlights the need for adaptive strategies and resource optimization. Organizations in Prishtina should prioritize targeted stress management, emphasizing a supportive culture, leadership training, and addressing local stressors. Integrating flexible work arrangements and technology management, along with wellness programs, promotes a holistic approach to improved satisfaction and performance. This study adds to the literature on stress management, highlighting nuanced interventions for different stressors.

Keywords:
contactless
cards,
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factors,
digital
payments,
workplace
stress,
usage
intention,

1 Introduction

Workplace stress is pervasive in enterprises worldwide, hurting employee well-being and overall corporate performance. Effective stress management in the workplace is a vital aspect of boosting worldwide performance in the dynamic and competitive corporate landscape (Catherine & Fonceca, 2022). Understanding and treating workplace pressures is becoming increasingly important as firms attempt to maintain a competitive advantage. Understanding and managing workplace stress is critical for a healthy and effective staff. According to researchers, stress can emerge from various factors, including job expectations, corporate culture, and interpersonal connections (Joy, 2020). Recognizing these stressors and executing measures to lessen their impact is essential for effective stress management. Workplace stress has become a common issue in today's fast-paced and competitive corporate climate, affecting people and businesses worldwide. Stress's negative consequences on employee well-being and organizational performance necessitate a proactive approach to stress management (Pandey, 2020).

This study focuses on exploring and implementing stress management strategies tailored to the unique context of businesses in the Prishtina region, primarily aiming to improve employee performance and organizational outcomes. Rapid globalization and technological advancements, coupled with the ever-changing nature of work, have contributed to a complex work environment, increasing the likelihood of employee stress. Recognizing the importance of stress management in promoting a healthy and productive workforce, this study aims to identify specific stressors in businesses in the Prishtina region and develop targeted interventions to alleviate stress and enhance global performance.

2 Literature review

2.1 Stress Management in the Workplace

Workplace stress management is essential for building a healthy and productive staff. Stress may arise from various factors in today's global and competitive work environment, including job demands, company culture, and interpersonal interactions. Recognizing these pressures is essential for carrying out successful

remedies. Workplace stress has a widespread influence on employee well-being and organizational performance, necessitating a proactive strategy (Atroszko et al., 2020).

Prioritizing stress management entails identifying its causes, recognizing individual and group consequences, and applying targeted stress-reduction techniques. By addressing these issues directly, companies may foster resilience, job satisfaction, and long-term productivity in their staff, resulting in a welcoming and harmonious working environment (Khammissa et al., 2022).

Stress in the workforce is defined as the emotional, bodily, and mental strain employees suffer due to work-related obligations and pressures. It has many diverse dimensions and influences, including job responsibilities, interpersonal connections, company culture, and external pressures. While little stress can be motivating, prolonged or severe stress can lead to burnout, lower job satisfaction, and poor performance (de Vries & Bakker, 2021).

High job demands, tight deadlines, and ambiguous employment objectives considerably increase stress levels. Employees subjected to unreasonable job objectives may suffer increased anxiety and decreased job satisfaction. Poor communication, disagreements with coworkers or bosses, and a lack of social support can all contribute to a challenging work environment (Yaşar & Sasan, 2020).

Work stresses have been shown to have a detrimental influence on cooperation, group dynamics, and overall work satisfaction (Wibowo et al., 2021). Stress may also be exacerbated by organizational culture, leadership style, and a need for more employee engagement in decision-making processes (Stufano et al., 2022).

2.1.1 Workplace Environment and Stress

The physical and psychological characteristics of the employment environment greatly influence employee stress levels. Workload, role uncertainty, and a lack of control have all been cited as prevalent stresses. Establishing a friendly and inclusive workplace culture, offering services for workers, and fostering work-life balance are critical for reducing workplace stress. Employees with excessive workloads and inadequate autonomy may suffer heightened stress, highlighting the necessity of balancing expectations and control. Organizational culture significantly impacts stress climate (Cao et al., 2023).

Supportive and open cultures reduce stress and improve employee well-being. Furthermore, adopting a transformational leadership style corresponds with stress reduction, as leaders who inspire and motivate generate a favourable work atmosphere. The impact of physical room design on stress is also highlighted. Natural light, ergonomic furniture, and well-ventilated areas are all associated with reduced stress levels. Their physical surroundings affect employees' comfort and focus, which influences their entire stress experience (De Carlo, Dal Corso, Carluccio, Colledani, & Falco, 2020).

Strong interpersonal ties defend against stresses, highlighting the importance of colleagues and leaders in fostering a supportive work environment. The development of remote work has sparked studies on its effect on stress. It should be highlighted that the impacts vary, with some employees claiming stress alleviation from commuting while others find difficulties managing work and life limits. The virtual work environment introduces unique dynamics that necessitate stress management solutions tailored to the situation. Technostress has emerged due to the integration of technology in the workplace. Employees are stressed due to constant connectedness, information overload, and digital demands. Understanding and controlling technostress is critical in today's workplace.

According to the Job Demands-Resources Model, not all demands are stressful; specific demands can be invigorating. Resources such as skill diversity and social support operate as stress buffers, emphasizing the need to consider both demands and resources in workplace treatments. The extensive use of virtual collaboration technologies impacts stress dynamics (Schneider et al., 2023).

2.1.2 Employee Performance and Stress

Identifying the ideal stress for peak performance and executing focused treatments are critical for an organization's success. The link between stress and employee performance has many interpretations, with various positive and negative consequences. While modest stress can be motivating, persistent stress can have a negative impact on performance. Chronic stress has been related to cognitive deficits that can affect decision-making and overall job performance (Sari et al., 2021).

Stress activates the body's physiologic reaction, producing cortisol, which affects memory, attention, and problem-solving abilities when extended. Chronic stress is thought to hurt emotional well-being and employee burnout. Employees who are burnt out have lower job engagement, more absenteeism, and lower performance, demonstrating the extensive effects of chronic stress (Pariona-Cabrera et al., 2020). In the stress-performance relationship, job satisfaction emerges as an important mediator. Happy employees are more likely to participate and be resilient under pressure (Quick et al., 1992).

Leadership styles significantly impact how stress appears in the workplace and, as a result, employee performance. Stress may be mitigated by supportive and revolutionary leadership. Leaders who provide direction, recognition, and resources create a pleasant work atmosphere that supports higher performance. Individual aspects like coping techniques and resilience help to moderate the stress-performance link. Employees with excellent coping methods are better suited to deal with pressures, which has a less negative influence on performance.

Workload overload and excessive job expectations are two separate stresses that negatively influence performance. To enhance performance without compromising happiness, organizations must balance pushing people and preserving their overall well-being (Pariona-Cabrera et al., 2020). As workplaces grow more digital, the idea of technostress has gained popularity. Employee performance is influenced by stress caused by constant connection and digital expectations (Pandey, 2020). To avoid performance deterioration due to technostress, organizations must control technology use.

Organizations have developed various strategies to control stress and increase employee performance (Maslach et al., 2001). Stress reduction programs based on awareness and resilience training show promise in stress reduction and performance enhancement. As stress management measures, flexible work arrangements, such as remote work possibilities and flexible timetables, have gained traction. Flexibility is thought to help improve work-life balance and, as a result, performance (Sari et al., 2021).

Employee Assistance Programs offer discreet counselling and support services to employees experiencing stress. Organizations that invest in health and well-being

activities, such as fitness programs and mental health resources, help to achieve a more comprehensive approach to stress management (Khammissa et al., 2022).

3 Methodology

The research is quantitative and qualitative, where, through a literature review, we have presented the aspect of stress management in a narrative form. At the same time, through surveys, we have conducted the quantitative part of the research, thus presenting the employees' opinions on behaviours and reasons for leaving their current jobs. The study includes a total of 60 employees during the period from December 1 to December 31, 2023. The research instrument contains demographic information (gender, age, education, years of experience), the human resources management section, and employee performance. The data were processed using the SPSS program (version 27), presenting demographic and comparative data through minimum, maximum, mean, and standard deviation parameters. For hypothesis verification, statistical tests such as Pearson correlation analysis were applied. The data are presented in tables and graphs in a narrative form.

Questions and hypotheses of the research:

1. How does stress management in the workplace affect the performance and well-being of employees in Prishtina's companies?
2. Which specific strategies and practices of stress management have been used by companies in the Prishtina region to improve the work culture and their long-term success?

H01. A high level of stress management in the workplace has a positive and statistically significant impact on the performance of employees in Prishtina's companies.

H02. Companies that use specific strategies of stress management have a higher level of employee performance compared to those that do not use these strategies in Prishtina.

4 Results

The research included 60 employees, 30 of whom were female and 30 male. Twenty-four had a bachelor's qualification, 12 had a master's qualification, 2 had a PhD, and

22 others had a different qualification. Their average age was 32.93 years with a standard deviation of 9.94 years, while the average experience in the current position was 5.07 years with a standard deviation of 2.8 years.

Tabela 1: Demographic results

Gender	N	%
Female	30	50.0
Male	30	50.0
Education	N	%
Bachelor	24	40.0
Master	12	20.0
PhD	2	3.3
Other	22	36.7
Age	Mean	Std.
	32,93	9,94
The duration of employment in this organization/business.	5,07	2,85

The survey results provide insight into employees' perceptions of various job duties, responsibilities, and environments. A significant percentage of respondents express dissatisfaction or disagreement with the detailed nature of their job duties and requirements, the written documentation of their responsibilities, and the specification of necessary knowledge, skills, and abilities. Moreover, there needs to be more clarity regarding identifying social and psychological conditions for job performance and the transparency of the job position announcement. The selection process, recognition of career aspirations, and formal training programs also receive mixed feedback. Additionally, employees seem divided on the presence and effectiveness of performance evaluation, compensation management systems, and the definition of monetary and non-monetary rewards in their jobs. Overall, these results highlight areas where improvements or adjustments in organizational practices may enhance employee satisfaction and engagement.

Table 2: Management of human resource

	Completely disagree.		Disagree		Neutral		Agree		Completely agree	
	N	%	N	%	N	%	N	%	N	%
	My job duties and requirements were detailed.	5	8.3%	28	46.7%	25	41.7%	2	3.3%	0
My job responsibilities were written down.	0	0.0%	14	23.3%	25	41.7%	21	35.0%	0	0.0%
The knowledge, skills, and abilities necessary to perform the job were specified.	0	0.0%	27	45.0%	33	55.0%	0	0.0%	0	0.0%
Social and psychological conditions for performing a job have been identified.	0	0.0%	21	35.0%	32	53.3%	7	11.7%	0	0.0%
My job position was announced in appropriate sources with clear and attractive job specifications.	0	0.0%	21	35.0%	31	51.7%	8	13.3%	0	0.0%
My selection process was based on clear evaluation criteria.	0	0.0%	11	18.3%	24	40.0%	16	26.7%	9	15.0%
The decision to hire me was made based on the best match between the organization's requirements and my skills and qualifications.	16	26.7%	30	50.0%	14	23.3%	0	0.0%	0	0.0%
My appointment was made based on critical assessment and fairness after the interview process.	0	0.0%	42	70.0%	18	30.0%	0	0.0%	0	0.0%
In my organization, there are formal training programs to be able to perform the job better.	0	0.0%	36	60.0%	24	40.0%	0	0.0%	0	0.0%
In my organization, there are training programs to enhance the knowledge and skills of employees.	0	0.0%	24	40.0%	23	38.3%	13	21.7%	0	0.0%
In my organization, there are clear career path plans.	0	0.0%	8	13.3%	29	48.3%	23	38.3%	0	0.0%
In my organization, career aspirations of employees are recognized by immediate supervisors.	0	0.0%	31	51.7%	24	40.0%	5	8.3%	0	0.0%
In my organization, there is an official performance evaluation system for measuring employees' performance.	0	0.0%	6	10.0%	20	33.3%	20	33.3%	14	23.3%

	Completely disagree.		Disagree		Neutral		Agree		Completely agree	
	N	%	N	%	N	%	N	%	N	%
The results of my work based on my job responsibilities are measured against certain standards.	0	0.0%	32	53.3%	26	43.3%	2	3.3%	0	0.0%
My immediate supervisor provides periodic feedback on my performance.	0	0.0%	0	0.0%	18	30.0%	27	45.0%	15	25.0%
The performance evaluation process is used to determine salary, career advancement, or the need for training.	0	0.0%	23	38.3%	14	23.3%	20	33.3%	3	5.0%
In my organization, there is an official compensation management system for employees' wages/benefits in exchange for their work.	0	0.0%	0	0.0%	12	20.0%	26	43.3%	22	36.7%
Monetary and non-monetary rewards are defined in my job.	0	0.0%	20	33.3%	20	33.3%	17	28.3%	3	5.0%
In my organization, a compensation management system is used to ensure fair pay for my work compared to others.	0	0.0%	8	13.3%	24	40.0%	19	31.7%	9	15.0%
I am paid for the work I do based on an official compensation system.	0	0.0%	8	13.3%	24	40.0%	19	31.7%	9	15.0%

Hypothesis

H01. A high level of stress management in the workplace has a positive and statistically significant impact on employees' performance in Prishtina-based companies.

The Pearson correlation test was applied to the relationship between stress management as the independent variable and employee performance as the dependent variable to confirm the hypothesis.

Table 3: Correlations between stress management and the performance of employees

		Stress management	The performance of employees
Stress management	Pearson Correlation	1	.748**
	Sig. (2-tailed)		.000
	N		60
The performance of employees	Pearson Correlation		1
	Sig. (2-tailed)		
	N		

** . Correlation is significant at the 0.01 level (2-tailed).

The research results indicate a positive correlation between stress management and improved employee performance ($r = .748^{**}$, p -value=0.000). This suggests that stress management for employees through various stress management methods statistically enhances their performance. Therefore, we accept the hypothesis and conclude that a high level of stress management in the workplace has a positive and statistically significant impact on employee performance in Prishtina's firms.

H02. Companies that use specific stress management strategies have a higher employee performance level than those that do not use these strategies in Prishtina.

To validate the hypothesis, I applied the Pearson correlation test between the two stress management methods, General Performance Management, Workplace Environment and Company Development Management, and employee performance as the dependent variable.

Table 4: Correlation between General Performance Management, Workplace Environment and Company Development Management and The performance of employees

		The performance of employees
General Performance Management	Pearson Correlation	.621**
	Sig. (2-tailed)	.000
	N	60
Workplace Environment and Company Development Management	Pearson Correlation	.715**
	Sig. (2-tailed)	.000
	N	60
The performance of employees	Pearson Correlation	1
	Sig. (2-tailed)	
	N	

The research results indicate a positive correlation between General Performance Management and job performance ($r=.621^{**}$, $p\text{-value}=0.000$), while we have a higher correlation between Workplace Environment and Company Development Management and employee performance ($r=.715^{**}$, $p\text{-value}=0.000$), showing that managing the work environment enhances employee performance. Therefore, we accept the hypothesis and conclude that companies utilizing specific stress management strategies have a higher employee performance level than those not employing these strategies in Prishtina.

5 Conclusions

According to the considerable literature on workplace stress and its management, stress is a ubiquitous concern affecting human well-being and organizational performance. The complex character of stress in the modern workplace, resulting from job demands, business culture, interpersonal interactions, and technological integration, necessitates a holistic approach to stress management. The research examined emphasizes the necessity of knowing the subtle elements contributing to workplace stress and implementing targeted remedies.

The working environment significantly impacts employee stress levels, with factors such as workload, position clarity, and leadership styles impacting employee well-being. Furthermore, introducing remote work and technostress creates new dynamics that demand adaptive stress management solutions. The Job Demands-Resources Model highlights the need to manage stressors and improve resources like skill diversity and social support to mitigate stress.

Furthermore, the complex link between stress and employee performance emphasizes the necessity for firms to achieve a balance between pushing individuals for peak performance and protecting their well-being. Effective leadership, coping methods, and establishing a healthy work culture all appear as critical components in reducing the harmful impact of stress on performance. The research also stresses the potential benefits of stress management programs, flexible work schedules, and employee support programs in fostering a healthier and more productive workforce. The survey findings description gives insight into employees' impressions of job obligations, responsibilities, and the general work environment. Overall, a sizable proportion of respondents are dissatisfied or disagree with the exact nature of their work assignments and requirements, the documentation of their obligations, and the identification of required knowledge, skills, and abilities. There also needs to be more clarity on identifying social and psychological prerequisites for work success and the openness of job postings. The selection procedure, identification of professional goals, and the availability of official training programs all earn mixed reviews. Furthermore, employees appear divided on the availability and efficacy of performance evaluation, pay management systems, and the definition of monetary and non-monetary benefits in their professions. The findings identify areas where organizational practices may be improved or adjusted to boost employee happiness and engagement.

The data analysis results demonstrate a statistically significant positive association between workplace stress management and employee performance, verifying the first hypothesis (H01). Similarly, the second hypothesis (H02) is verified, showing that firms in Prishtina that use specialized stress management tactics have greater levels of employee performance than those that do not. To improve these outcomes, firms should consciously and transparently create and apply stress management measures, such as performance management and working environment improvement, to increase employee happiness and efficiency.

6 Recommendations

According to the literature study, organizations in the Prishtina region should emphasize developing and implementing tailored stress management techniques. Initiatives should prioritize the development of a supportive workplace culture, providing resources to employees, and identifying and resolving specific stresses in the local environment. Leadership development programs that stress supportive and transformational leadership styles can create a healthy work environment. Furthermore, to alleviate the impact of technostress, firms can consider implementing flexible work arrangements and technology management strategies. Employee well-being programs, such as counselling services and health initiatives, can supplement these efforts by promoting a comprehensive stress management approach that improves individual happiness and organizational performance.

Some of the characteristics essential recommendations for companies may be made based on the analysis results. The primary goal should be to strengthen job tasks and required specifications to provide a clear grasp of expectations. Transparency in the selection process and job postings will help to build a fair and motivated workplace. Managing social and psychological circumstances at work, improving training programs, and implementing stress management measures are critical to increasing employee engagement and happiness. Interventions in performance management and remuneration systems are required to increase motivation. Continuous communication and involving people in decision-making are critical to linking success and organizational performance.

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DIGITAL TRANSITION OF THE MAINTENANCE PROCESS: CASE OF RAIL TRANSPORT COMPANY

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Digital transformation of business activities has outgrown from competitive advantage to necessity in recent years. Evolution of information and communication technologies (ICT) has created the world where electronic business (E-Business), document management systems (DMS) and enterprise resource planning (ERP) solutions have become standard, even for micro, small and medium enterprises (MSME) in developing countries. Modern businesses focus on implementing data analysis, business intelligence (BI) and even artificial intelligence (AI) concepts in their everyday activities, thus the digitalization of business activities is simply considered as default. Nevertheless, public companies in developing countries fall behind and struggle in this transformation process, as usual. Due to various reasons, they are still in the phase of digitalization, rather than implementing advanced solutions. Any organizational change demands unfreezing and mindset redirection, among both management and executors, which is always challenging, especially in the public sector. This paper aims to explain the preconditions and benefits of digital transition of the train maintenance process, and key challenges in such transformation.

Keywords:

digital transformation, organizational change, business process digitalization, train transport, railway, maintenance, public sector management

1 Introduction

Rapid changes in the business environment require constant adaptation of all modern organizations since these adjustments have become the only way to maintain competitiveness and achieve satisfactory business results (Kraus, et al., 2021). In parallel, the development of Industry 4.0 has contributed to the fact that digital tools are increasingly used in practically all business spheres, which creates the basis for the introduction of digital transformation (Krivokapić et al., 2023). Digital transformation implies the use of digital technologies to create new or to modify existing business models and processes, and represents support for the transformation of organizational structure, resources, and internal and external relations (Plekhanov et al., 2022).

Digital transformation brings with it many potential benefits. If implemented in an appropriate manner, it is possible to improve the company's performance through:

- More efficient data collection and analysis (Tratkowska, 2019) - digital technologies allow data to be collected more easily and used better, and as such can represent the basis for various types of analysis.
- Better resource management (Hu et al., 2023) - modern technologies enable standardization and centralization of all company's resources, which may lead to better and more accurate records of their spending and perception of accountable employees,
- Improved productivity (Du & Jiang, 2022) - automatization of activities and better coordination of employees' efforts enable jobs to be performed more efficiently which makes final outputs better.
- Adaptation to user needs and better consumer experience (Hoyer et al., 2020) - better understanding of user requirements enable companies to become consumer-oriented.
- Increased agility (Saleh & Saad, 2023) - quick adaptations through multiple cycles allow more innovations in both key and supporting processes.

On the other hand, digital transformation also represents a major organizational challenge (Chaanoun et al., 2022). The use of digital technologies implies a change in the way activities are carried out, which requires the need for employees'

education, change in their awareness regarding their roles in the processes, as well as the provision of solutions for overcoming potential resistance (Scholkman, 2021) that might arise due to the fear that all these changes are carrying. Having this in mind, digital transformation must be precisely designed and adapted to the specifics of each company, to generate all potential benefits and to overcome the obstacles as easily as possible.

2 Maintenance Process and Digitalization

Maintenance represents one of the most important processes in every organization with a high amount of fixed assets. Ensuring the correctness, functionality and development of technical systems is one of the prerequisites for continuity of production or provision of services (Todorović, Komazec & Marič, 2020). On the other hand, keeping them functional generates expenditures that usually correlate with their value. Influence on business operations and cost structure (Fontanini & Wollmann, 2021) pushes the management of maintenance activities among the top aspects in generating the business strategy (Barberá, Crespo, Viveros & Stegmaier, 2012). While corrective maintenance is focused on removing the faults with minimal costs and in shortest time whenever they occur, preventive maintenance can be scheduled (Lao, Ellis & Christofides, 2014). Preventive maintenance planning is one of the key activities in the realization of the maintenance process (Klos & Patalas-Maliszewska, 2013), which is aimed towards detecting the proper elements and assignments for pro-active repairs and confirming that sufficient resources for the operations execution are available (Rosqvist, Laakso & Reunanen, 2009).

Preventive maintenance can be planned at an operational level, but corrective maintenance activities are stochastic. Nevertheless, when it comes to financial planning, costs of both types of maintenance can be predicted with high accuracy, if the organization owns adequate historical evidence about corrective maintenance activities. Additionally, human capacities required for the execution of annual maintenance operations can also be calculated on the base of the suitable maintenance reports from previous years (Todorović, Komazec & Jaško, 2021). Deficiency of data suitable for analytics disables the maintenance process optimization and leads towards cost increase as the organizations strive to ensure the enough resources to secure the systems from failures, sometimes performing more operations than necessary or providing more employees and parts in stock

than required (Komazec, Todorović & Jaško, 2015). Organizations tend to define the most effective maintenance plans (Schutz, Rezg & Léger, 2013), but they should also keep an eye on the reporting methods, as they are preconditions for good planning (Jovanović, Mrvić & Todorović, 2020).

3 Research hypothesis and methodology

ICT could be an important tool for reaching efficiency and effectiveness within maintenance (Kans, 2008). ERP solutions can secure operational and financial planning, but also the reporting that generates the base for data analytics and BI in the field of maintenance. This paper will try to explain the process of ERP introduction in the maintenance function and potential accompanying benefits, in the case of a train transportation company. Therefore, we hypothesize that:

Hypothesis: The introduction of ERP system in the maintenance function improves various aspects of the maintenance process.

As a research method we use case study, a standard tool in management consulting practice (Bosilj Vukšić, Pejić Bach & Popović, 2013) for conducting a complete analysis and report of an individual subject with respect to specific phase of its totality (Krishnaswamy, Sivakumar & Mathirajan, 2006). All data presented in the paper were generated during the 8 months of consulting project in a rail transport company. The research concluded documentation analysis, process mapping, direct observation and interviews. All the authors of this article were members of the consulting team. Situational analysis of the observed case of rail transport company and key research findings will be provided in separate chapters, followed by the concluding remarks.

4 Situational Analysis

To effectively implement the digitalization of the maintenance process, it is necessary to map the current process flow, especially around creating and validating the maintenance work orders, and the issues that appear because of inadequate process organization. The company introduced the SAP system into its operations some time ago, along with its plant maintenance module. However, during the implementation, the adaptation of the system to the process was not carried out in the best possible way, i.e. vice versa, the process was not sufficiently optimized, so

that it can take all the advantages and opportunities that SAP, as such a system, provides.

After bringing the vehicle to the workshop, the Train Driver initiates the maintenance process by fulfilling the Maintenance Request form, on paper, and handing it over to the one of the engineers from the Maintenance Department. In the Maintenance Request, the Train Driver manually writes the reason for handing over the vehicle to the workshop, which can be regular inspection or emergency repair. One Maintenance Request very often includes one of the regular inspections and one or more emergency repairs, where the Train Driver specifies the type of inspection that needs to be done, and all the repairs that he considers necessary to bring the vehicle into driving condition.

The next step, which is anything but logical from the aspect of responsibility and process control, is that the engineer from the Maintenance Department, in the role of maintenance planner, enters the Maintenance Request into SAP system, to later create a specific Work Order based on that same request. This leads to certain problems when entering data into the system. First, maintenance requests are very often illegible, due to the poor handwriting of those who filled them in, and the person who enters them into the system sometimes must presume what the Train Driver was thinking of when filling out the form. Secondly, maintenance requests are filled out in a non-standardized way, in a free form, where each Train Driver fills in the request in his own unique way. This results in requests for the repair of the same parts or assemblies not being filled in the same way by different Train Drivers, and even by the same Train Driver, but on a different date. In addition, Train Drivers write down specific failures that they suspect, but they are not expert enough to be able to recognize them all, so they can mislead maintenance planner and maintenance workers, where they may focus on a misrepresented problem, instead of primarily investigating what could be the real problem.

Every fault reported by the Train Driver, the maintenance planner must enter the system by selecting the appropriate item from the predefined list of faults in the system. After creating the Maintenance Request in the system, the maintenance planner approaches the creation of the Work Order, which is referenced to the Maintenance Request and takes over the same title, which he previously entered in free form, based on the items written down by the train driver. The biggest process

irrationality is that work orders are often issued retroactively, that is, at the end of the maintenance process. Maintenance workers carry out maintenance activities based on the received Maintenance Request on paper. After the completion of the maintenance operations, they write down what has been done and finally the maintenance planner enters it into the system and creates a Work Order. In doing so, the maintenance Supervisor will only write down the completion time of the Work Order, i.e. the time of handing over the vehicle back for the drive, while not recording the actual duration of the maintenance operations, nor which of the employees performed the operations.

The maintenance planner, when entering data into the system, creates a Work Order based on the opened Maintenance Request, to which he adds the planned maintenance operations, which the maintenance workers have already performed and very poorly recorded on the Maintenance Request, in free form. In the existing system, for regular inspections there is a predefined menu from which it is possible to select the type of inspection, while there is none for emergency repairs. Each emergency repair must be entered manually into the system. Because of this, a situation arises where the same emergency repairs are entered under different titles, and it is very difficult to perform any analysis related to emergency repairs conducted in the past.

An additional problem arises in the process of confirming the realization of the Work Order. In the case of work orders that contain regular inspections, the execution time durations that are entered are equal to the planned, i.e. normed duration of operations. This means that in any analysis of work orders in the system, planned times and actual working hours are equal. Moreover, actual working hours are not even entered according to the profession and qualification of the employees who did the work. Instead of that, the entire normed time for the realization of work order activities is entered in total hours, which the system then divides according to the set parameters and displays the number of employees who worked on the work order, which coincides with the norms. This means that it is impossible to determine the real maintenance costs, based on the analytics from the system, because neither the duration of activities, nor the structure of the employees who performed those activities are realistic. Whether an engineer or a technician worked on the Work Order is not relevant in the current system.

As a result of the inadequately organized process of creating and confirming the realization of work orders, many problems arise related to later analytics of work orders, such as following statements:

- The unstructured titles of the work orders significantly complicate any analysis regarding the number of breakdowns of specific assemblies or parts on vehicles.
- Work orders realization times do not deviate from the planned duration due to entering planned working norms when confirming the maintenance operations execution for regular inspections.
- In case of confirming the duration of operations for emergency repairs, it is estimated by the maintenance planner or the maintenance Supervisor, if the maintenance planner asks for his opinion.
- Emergency repairs have no standardized maintenance operations, so in connection with that, the duration entered for the same operations in different work orders will also differ in the planning settings of work orders, because they will also be entered by the maintenance planner based on estimation.

It is impossible to determine the real costs incurred by the work order, because specific employees, or at least groups of workplaces participating in maintenance, are not recorded. The system works by dividing the total maintenance work time equally between the average number of people defined in the maintenance norms and the average hourly cost of maintenance workers. The information that employees whose hourly price is more expensive or cheaper than the average hourly price worked on a certain Work Order is completely lost. Therefore, it is impossible to calculate the real costs per Work Order, which according to the data do not deviate from the planned ones, because they were entered in an identical way.

4 Results and Discussion

Digitalization of key processes, such as maintenance, especially in large state-owned enterprises, implies that certain prerequisites for adequate implementation, and subsequent use of the information system, have been met (Todorović, Komazec & Marić, 2020). There are rare examples where the current situation found in state-owned enterprises is good enough for the almost immediate implementation of an

information system that would digitalize a certain process. Based on the mapped situation in the railway transportation company, the necessity of process reengineering is evident, and based on that, certain changes in the organizational structure of the company, which would accompany changes in the responsibilities and duties of certain participants in the maintenance processes. Technological advances often cause changes in the organizational structure (Todorović, Čudanov & Komazec, 2012). In this case, under the reengineering of the maintenance process is considered a change in the way of creating, recording, and confirming the realization of work orders for the maintenance of train vehicles. Changes refer to the order and method of activities execution, the workplaces responsible for their conduction, as well as the inputs of certain activities, that is, the documentation used in the process. Potentials for additional improvements through further digitalization of the maintenance process have also been recognized and noted.

First, changes were made in the way the process is carried out, where now the person who creates the maintenance request is responsible for entering it into the system, which is the Train Driver. Data entry into the system is standardized, in such a way that arbitrary entry of the title of the Maintenance Request is not possible.

Changes in the organizational structure, conditioned by the redesign of the process, are reflected in the design of adequate job gradation levels for each work position in the operational part of the Maintenance Department, as well as the revision of the job descriptions of the workplaces in the company. Adequately defined gradation of workplaces is of great importance when assigning employees to the realization of specific Work Orders, from the point of view of the price of an employee's hour of work and the subsequent analysis of maintenance costs. With new job descriptions, it was important to precisely define the duties and responsibilities of employees at workplaces, as a starting framework for the assignment of employees to specific work orders and the realization of maintenance activities.

In addition to the redesign of the organizational structure, it is necessary to review the list of standard maintenance operations and defined norms. The situation analysis revealed that there are work norms for operations of regular inspections, while they do not exist for operations of emergency repairs. However, during the review of the work norms for regular inspection operations, it was determined that in a certain number of cases they are not realistic. They were either given by the

manufacturer during the procurement of vehicles or were determined at some point by an unknown method and under working conditions that used to be valid in the time of setting norms, and now they may have changed. Therefore, their audit was an integral part of the maintenance digitalization process. On the other hand, the list of emergency repair operations does not exist, nor do the work norms for the operations. From the current system and way of recording Work Orders, it is very difficult to conduct any analysis, and even that it would be wrong as such. In this connection, a list of emergency repairs was defined, where the most expert employees from the company in collaboration with external experts gave their estimates regarding the norms of certain operations. The list and norms were adopted as preliminary and will be as such until their validation is shown through future use of the system. As a result of the work norming process, defined up-to-date lists of operations for regular inspections and emergency repairs should form the basis for planning every Work Order for the train vehicles maintenance.

In addition to the revision of the norms and the definition of the list of emergency repair operations, the list of malfunctions was also revised, i.e. the logic according to which malfunctions are reported by the Train Driver. The new defect list now contains two levels of decomposition, which are *assembly* and *part* (one *assembly* consists of several *part(s)*). On the Maintenance Request it is possible to select the *assembly* and/or *part* suspected of having a problem from the predefined list, and anything else the Train Driver has to say can be written in an additional comment.

With the introduced process changes and added functionalities to the system, the process of creating and confirming the realization of Work Orders has been improved, which is now carried out in the following way. The Maintenance Request is opened by the Train Driver in the system, after bringing the train to the workshop for maintenance. By changing the responsibility of opening this document in the system, it is ensured that there is no gap between what the Train Driver wants to report and what is entered into the system. Also, predefined lists now prevent arbitrary entry of Maintenance Request titles, which contributes to the standardized filling of documents in the system, which is later suitable for various types of analytics. The maintenance planner creates a Work Order that is referenced on the open Maintenance Request and assigns planned activities to it from the list of regular inspections operations or emergency repairs, in consultation with the maintenance Supervisor. Upon receipt of the Work Order, the maintenance Supervisor

determines a team of workers who will conduct maintenance and begin operations. If, during maintenance, it becomes apparent that additional operations need to be performed, the maintenance Supervisor informs the maintenance planner to add certain activities to the Work Order. After the implementation of the planned maintenance activities, maintenance Supervisor records the specific executors of each individually defined operation on the Work Order, as well as the accurate working hours that employees spent on their realization. The completed Work Order is then submitted to the maintenance planner, who confirms the real durations and maintenance participants in the system for each Work Order activity. Selecting the specific executor of the operation in the system retrieves data about the work center (employee), i.e. his hourly price, which gives precise information about the costs of the employee who performed that operation for the time shown.

Adequate entry of data into Work Orders ensures precise calculations of actual working time for each activity and Work Order as a whole, which enables the possibility to compare planned and realized working time for each. Such data are of great importance when calculating the real labor costs per Work Order, where it is possible to see the difference between the planned and actual maintenance labor costs, where that difference arose, and to optimize maintenance costs. After a while, it will also be possible to compare realization of Work Orders of the same title through time and make conclusions. In this way it is only possible to create the basis for future precise analyzes regarding the reality of maintenance norms and the eventual need for norm corrections. Considering that ERP introduction in a described way has positive effect on maintenance planning, reporting and costs, the results indicate that digitalization of the maintenance process improves various aspects of the maintenance process, which confirms our hypothesis.

5 Conclusions

Digitalization of maintenance process enables precise monitoring of work performance down to the level of specific operators of activities, where for each employee the actual working time spent on the realization of specific activities would be recorded and compared with the normed time required for the execution of the activity. It creates quantitative and transparent bases that can be used for assigning employees by gradation levels within the same workplace and incentive rewarding

of employees, based on achieved and recorded work performance. On top of that, the bases have been set for:

- Accurate record of planned and realized maintenance activities, in the digital format suitable for analysis.
- Continuous review and revision of maintenance norms, based on a comparison of planned and realized operations execution times.
- Systematization of all relevant data related to maintenance of specific vehicle and decision making according to that.
- More accurate records and allocation of labor costs, based on actual work hours of specific employees in the process.
- Capacity analysis and utilization of the maintenance resources.
- Process analysis and decision making regarding the improvement of the organization and work methods in the Maintenance Department.

Following successful implementation, after a certain period, a review of what has been done is required. The established work standards would, over time, accumulate a history of data for comparative analysis and potential modifications. New work norms could be defined, aiming for even greater precision compared to the initially set standards. The findings can be used as guidelines for digitization of any process, but especially those containing wide sets of operations and executors. Key directions for future research may involve investigating the impact of process digitalization on the productivity of employees engaged in maintenance tasks and possible ways for introducing more sophisticated digital processes through various tools and methods.

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EXPLORING THE NEXUS BETWEEN EXPENDITURE IN ENVIRONMENTAL PROTECTION AND GREEN GDP IN THE EU

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Amidst profound environmental changes and ecological uncertainty, concerns arise that the sole pursuit of economic growth alongside unsustainable patterns of production, rapid urbanization, consumer-driven behaviour, and associated lifestyle requirements may upset the delicate ecological capacity, economic stability, and socio-economic security. Embracing green growth has emerged as a strategic approach aimed at increasing the use of renewable energy sources, lowering carbon emissions, investing in R&D for green technologies and sustainable practices and etc., hence is widely acknowledged as a viable remedy to steer an economic system that aspires to improve human well-being and social equity while significantly reducing environmental risks and ecological scarcities. This study delves into the intricate interconnection between investment in environmental protection efforts and the resulting impact on a nation's Green GDP. With an increasing global emphasis on green growth and development, understanding the relationship between environmental expenditure and sustainable economic growth has gained paramount significance. The research adopts a time-series cross-sectional methodology, employing a panel cointegration analysis covering a diverse set of EU countries.

Keywords:

digital transformation, organizational change, business process digitalization, train transport, railway, maintenance, public sector management

1 Introduction

Understanding the intricate relationship between expenditure in environmental protection and its impact on various facets of socio-economic indices like gross domestic product (GDP), green GDP, green economy, sustainability, ecology, human well-being, and social equity is a critical area of study in contemporary scientific discourse. The interconnection between these variables forms a nexus that shapes the trajectory of global development, societal welfare, and environmental sustainability. At its core, expenditure in environmental protection directly influences the state of the environment and subsequently impacts the economy and society. Investments in environmental protection measures, such as pollution control, resource conservation, and renewable energy initiatives, bear a direct correlation with the green GDP, a metric that accounts for economic growth while considering environmental factors. This relationship elucidates the symbiotic nature of economic prosperity and ecological preservation, highlighting that a thriving economy can coexist with sustainable environmental practices. Moreover, this nexus extends beyond economic metrics, encapsulating broader notions of a green economy and sustainability. A green economy emphasizes resource efficiency, minimization of carbon footprint, and the promotion of renewable energy sources, fostering a framework for sustainable development. It is within this context that the concept of sustainability intersects with ecological preservation and human well-being, emphasizing the intrinsic connection between a healthy environment and the quality of life for present and future generations.

Crucially, understanding this nexus also involves acknowledging the implications for social equity. Environmental degradation often disproportionately affects marginalized communities, exacerbating social inequalities. Conversely, investments in environmental protection can serve as a catalyst for addressing these disparities by creating green jobs, ensuring access to clean resources, and enhancing overall societal resilience. In essence, exploring the nexus between expenditure in environmental protection and relevant social constructs underscores the imperative for integrated approaches to development. By recognizing the interconnectedness of these elements, policymakers, businesses, and communities can work synergistically towards fostering a harmonious balance between economic growth, environmental conservation, and societal well-being, laying the groundwork for a more sustainable and equitable future.

Scarce empirics on environmental protection expenditure – green growth dynamics nexus, steered this research towards the question; how ‘investments’ in environment protection (expenditures and transfers in environmental protection) affect the green growth prospect? Hence, the main goal is to reveal whether spending on environmental protection indeed cuts the gap between conventional GDP and Green GDP measures. Long-run empirical assessment is founded on a panel cointegration modelling for the period 2014-2019 for the sample of 7 European countries. The results confirmed positive influence of environmental spending on green growth dynamics.

2 The relevance of environmental protection

2.1 Theoretical background on the topic

Unsustainable economic practices have widened the socio-economic disparity between developed nations and others, necessitating a pressing call for innovative synergies between economic and environmental approaches. It is imperative to reassess genuine progress and prosperity in the future context. Amidst profound environmental changes and ecological uncertainty, concerns arise that the sole pursuit of economic growth alongside unsustainable patterns of production, rapid urbanization, consumer-driven behaviour, and associated lifestyle requirements may upset the delicate ecological capacity, economic stability, and socio-economic security. Embracing green growth has emerged as a strategic approach aimed at increasing the use of renewable energy sources, lowering carbon emissions, investing in R&D for green technologies and sustainable practices and etc., hence is widely acknowledged as a viable remedy to steer an economic system that aspires to improve human well-being and social equity while significantly reducing environmental risks and ecological scarcities. Widely acknowledged, green growth presents a viable solution to steer socio-economic advancement in a sustainable direction. This paradigm shift aims to harmonize economic and environmental considerations, fostering a more balanced and resilient framework for social development (Tomić and Stjepanović, 2022). With an increasing global emphasis on green growth and development, understanding the relationship between environmental expenditure and sustainable economic growth has gained paramount significance.

Ditto, the embrace of a green economy has evolved into a prevalent value orientation guiding both societal and global economic development, driven by the imperative to enhance and safeguard ecological environments. Drastic reductions in funding for the green economy during a crisis yield detrimental consequences, contributing to societal distress. The magnitude of government expenditure within the realm of a green economy, along with the interplay between the composition of such spending and economic growth, significantly influences the execution of fiscal policy. This inquiry stems from the recognition that certain components of public expenditure exert a more pronounced influence on green economic activities than others (Feng et al., 2022).

A substantial body of literature underscores the direct influence of environmental degradation on the configuration of government fiscal expenditure (Yuelan et al., 2019). However, there remains a notable gap in comprehensive evidence regarding the relationship between green economic growth and government fiscal expenditure. Prior studies have shed light on the pivotal role of government fiscal spending as a decisive factor in promoting green economic growth. While an increase in fiscal spending contributes to the enhancement of green economic growth, it is noteworthy that such growth may experience a decline owing to heightened environmental vulnerabilities. Furthermore, fiscal spending serves as a tool to address market failures, thereby stimulating avenues for innovative technological solutions. In this context, the utilization of fiscal resources not only supports the growth of a green economy but also plays a critical role in mitigating environmental challenges and fostering advancements in technology. This multifaceted interplay underscores the intricate dynamics between government fiscal policies and the pursuit of sustainable, environmentally conscious economic development (Huang et al., 2022).

Thus, the significance of government spending extends beyond immediate economic considerations to encompass broader societal and environmental impacts. Integral to the broader spectrum of government governance, as elucidated by Feng et al. (2022), is the aspect of government spending dedicated to environmental protection. This dimension of expenditure, though sometimes overlooked, can exert a macro-level influence on a nation's Environmental, Social, and Governance (ESG) performance to a considerable extent. By investing in environmental protection initiatives, governments contribute not only to ecological well-being but also

position themselves as key players in advancing national ESG goals. The nexus between government spending, societal well-being, and environmental stewardship thus emerges as a crucial element in shaping the trajectory of sustainable development (Niu, 2024). As Gallo and Ndiaye (2021) indicate, exploring potential interactions in environmental expenditures among countries holds significant implications for various reasons. Firstly, it enables the comparison of efforts made by different nations in the realm of environmental protection. Moreover, the recognition of possible expenditure externalities suggests that countries' policy decisions are interconnected rather than independent. In the context of environmental expenditures, these externalities may manifest as the ripple effects of public investments in environmental infrastructures within a particular country, extending their benefits to neighbouring nations. This interdependence underscores the need for a holistic understanding of the interconnected nature of environmental expenditures on a global scale.

This study delves into the intricate interconnection between investment in environmental protection efforts and the resulting impact on a nation's Green GDP. The assessment of 'green performance' necessitates a foundation of reliable statistical data. Meaningful international comparisons regarding environmental, sustainability, and 'green' issues hinge upon robust green data collection and indicator capacity building, as highlighted by Stjepanović, Tomić, and Škare (2022). Boyd (2006) posits that societies should be equipped to discern the impact of market consumption on the utilization of public goods. Environmentalists seek to monitor the provision of future nature's benefits, either to hold governments accountable or to benchmark their environmental situations against other nations. Economists, in turn, advocate for societal articulation of trade-offs, performance measurement, and the maximization of social well-being. Meeting these aspirations requires a comprehensive measure of GDP progress, hence the necessity for a Green GDP indicator. Such an indicator empowers countries to integrate green growth approaches into national planning, choose policy instruments that foster growth in key sectors or resources, and facilitate institutional mechanisms linking development factors for continuous improvement. Contrary to the notion that economic development and growth automatically translate into environmental sustainability, the reality, as emphasized by Stjepanović, Tomić, and Škare (2019), is that developed countries tend to consume more resources per capita than their developing counterparts, and the ecological/economic impact extends beyond national borders.

This underscores the potential of Green GDP, a variable to be utilized throughout the paper, to function as a metric for shaping sustainable progress policies and gauging the effectiveness of implementation measures for sustainability-promoting policies or programs.

2.2 Short empirical background

In this part we will mention just latest and topic related researches. Feng et al. (2022) employed data envelopment analysis and system GMM techniques to assess the correlation between government expenditure and green economic performance by using utilized panel data spanning the period from 2008 to 2018 across selected Belt and Road Initiative (BRI) countries. Authors suggest that the fluctuations observed in the green economic performance index of BRI countries stem from a lack of robust government policies. Importantly, the econometric results revealed a positive and significant impact of government expenditure on green economic performance.

Gallo and Ndiaye (2021) conducted an analysis utilizing data spanning the years 1995 to 2017 across a sample of 28 OECD countries. Their study delves into the nature and scope of strategic interactions in environmental expenditures among these countries, employing a spatial Durbin model. The results of their investigation revealed a noteworthy presence of significant positive spatial dependence in environmental spending among OECD countries. This suggested that these countries take into account the behaviour of their neighbours when formulating policy decisions pertaining to environmental expenditures. Furthermore, their study highlighted distinctive patterns, indicating that the most populous nations or those grappling with high unemployment tend to allocate comparatively lesser funds towards environmental concerns. Huang et al. (2022) explored the influence of public sector investments in education and research and development on green economic growth in specific Asian economies from 1991 to 2019. Employing FMOLS and DOLS methods, the study aimed to scrutinize the relationship between public expenditures in the education and research and development sectors and the trajectory of green economic growth. Their findings accentuated that expenditures in both education and research and development play a substantial and positive role in augmenting green economic growth across the majority of the selected Asian economies. Leveraging comprehensive indicator data on national Environmental, Social, and Governance (ESG) performance across 27 countries spanning the years

2006 to 2020, Niu (2024) conducted an examination using a panel Tobit model. Author's results revealed a statistically significant and positive correlation between government environmental protection spending and national ESG performance. Furthermore, author found that directing resources towards environmental protection not only enhances a nation's ecological and societal performance but also contributes to an improvement in governance standards and that an increase in government spending on environmental protection triggers a surge in green innovation, consequently exerting a positive impact on the overall national ESG performance.

In a recent study, Arjomandi et al. (2022) utilized the Pooled Mean Group Autoregressive Distributed Lag model to explore the immediate and prolonged impacts of environmental policy stringency and environmental spending on pollution-adjusted GDP and productivity growth across a selection of OECD countries. Despite notable variations in policies and outcomes among countries, our investigation indicates that, in the short term, governmental investment in environmental protection significantly stimulates national output. However, their long-term analysis suggests that both heightened environmental policies and increased environmental expenditure may decelerate 'green' GDP and productivity growth over time, with policy stringency exhibiting a comparatively weaker influence. Contrary to the Porter Hypothesis, their findings do not lend support to the idea that environmental regulations can spur economic growth. Instead, they align with the prevailing perspective that such policies might impede economic activity and long-term growth. Li et al. (2016) analyzed the impact of environmental protection investment on economic growth, specifically its benefits for the development of the green economy in China. Utilizing data spanning the years 2004 to 2014, the study employed a multivariate regression model to empirically assess the influence of environmental protection investment on GDP growth. Results revealed a positive effect on GDP growth attributed to investments in environmental pollution control, industrial pollution control projects, and energy-saving and environmental protection initiatives.

3 The scope of the research

3.1 Empirical approach

In order to evaluate the relationship between spending on environmental protection and green aspiration, we will use two variables to represent 'investments' in environment protection i.e. expenditures and transfers in environmental protection. On the other side, we will use the gap variable to represent green growth prospect, as the main point of this research is to reveal whether spending on environmental protection indeed cuts the gap between conventional GDP and Green GDP measures. Therefore, our formulation will be expressed through two models, one relating expenditure in environmental protection to so-called green gap and other to test and confirm the credibility of the first, relating environmental protection transfers to green gap. Finally, our models want to test the hypothesis of positive influence of environmental protection investment on green economy aspiration.

Empirical assessment will be based on a cross-country panel cointegration modelling for the period 2014-2019 for the sample of 7 European Union (EU) countries. Environmental protection expenditure witnessed a notable uptick from 2.1% to 2.3% of the GDP between 2018 and 2020 on a pan-European scale. Notably, the environmental protection expenditure to GDP ratios exhibited significant divergence among the EU members. Austria, Belgium, and Romania stood out with this kind of expenditure constituting more than 3% of their respective GDPs, while in Ireland, the proportion was less than 1%. An intriguing trend unfolded across the 27 EU countries during the 2018-2020 timeframe, with 21 countries experiencing an expansion in this ratio. Poland marked the most substantial increase, surging by 1 percentage point, closely followed by Malta, which witnessed a rise of 0.6 percentage points. In contrast, the remaining EU countries observed a decline in this share, with Lithuania and Cyprus experiencing the most significant reductions (European Environment Agency, 2023). This dynamic scenario reflects the diverse fiscal landscapes within the EU, underlining the nuanced trajectories of public expenditure across its member nations. General government expenditure in the EU on 'environmental protection' amounted to €119 billion (0.8 % of GDP) in 2021 (Eurostat, 2023). In line with this trend, we selected 7 EU countries which invested the most in environmental protection, thus exceeding 2.5% of environmental

protection expenditure to GDP ratio (reflection dynamics in 2018 and/or 2020), as a respectable sample for testing our hypothesis (Figure 1).

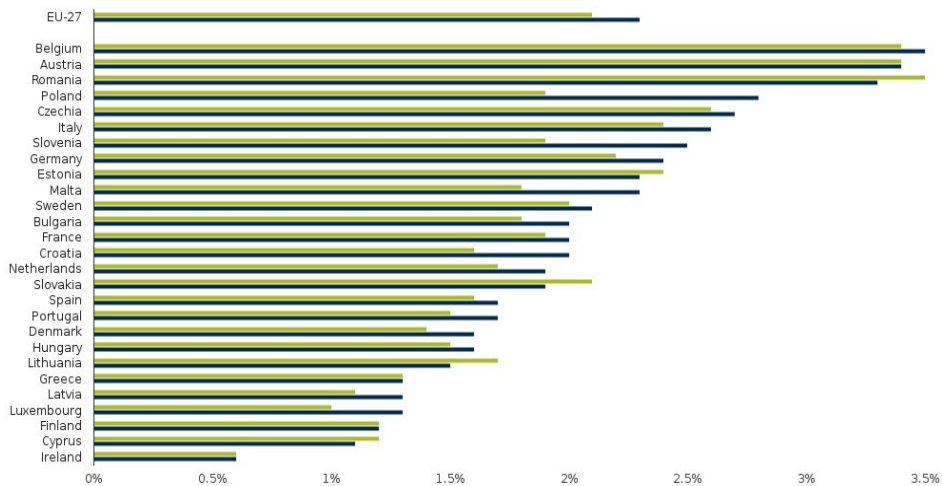


Figure 1: Expenditure on environmental protection by EU countries, 2018 and 2020, (% of GDP)

Source: European Environment Agency, 2023

3.2 Data and model selection

Annual data on environmental protection and environmental transfers, covering the period 2014-2019 for the sample of 7 EU countries (Belgium, Romania, Austria, Czechia, Slovenia, Poland and Italy), are taken from the Eurostat (Eurostat, 2024). The data for Green GDP are based on the paper Stjepanović, Tomić and Škare (2022) following their alternative approach to sustainability and green growth (Stjepanović, Tomić and Škare, 2017). Data are expressed in logarithms and presented as: $\ln\text{GAP}$ as the logarithm of the gap from Green GDP to standard GDP measure in current U.S. dollars, $\ln\text{EE}$ as the logarithm of national expenditure on environmental protection by institutional sector in euros and $\ln\text{ET}$ as the logarithm of environmental protection transfers by environmental protection activity and institutional sector in total environmental protection activities.

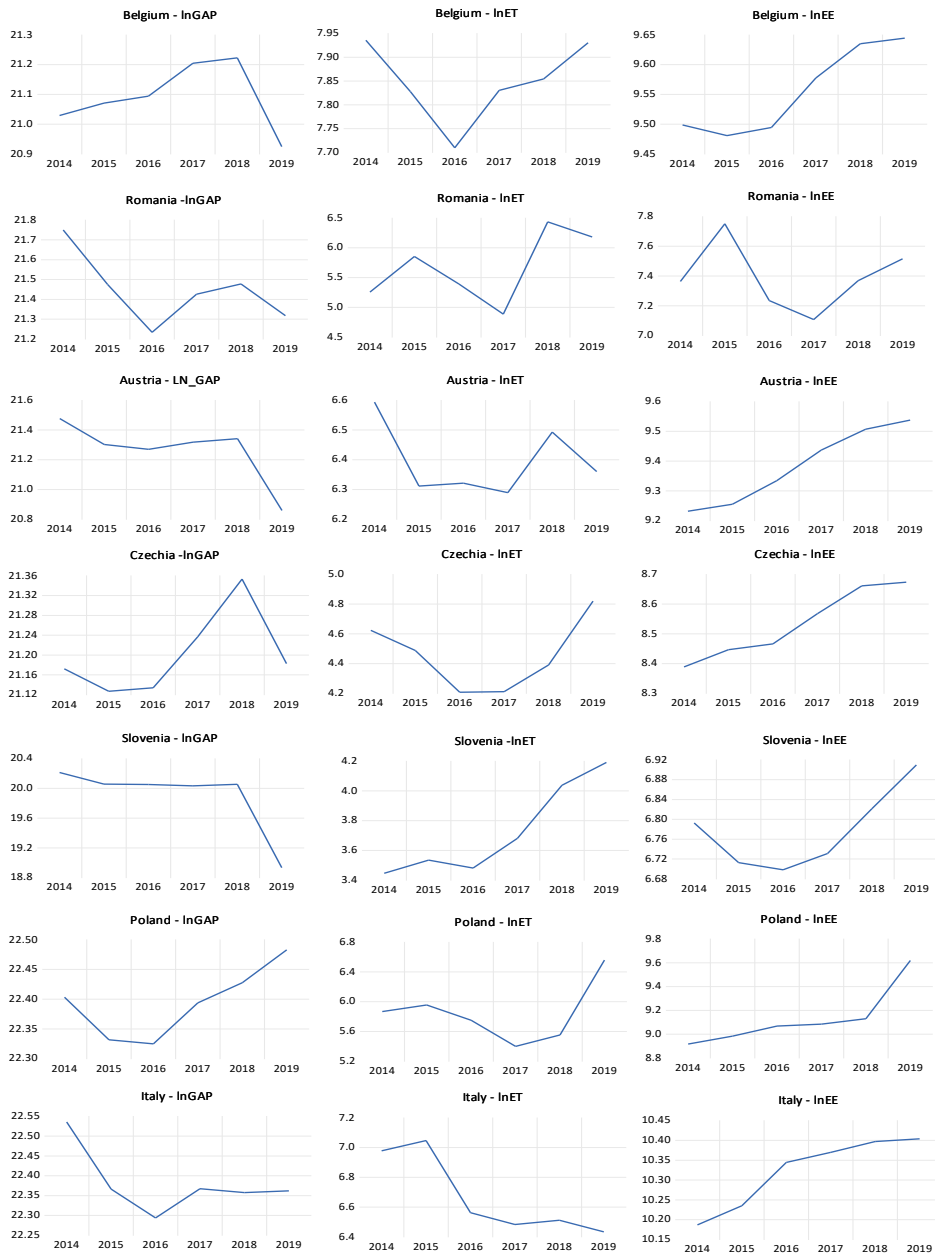


Figure 2: Variables lnGAP, lnEE and lnET by selected EU countries

Source: Authors' calculations.

Following the literature, recent trends and possible homogeneity among the EU countries, it can be anticipated that cointegration between included variables may exist. Hence, we intend to employ the cointegration method using panel data modeling. If the variables are non-stationary and integrated of the same order, the analysis can continue with testing for the panel cointegration. Following the graphical display of the variables across the countries (*Figure 2*) as well as the results of several panel unit root tests (*Table 1*), namely LLC test (Levin, Lin and Chu, 2002), Breitung test (Breitung, 2000), IPS test (Im, Pesaran and Shin, 2003) and Hadri tests (Hadri, 2000), we came to conclusion that all variables could be integrated I(1), meaning they are stationary in their first differences, which is an important property for our modelling.

Table 1: Panel unit root tests

Variable and test	Level		First difference	
	Intercept	Intercept and trend	Intercept	Intercept and trend
Levin, Lin and Chu t*	Prob.**			
lnGAP	0.00	0.00	0.04	0.99
lnEE	0.23	0.00	0.00	0.00
lnET	0.07	0.00	0.00	0.00
Breitung t-stat	Prob.**			
lnGAP	-	0.95	-	0.99
lnEE	-	0.98	-	0.97
lnET	-	0.98	-	0.99
Im, Pesaran and Shin W-stat	Prob.**			
lnGAP	0.45	0.66	0.47	0.97
lnEE	0.96	0.70	0.29	0.54
lnET	0.62	0.82	0.39	0.16
Hadri test	Prob.**			
lnGAP	0.00	0.00	0.00	0.00
lnEE	0.00	0.00	0.00	0.00
lnET	0.00	0.00	0.00	0.00

Notes: * Heteroscedastic Consistent. ** Probabilities are computed assuming asymptotic normality

Source: Authors' calculations

3.3 The model and results

Resulting from the conceptual framework and the characteristic of the data, our model can be presented as:

$$\ln\text{GAP}_t = \beta_0 + \beta_1 \ln\text{EE}_t + \varepsilon_t \quad (1)$$

$$\ln\text{GAP}_t = \beta_0 + \beta_1 \ln\text{ET}_t + \varepsilon_t \quad (2)$$

therefore, they can be regarded as candidates for modelling panel cointegration. Following the research logic from Škare, Tomić and Kristek (2020), panel cointegration tests were evaluated according to Pedroni (1999, 2004) and Kao (1999), as Johansen Fisher trace and maximum eingevalue cointegration tests could not be fully obtained. Pedroni and Kao expand upon the two-step Engle-Granger framework to encompass tests related to panel data. Pedroni introduces various cointegration tests that accommodate diverse intercepts and trend coefficients across different cross-sections, presenting two alternative hypotheses: the homogenous alternative and the heterogeneous alternative. The Kao test follows the same approach as the Pedroni tests, but specifies cross-section specific intercepts and homogeneous coefficients within the first-stage regressors.

Based on the results of Pedroni's panel cointegration tests (as shown in Table 2), it is evident that when considering only the intercept or both intercept and trend, a majority of Pedroni's statistics reject the null hypothesis, indicating the presence of a long-run panel cointegration relationship between the variables, with at least one cointegrating vector. Kao's panel cointegration test, on the other hand, strongly accepts the null hypothesis, indicating the non-existence of a long-run panel cointegration relationship. Consequently, at least on residual cointegration test provide compelling evidence of a long-term cointegration between the variables in both equations. Due to the potential variation in results from Johansen Fisher panel cointegration test, depending on the number of lags and other specifications, and given the inconclusive outcomes obtained from this method, it was decided not to utilize this particular type of cointegration test.

Table 2: Cointegration tests

<i>Variables: lnGAP vs. lnEE</i>								
<i>Pedroni residual cointegration test</i>	<i>Intercept</i>				<i>Intercept and trend</i>			
	<i>Statistic</i>	<i>Prob.</i>	<i>Weighted Statistic</i>	<i>Prob.</i>	<i>Statistic</i>	<i>Prob.</i>	<i>Weighted Statistic</i>	<i>Prob.</i>
Panel v	0.91	0.18	0.55	0.29	-0.64	0.74	-1.13	0.87
Panel rho	-0.19	0.42	-0.02	0.49	1.87	0.97	1.67	0.95
Panel PP	-6.58	0.00	-3.32	0.00	-2.43	0.01	-1.99	0.02
Panel ADF	-6.15	0.00	-6.99	0.00	/	/	/	/
Group rho	1.43	0.92			2.65	0.99		
Group PP	-3.99	0.00			-1.69	0.05		
Group ADF	-10.27	0.00			/	/		
<i>Kao residual cointegration test</i>	<i>t-Statistic</i>				<i>Prob.</i>			
ADF	-0.21				0.42			

<i>Variables: lnGAP vs. lnET</i>								
<i>Pedroni residual cointegration test</i>	<i>Intercept</i>				<i>Intercept and trend</i>			
	<i>Statistic</i>	<i>Prob.</i>	<i>Weighted Statistic</i>	<i>Prob.</i>	<i>Statistic</i>	<i>Prob.</i>	<i>Weighted Statistic</i>	<i>Prob.</i>
Panel v	0.93	0.18	-0.17	0.57	-1.93	0.97	-1.96	0.98
Panel rho	-0.01	0.49	0.77	0.78	-0.42	0.33	-0.28	0.39
Panel PP	-2.17	0.02	-0.70	0.24	-1.02	0.15	-0.42	0.34
Panel ADF	-6.05	0.00	-5.78	0.00	-2.63	0.00	-6.83	0.00
Group rho	1.81	0.97			1.51	0.93		
Group PP	-0.99	0.16			-0.47	0.32		
Group ADF	-8.01	0.00			-4.50	0.00		
<i>Kao residual cointegration test</i>	<i>t-Statistic</i>				<i>Prob.</i>			
ADF	-0.74				0.23			

Source: Authors' calculations

3.4 Panel cointegration results

The long-run cointegration is estimated using the pooled and grouped Panel Fully Modified Least Squares (FMOLS) and pooled and grouped Panel Dynamic Least Squares (DOLS) estimation methods. We opted not to estimate Pooled Mean Group/AR Distributed Lag (PMG/ARDL) due to results inconsistency. FMOLS and DOLS estimation methods for panel settings allow the estimation of the panel cointegrating regression equation for non-stationary data by correcting the standard pooled OLS for serial correlation and endogeneity of regressors that are usually present in long-run relationships. In addition, the DOLS allows augmenting the panel cointegrating regression equation with cross-section specific lags and leads to eliminate the endogeneity and serial correlation. Therefore, a key advantage over FMOLS and DOLS is that it permits the short-run dynamic specification to vary across cross-sections, while maintaining the constraint that the long-run coefficients remain invariant.

Table 4: Panel cointegration results– lnGAP (dependent variable)

<i>Panel Fully Modified Least Squares (FMOLS) – (lags-leads; 1,1) – grouped estimation</i>								
<i>Variable</i>	<i>Constant</i>				<i>Constant and trend</i>			
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
lnEE	-0.76	0.17	-4.51	0.00	-0.89	0.15	-5.94	0.00
<i>Panel Dynamic Least Squares (DOLS) – (lags-leads; 0,0)- pooled estimation</i>								
<i>Variable</i>	<i>Constant</i>				<i>Linear trend</i>			
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
lnEE	-0.52	0.30	-1.72	0.10	-0.26	0.13	-2.03	0.06

<i>Panel Fully Modified Least Squares (FMOLS) – (lags-leads; 1,1) – pooled estimation</i>								
<i>Variable</i>	<i>Constant</i>				<i>Constant and trend</i>			
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
lnET	-0.17	0.11	-1.62	0.12	-0.21	0.11	-2.02	0.05
<i>Panel Dynamic Least Squares (DOLS) – (lags-leads; 0,0)- grouped estimation</i>								
<i>Variable</i>	<i>Constant</i>				<i>Linear trend</i>			
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-Statistic</i>	<i>Prob.</i>
lnET	-0.44	0.17	-2.59	0.02	-0.27	0.14	-1.92	0.08

Source: Authors' calculations

The outcomes from nearly all estimation methods (Table 4) reveal statistically significant long-term coefficients aligning with the theoretically anticipated direction and remaining consistent with empirical dynamics. Zero restrictions on the long-run parameters are tested using the Wald test, confirming their statistical significance. Results from equation (1) reveal negative and strongly significant coefficients for variable $\ln EE$ varying from -0.52 to -0.76 in the case with constant, and from -0.26 to -0.89 in the case for constant with linear trend. Results from equation (2) display statistically significant negative relationship for variable $\ln ET$, varying from -0.17 to -0.44 in cases with constant, and from -0.21 to -0.27 in cases with constant and linear trend. Hence, one can infer that an escalation in both environmental protection expenditure and environmental protection transfers serves to reduce the disparity between conventional GDP and Green GDP measurements for 7 selected EU countries. This suggests that allocating resources to environmental protection activities has a positive impact on aligning economic indicators with environmentally sustainable practices, reflected in the convergence of these GDP metrics. The findings indicate a critical need for the government to augment its investment in environmental protection and enhance the efficiency of both input and output processes. This strategic approach is essential for fostering sustained, rapid, and healthy development in the national economy, as well as driving advancements in social well-being (Stjepanović, Tomić, and Škare, 2019). Specifically, a heightened investment in environmental protection within the EU is poised to yield positive outcomes for green economic growth, particularly for those countries committed to investing in sustainability.

4 Beyond conclusion

Based on this research it can be concluded that an increase in the environmental protection expenditure and environmental protection transfers curtails the gap between the conventional GDP and Green GDP measures for 7 EU countries (Belgium, Romania, Austria, Czechia, Slovenia, Poland and Italy). While the environmental laws and investments in environmental protection in the examined nations operate independently, the realization of a comprehensive environmental strategy is crucial to bring about distinct economic and environmental impacts. Our findings underscore the imperative for countries to formulate robust environmental policies and strategies; however, the successful implementation of such plans necessitates collaboration among all economic stakeholders.

It's important to note that this study has certain limitations, such as the relatively limited number of observed years. Although the observed time frame captures unique dynamics, a more extensive analysis over a broader period would likely yield more robust results. Furthermore, relying solely on Standard GDP as a measure of economic success and growth has its limitations, particularly regarding its failure to adequately account for the environmental component.

Ultimately, while our ability to offer extensive international evidence on the comprehensive impact of investments in environmental protection is limited, it is noteworthy that the observed relationship exhibits a high level of statistical significance and robustness. We aspire to make a modest contribution to advancing the understanding of the practical and methodological dimensions of this relevant green topic. It's important to note that our approach and the deductions presented herein represent our current perspective and are subject to potential revisions in the future.

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ANALYTICS WITH ORACLE APEX FOR ENHANCED DATA WAREHOUSE MANAGEMENT: A CASE STUDY OF A GREEK SOFT DRINKS COMPANY

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This research paper examines the strategic deployment of Oracle APEX by a prominent Greek soft drinks manufacturing enterprise for the enhancement of data warehouse management spanning the period from 2018 to 2022. The integration of Oracle APEX, renowned for its low-code application development capabilities, has emerged as a pivotal catalyst in optimizing data processing workflows, elevating analytical functionalities, and cultivating streamlined decision-making processes within the organization's data ecosystem. This article delves into the specific benefits and outcomes derived from the adoption of Oracle APEX in the context of data warehousing, shedding light on the transformative impact on the company's operations.

Keywords:

oracle
APEX,
data
warehouse,
company,
decision
making,
analytics

1 Introduction

In the dynamic realm of data management, organizations are progressively embracing cutting-edge tools and technologies to unlock the complete potential of their data resources. This article centers on a Greek Soft Drinks manufacturing enterprise that, recognizing the need for a robust data warehouse solution, implemented Oracle APEX for the data of years 2018 to 2022.

The integration of data warehousing in soft drinks companies revolves the combination of data from diverse sources to facilitate effective decision-making, analysis, and reporting. This often entails the utilization of the Snowflake schema, a sophisticated approach to organizing data in a warehouse. A study conducted by Mohammed, (Mohammed, 2019), delves into a comparative analysis of the Star and Snowflake Schemas within the framework of structured databases, focusing on a trading company with global operations. The findings of this study suggest that the Star Schema surpasses the Snowflake Schema in terms of query complexity and performance efficiency. Additionally, Levene and Loizou, (Levene & Loizou, 2003) examine the snowflake schema, emphasizing its efficacy as a robust design for data warehouses. They underscore its structural attributes and its capacity to update relations independently, all while preserving referential integrity. A study by Wang and Kourik, (Wang & Kourik, 2015), explores the Snowflake schema's role in connecting data warehouse environments with analytical processing, enabling adaptable analysis and navigation through hierarchies. Dageville et al. (Dageville, et al., 2016), describe the Snowflake Elastic Data Warehouse, a multi-tenant, scalable, and elastic system with full SQL support, emphasizing its suitability for semi-structured and schema-less data. These investigations showcase the development and implementation of data warehouse designs such as the Snowflake schema, underscoring their significance in large-scale data management, particularly in sectors like the soft drinks industry.

Oracle APEX, a low-code development platform, offers a comprehensive suite of tools for creating web applications and is particularly well-suited for data-centric applications, (Angeioplastis, Tsimpiris, Varsamis, Baggia, & Leskovar, 2023). The incorporation of Oracle APEX by the company followed a methodical integration approach, encompassing tasks such as migrating existing data and creating customized applications tailored to their precise requirements. (Ahmed, 2016)

explores the contribution of Oracle APEX in the development of cloud-based applications, underscoring its user-friendly nature in crafting web-based data-centric applications. The study suggests that Oracle APEX's interactive reports enable the creation of intricate applications with minimal coding effort. In a complementary vein, Srinivas, Biswas and Srinivasan, (Srinivas, Biswas, & Srinivasan, 2010), introduce a tool that complements Oracle APEX by providing an application overview, likely incorporating interactive reporting features. This implies the pivotal role of interactive reports in comprehending and managing complex database applications. Addressing the security dimension, (Austwick, 2013) delves into the secure implementation of Oracle APEX, including interactive reports, to ensure data integrity and privacy. Lastly, Veerasamy, (Veerasamy, 2022), emphasizes Oracle APEX's capacity for low-code application development, extending to the creation of interactive reports. These reports are deemed essential for swift application development in Oracle APEX, especially for business analytics and decision-making purposes.

This article examines the step-by-step implementation methodology, detailing how Oracle APEX was configured to meet the company's data warehousing requirements.

2 Methods and materials

2.1 Data warehouses

A data warehouse (DW) is a digital storage system that connects and harmonizes large quantities of data from various sources. Its purpose is to fuel business intelligence (BI), reporting, and analytics while supporting regulatory requirements, enabling companies to transform their data into information and make intelligent decisions based on insights. Data warehouses store both current and historical data in one location, serving as a single source of truth for an organization. Data flows into a data warehouse from operational systems, databases and external sources, typically at regular intervals. A well-designed data warehouse serves as the foundation for any successful BI or analytics program. Its primary function is to fuel the reports, dashboards, and analytical tools that have become essential for modern businesses. A data warehouse provides the information for your decisions based on

data and assists you in everything from developing new products to managing inventory levels.

2.1.1 Methodology

We gathered four years' worth of operational data for the business, encompassing values such as quantities, costs, profits, transportation costs, dates, product names, etc, (see. Table 1.)

Table 1: The structure of the star schema fact table

Column Name	Data Type	Nullable
ID	NUMBER	N
SUMCOST	NUMBER	Y
YEARDATE	NUMBER	Y
MONTHDATE	NUMBER	Y
SUMAMOUNT	NUMBER	Y
SUMPROFIT	NUMBER	Y
PRODUCTNAME	CHARACTER	Y
SUMTRANSPCOST	NUMBER	Y

Following this, we proceeded to a process of data cleansing and modification. Then, we employed a targeted SQL query to aggregate and summarize operational data crucial for our business analysis. The query, executed on the **RAW_FULL_SALE** table, focused on extracting key metrics such as quantities, costs, profits, and associated product details.

```
SELECT year(`date`) as yaerdate, month(`date`) as monthdate,
`productName`, sum(`amount`) as sumamount, sum(`cost`) as
sumcost,      sum(`transportCost`)      as      sumtranspcost,
sum(`profit`) as sumprofit
FROM `RAW_FULL_SALE`
group by year(date), month(date), `productName`;
```

This SQL query employs the **GROUP BY** clause to aggregate data based on the year, month, and product name. The resulting dataset provides a summarized view of quantities, costs, transport costs, and profits, organized for effective analysis.

Furthermore, this aggregated data serves as the foundation for our Fact Table, a central component in our analytical framework. By structuring the data in this manner, we aim to facilitate seamless integration and utilization within the Oracle APEX environment.

To visually represent this process, refer to Figure 1, depicting the SQL query results and their subsequent integration into the Oracle APEX tool for enhanced analytical capabilities. The effective translation of raw business data into this structured format lays the groundwork for insightful decision-making within the broader context of our study.

This SQL-driven data aggregation and integration methodology ensures a robust and structured approach to deriving meaningful insights from our business data. The subsequent analysis within Oracle APEX enhances our ability to make informed decisions and underscores the synergy between SQL-based data processing and advanced analytics tools.

Subsequently, we transferred the table to Oracle APEX, enabling us to leverage the tools it provides. Utilizing the functionalities within the Oracle environment, we proceeded to apply and implement various operations. This comprehensive approach allowed us to harness the capabilities of Oracle APEX effectively. Ultimately, the objective was to empower the company to make informed decisions based on the refined and organized data.

By incorporating the data into Oracle APEX and employing its robust features, the company can streamline data analysis, generate insightful reports, and gain valuable business intelligence. This process facilitates the decision-making process, enabling the company to navigate areas such as product development and inventory management with greater precision and strategic foresight.

3 Results

Following our meticulous data processing methodology, the Results section unveils a comprehensive analysis drawn from aggregated data. The subsequent visual depiction, showcased in Figure 1, illuminates the central menu interface of the application designed for Nektar Company. The refined data facilitates an intuitive

exploration of key metrics, empowering users with a platform for informed decision-making.

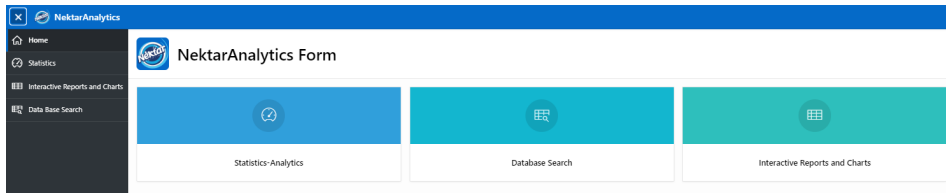


Figure 1: The main menu of the application

Source: Own - Printscreen

Figure 2. unfolds a visual narrative through a dynamic dashboard within the Nektar Company's application, featuring an array of charts to illuminate key performance metrics. This dashboard offers a comprehensive overview of financial insights, with pie charts dedicated to showcasing Cost per Year and Profit per Product Names. The Cost per Year pie chart provides an immediate visual representation of annual financial distributions, facilitating quick comparisons and trend identification. Simultaneously, the Profit per Product Names pie chart offers a focused lens on individual product profitability, guiding strategic decision-making. Complementing these pie charts are insightful histograms presenting additional dimensions of financial analysis. Cost per Month, Profit per Year, Profit per Month, and Cost per Product Names histograms delve into finer details, unraveling temporal patterns and product-specific financial nuances. This graphical representation not only enhances the interpretability of the data but also equips stakeholders with actionable insights for optimized financial management. As we proceed, subsequent sections will delve into the nuanced interpretations of these charts, extracting implications and strategic considerations derived from this visual representation to guide Nektar Company in its pursuit of informed decision-making.

Interactive reports within Oracle Application Express (APEX) emerge as a robust mechanism for the visualization and interactive exploration of data in web applications. This sophisticated feature not only elevates the user experience but also substantially refines data handling within the Oracle APEX environment. Serving as a pivotal tool for data visualization and management, these interactive reports provide a versatile platform characterized by customization, security, and user-

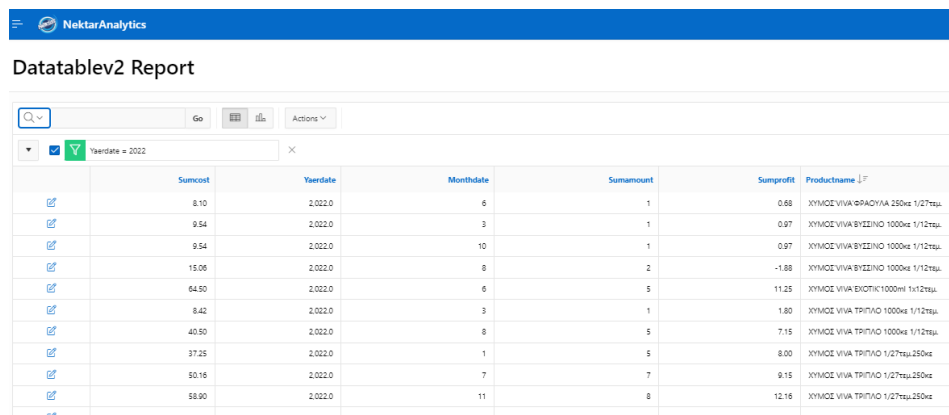
friendly functionalities. By offering dynamic and responsive ways to interact with data, interactive reports in Oracle APEX play a pivotal role in empowering users to glean meaningful insights and navigate through complex datasets seamlessly.



Figure 2: Dashboard with analytics in various charts

Source: Own - Printscreen

In this study, we harnessed the capabilities of this powerful tool to create an Interactive Reports form, as illustrated in Figure 3. This form provides users with dynamic control, enabling them to execute actions on the table data, such as applying filters and generating charts. The user-friendly interface and interactive functionalities embedded in the form enhance the flexibility and efficiency of data manipulation, facilitating seamless exploration and analysis within the dataset.



Datatablev2 Report

Search: [Q] Go [Grid] [List] Actions

Yeardate = 2022

	Sumcost	Yeardate	Monthdate	Sumamount	Sumprofit	Productname
	8.10	2.022.0	6	1	0.68	XYMOE VIVA ΦΡΑΔΙΥΑ 250κx 1/2Tsp.
	9.54	2.022.0	3	1	0.97	XYMOE VIVA ΒΥΣΣΙΝΟ 1000κx 1/12Tsp.
	9.54	2.022.0	10	1	0.97	XYMOE VIVA ΒΥΣΣΙΝΟ 1000κx 1/12Tsp.
	15.06	2.022.0	8	2	-1.88	XYMOE VIVA ΒΥΣΣΙΝΟ 1000κx 1/12Tsp.
	64.50	2.022.0	6	5	11.25	XYMOE VIVA ΕΞΟΤΙΚ 1000κx 1x12Tsp.
	8.42	2.022.0	3	1	1.80	XYMOE VIVA ΤΡΙΠΛΟ 1000κx 1/12Tsp.
	40.50	2.022.0	8	5	7.15	XYMOE VIVA ΤΡΙΠΛΟ 1000κx 1/12Tsp.
	37.25	2.022.0	1	5	8.00	XYMOE VIVA ΤΡΙΠΛΟ 1/27Tsp.250κx
	50.16	2.022.0	7	7	9.15	XYMOE VIVA ΤΡΙΠΛΟ 1/27Tsp.250κx
	58.90	2.022.0	11	8	12.16	XYMOE VIVA ΤΡΙΠΛΟ 1/27Tsp.250κx

Figure 3: Interactive Report tool

Source: Own - Printscreens

In Figure 4, the upper side showcases settings pertaining to the report's printing functionality, such as page size and width. On the left side, users are presented with dynamic options to customize the chart type (bar, line with area, pie, and line) and define axis values. This dual presentation offers a comprehensive view of the user-driven choices available, empowering them to dynamically configure the report to suit their analytical preferences. The presented settings underscore the adaptability of the interactive report, providing users with the flexibility to tailor visualizations and printing parameters according to their specific requirements.

Figure 5 presents a dynamic chart illustrating the overall profit of the enterprise on a monthly basis for the year 2022. This graph was dynamically generated using the Interactive Reports tab, in accordance with the selections provided in Figure 4. The chart visually encapsulates the financial performance of the business throughout the year, offering a clear representation of monthly profit variations.

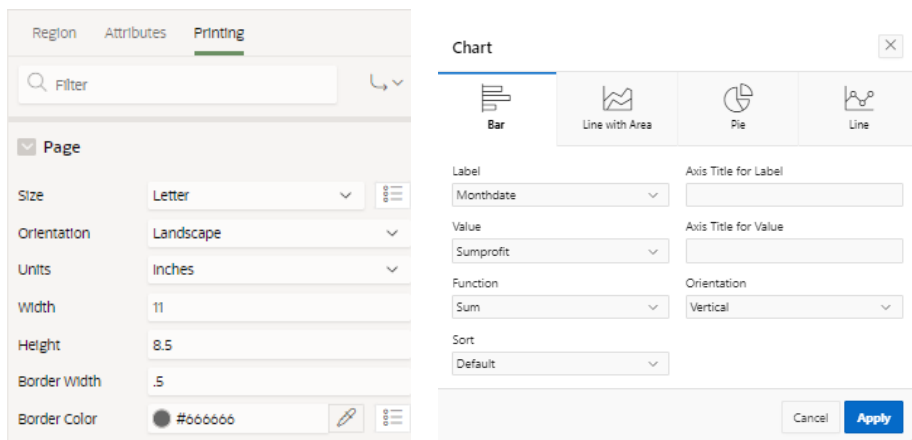


Figure 4: Settings and parameters in the interactive report

Source: Own - Printscreen

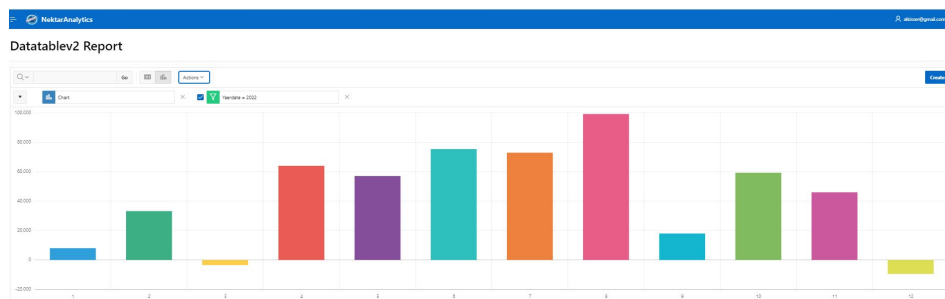


Figure 5: Total profit per month for 2022 year

Source: Own - Printscreen

In a similar fashion, Figures 6 and 7 were dynamically generated to depict the overall profit of the company per product, specifically when the total profit exceeds 5000 units. Additionally, Figure 7 employs a pie chart to showcase the company's total costs for the years 2018-2022. This visualization enhances the understanding of cost distribution over the specified period, adding a layer of granularity to the financial analysis.

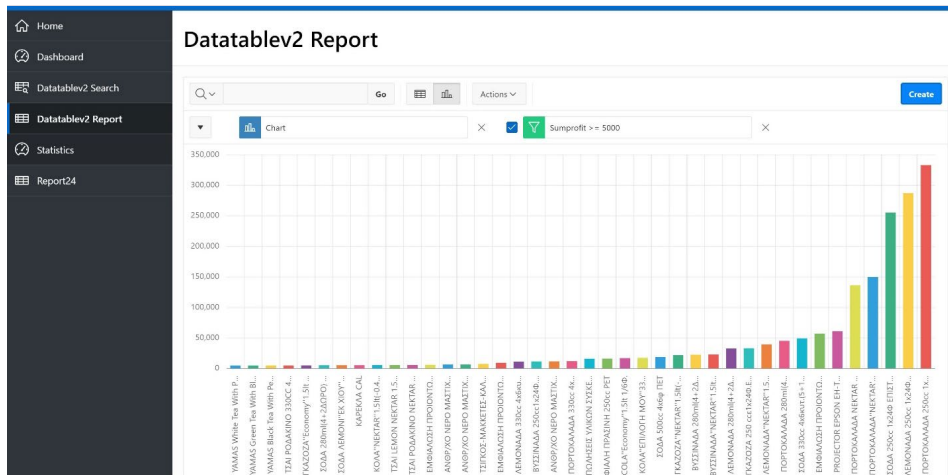


Figure 6: A bar chart of total profit per product with a filter in profit values
Source: Own - Printscreens

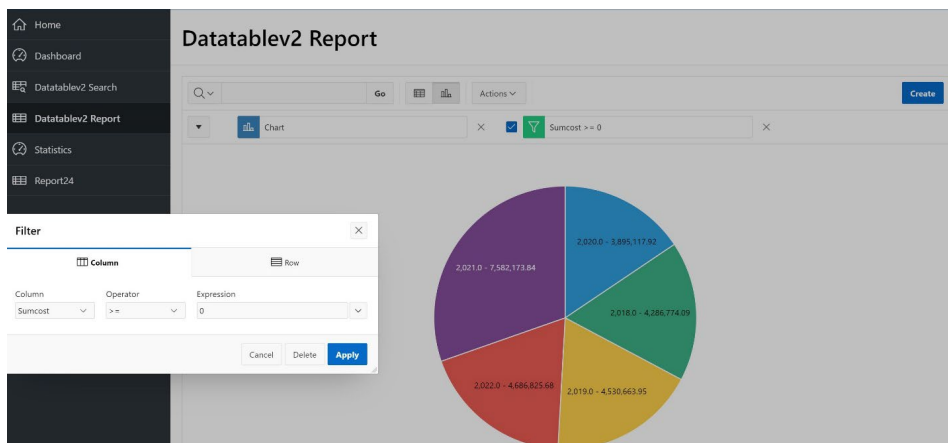


Figure 7: Pie chart for total cost per year
Source: Own - Printscreens

Figure 8 illustrates the Database Search Form, a pivotal component in our analytical framework. This form serves as a user-friendly gateway, empowering users to dynamically query and explore the underlying database. The interactive elements within the form enable users to refine searches based on various parameters, fostering a seamless and tailored exploration of the dataset. By facilitating precise

data retrieval, the Database Search Form enhances the efficiency of information discovery and supports users in obtaining specific insights within the expansive dataset.

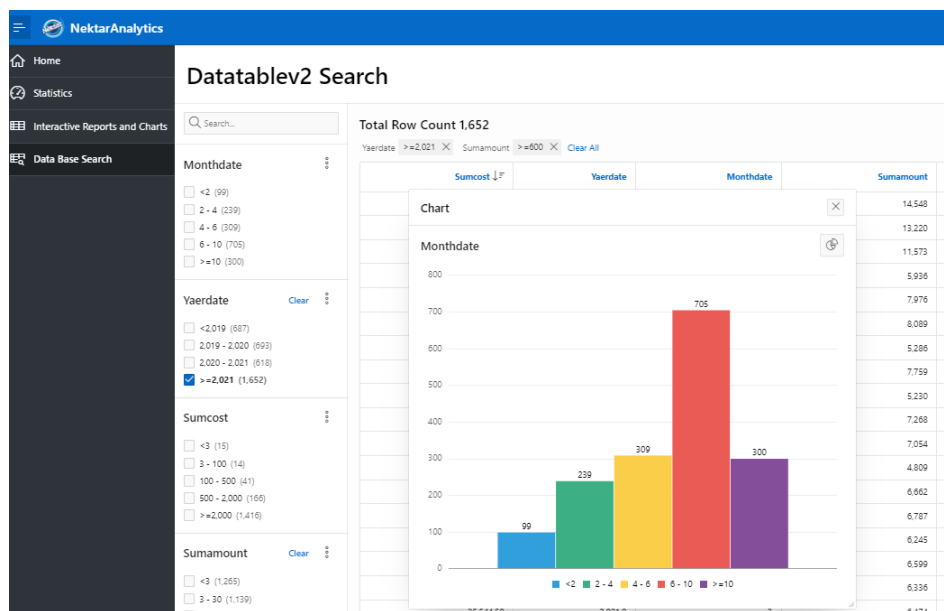


Figure 8: The Data Base Search form

Source: Own - Printscreens

3 Conclusion

This research paper highlights the strategic implementation of Oracle APEX in a leading Greek soft drinks manufacturing enterprise, showcasing its profound impact on data warehouse management from 2018 to 2022. The integration of Oracle APEX, renowned for its low-code application development capabilities, played a pivotal role in optimizing data processing workflows, enhancing analytical functionalities, and fostering streamlined decision-making processes within the organization's data ecosystem. In line with the findings and outcomes of this study, the positive implications of Oracle APEX in data warehousing at the examined company can be succinctly summarized. The systematic integration of Oracle APEX resulted in streamlined data processing, significantly reducing latency and enhancing the overall efficiency of the data warehouse operations. This optimization directly

impacts the timeliness and reliability of data-driven insights. The company experienced a notable improvement in analytical capabilities, enabling more in-depth data exploration and trend analysis. This enhancement contributes to a nuanced understanding of the business landscape, supporting strategic decision-making. In addition, decision-makers now have real-time access to critical insights, fostering faster and more informed choices. This acceleration in decision-making is particularly valuable in the dynamic business environment. The step-by-step implementation methodology outlined in this study, detailing the configuration of Oracle APEX to meet specific data warehousing requirements, serves as a blueprint for organizations seeking to leverage advanced technologies for enhanced data-driven operations. The combination of SQL-based data processing and Oracle APEX's advanced analytics tools exemplifies a harmonious synergy, enabling robust and structured data analysis.

In conclusion, the successful integration of Oracle APEX into the data warehousing practices of the Greek soft drinks manufacturing company not only exemplifies the transformative power of advanced technologies but also serves as a guiding example for organizations navigating the complexities of modern data management. As businesses continue to adapt to the digital era, Oracle APEX emerges as a potent tool for optimizing data warehouse operations, unlocking the full potential of organizational data, and facilitating a data-driven decision-making culture.

Acknowledgements

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ZELENI PREHOD V SLOVENSKEM TURIZMU: TURIZEM IN BLAŽENJE PODNEBNIH SPREMEMB

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Prispevek oriše rezultate ciljnega raziskovalnega projekta »Podnebne spremembe in trajnostni razvoj slovenskega turizma« (ARIS V7-2128) glede vloge turizma pri blaženju podnebnih sprememb. Pri tem izpostavlja vlogo Evropskih zavez Zelenega prehoda in umeščenost slovenskega turizma v širše evropske strategije. Hkrati prispevek analizira razvoj deklarativnih podnebnih zavez v turizmu: od Djerba deklaracije (2004), do Davos deklaracije (2007) in zadnje Glasgowske deklaracije (2021). Prispevek predstavi potrebne strateške preusmeritve trajnostnega razvoja turizma z osrednjim fokusom na štirih hierarhično razporejenih strategijah zmanjševanja izpustov: izogibanje, zmanjševanje, iskanje alternativ in šele kot zadnjo možnost tudi izravnava. Pri tem gradi na rezultatih modela izračuna ogljičnega odtisa slovenskega turizma. Analizirana so štiri področja turizma: prevoz, nastanitve, doživetja in prehranski sistemi. Rezultati pokažejo, da je potreben predvsem strateški fokus na prevozu turistov, ki zavzame največji delež ogljičnega odtisa slovenskega turizma. Na drugem mestu je potreben fokus na nastanitvah, kjer so pa potenciali hitrega doseganja ciljev do 2030 med vsemi področji turizma največji.

Ključne besede:

turizem,
ogljčni
odtis,
blaženje
podnebnih
sprememb,
Glasgowska
deklaracija

GREEN TRANSITION IN SLOVENIAN TOURISM: TOURISM AND CLIMATE CHANGE MITIGATION

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The contribution outlines the results of the targeted research project "Climate change and sustainable tourism development in Slovenia" (ARIS V7-2128) regarding the role of tourism in mitigating climate change. It highlights the role of European Green Deal commitments and the placement of Slovenian tourism within broader European strategies. Simultaneously, the contribution analyses the development of declarative climate commitments in tourism: from the Djerba Declaration (2004) to the Davos Declaration (2007) and the latest Glasgow Declaration (2021). The article presents the necessary strategic shifts for the sustainable development of tourism, with a central focus on four hierarchically arranged emission reduction strategies: avoidance, reduction, seeking alternatives, and only as a last resort, offsetting. It builds on the results of the carbon footprint calculation model for Slovenian tourism. Four tourism sectors are analysed: transportation, accommodations, experiences, and food systems. The results indicate that there is a need for a strategic focus, particularly on tourist transportation, which constitutes the largest share of the carbon footprint of Slovenian tourism. Accommodations come second, offering the highest potential for achieving goals by 2030 among all tourism sectors.

Keywords:

tourism,
carbon
footprint
climate
change
mitigation,
Glasgow
Declaration

1 Uvod

Na Fakulteti za turizem Univerze v Mariboru in Biotehniški fakulteti Univerze v Ljubljani smo v letu 2023 zaključili vseslovenski ciljni raziskovalni projekt V7-2128 Podnebne spremembe in trajnostni razvoj slovenskega turizma, ki sta ga naročila Ministrstvo za gospodarstvo, turizem in šport ter Javna agencija za znanstveno raziskovalno in inovacijsko dejavnost. Projekt sta vodili dve vprašanji: (a) Kakšna je vloga slovenskega turizma pri nastanku ogljičnega odtisa ter s tem priporočila ukrepov zmanjšanja ogljičnega odtisa oz. blaženja podnebnih sprememb? In (b) Kakšni so scenariji vpliva podnebnih sprememb na slovenski turizem in s tem priporočila o prilagajanju slovenskega turizma podnebnim spremembam? V prispevku predstavljamo rezultate raziskave, vezane na prvo vprašanje (celotni rezultati so dostopni v (Turnšek & Pogačar, 2023 (v tisku)).

2 Od globalnih deklaracij do Zelenega prehoda EU in slovenske strategije trajnostnega razvoja turizma

Blaženje podnebnih sprememb pomeni ukrepe zmanjševanja izpustov toplogrednih plinov oz. z drugimi besedami zmanjševanje našega ogljičnega odtisa. V letu 2021 je Svetovna turistična organizacija (UNWTO) pozvala turistične deležnike k podpisu Glasgowske deklaracije kot zaveze k desetletju podnebnih ukrepov v turizmu. V deklaraciji se podpisniki zavežejo k oblikovanju, javni objavi in javnemu spremljanju svojih akcijskih načrtov o podnebnih ukrepih. Večinoma se zahtevani ukrepi navezujejo na vlogo turizma pri blaženju podnebnih sprememb – to je preprečevanju, da bi se potencialno najhujši scenariji, katerim bi se morali prilagajati, sploh udejanjili. Glasgowska deklaracija poziva turistične akterje k merjenju svojega ogljičnega odtisa turizma, njegovemu zmanjševanju, obnovi in zaščiti ekosistemov, sodelovanju in širjenju znanja ter zadostnemu financiranju potrebnih podnebnih ukrepov (glej Sliko 1).

Glasgowska deklaracija je zgolj zadnja v nizu globalni turističnih zavez o vlogi turizma pri blaženju in prilagajanju na podnebne spremembe. Že pred dvajsetimi leti je UNWTO sprejela Djerba deklaracijo (UNWTO, 2004), tri leta kasneje pa Davos deklaracijo (UNWTO, 2007). V primerjavi s prejšnjima deklaracijama, zadnja Glasgowska deklaracija (UNWTO, 2021) predstavlja pomemben korak naprej, saj vključuje jasno določene ukrepe, časovne roke, pa tudi zavezo javnega in rednega

objavljanja napredka pri podnebnih zavezah. Vendar gre za deklarativen in nezavezujoč dokument. Kot izpostavljata (Scott & Gössling, 2021), so priporočila vsebinsko podobna že vseh dvajset let, ki pa jih je v prvi vrsti zaznamovalo neukrepanje in ni dokazov, da sta prejšnji deklaraciji dejansko spremenili rast toplogrednih plinov v sektorju turizma ali vplivali na vključevanje podnebnih sprememb v politiko in načrtovanje turizma.



Slika 1: Glasgowska deklaracija v turizmu, UNWTO 2021

Vir: (Turnšek et al., 2024) , str. 43

Več neposrednih učinkov lahko pričakujemo od zavez Evropske unije k t.i. Zelenemu prehodu. »Podnebni in energetske okvir 2030« Evropskega sveta določa zavezujoči cilj za zmanjšanje izpustov na ozemlju EU za vsaj 40 % do leta 2030 (glede na 1990). Sveženj »Pripravljeni na 55« je sklop predlogov za revizijo in posodobitev zakonodaje EU in vsebuje predlagano zakonodajo na naslednjih

področjih: sistem EU za trgovanje z emisijami; uredba o porazdelitvi prizadevanj; raba zemljišč in gozdarstvo; infrastruktura za alternativna goriva; mehanizem za ogljično prilagoditev na mejah; socialni sklad za podnebje; RefuelEU letalstvo in FuelEU pomorski promet; standardi emisij za avtomobile in kombinirana vozila; obdavčitev energije; energija iz obnovljivih virov; energijska učinkovitost in energijska učinkovitost stavb (Evropski (Svet, 2022)). Skoraj vsa ta področja zadevajo turizem in bodo pričakovano pomembno vplivala na večjo uveljavljanje ukrepov blaženja podnebnih sprememb v turizmu.

Slovenija ima dolgo tradicijo izpostavljanja trajnosti v spodbujanju razvoja turizma, pri čemer bi izpostavili predvsem delovanje Zelene sheme slovenskega turizma, kjer je med vsemi državami, ki omogočajo trajnostno certificiranje Slovenija pri samem vrhu po številu destinacij, ki so se odločile za certifikat. Večji izziv je vključevanje turističnih ponudnikov v procese trajnostnega certificiranja, kjer bodo potrebne dodatne spodbude in sankcije. Strategija slovenskega turizma 2022-2028 ((MGRT, 2022) za osrednji cilj izpostavlja razvoj, ki bi omogočal nadaljnjo rast turizma, a z manjšim okoljskim in ogljičnim odtisom, pri čemer se glede zelenega prehoda in ukrepov blaženja podnebnih sprememb osredotoča predvsem na odtis nastanitev in prevoz turistov po destinaciji. Vendar, kot bo videli spodaj, tudi do tri četrtine ogljičnega odtisa slovenskega turizma predstavlja sam prevoz na destinacijo, tj. do Slovenije.

Strategija nadaljnje določa cilj »*Vzpostavitev nacionalnega sistema za merjenje, zmanjšanje in izravnavo ogljičnega odtisa v turizmu*«:

Za potrebe naslavljanja izzivov na področju razogljčenja slovenskega turizma ukrep predvideva več ključnih aktivnosti:

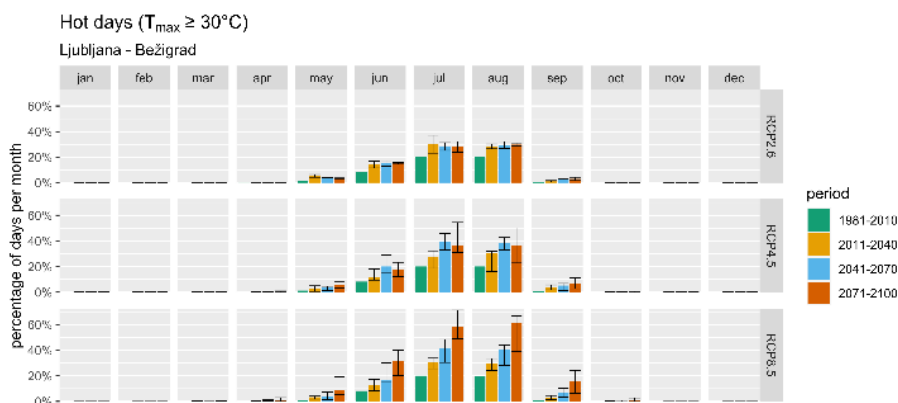
- a) *Vzpostavitev učinkovitega digitalnega orodja za merjenje, spremljanje in izračunavanje predvidenih kazalnikov CO₂ ekv. odtisa podjetij in obiskovalcev tako na ravni destinacij kot tudi ponudnikov in sprotnih izračunov na nacionalni ravni, tudi v navezavi z Nacionalnim informacijskim središčem (z možnostjo nadgradnje obstoječega orodja za destinacije, razvitega v sodelovanju med KSG in Univerzo Breda z Nizozemske, oziroma prek CRP Analiza vpliva podnebnih sprememb in turističnega prometa na trajnostni razvoj turističnih destinacij z identifikacijo potrebnih ukrepov za javni in zasebni sektor ipd.*

- b) *Oblikovanje in pospeševanje modelov, ki nižajo CO2 odtis na nivoju ponudnikov in destinacij, tudi prek uvajanja »default« trajnostnih nastavitvev turizma (tj. preoblikovanje ponudbe na način, da je za obiskovalca trajnostno vedenje lažje dostopno kot netrajnostno – npr. danes sobo »defaultno« vsake dan očistimo, gost pa lahko izbere, da tega ne želi; premik »defaulta« v smer, da sobe »defaultno« vsake dan ne očistimo, gost pa lahko izbere, da to želi);*
- c) *Finančno in svetovalno pomoč destinacijam in podjetjem pri pripravi in implementaciji ukrepov za zmanjšanje ogljičnega odtisa in blaženje podnebnih sprememb;*
- d) *Razvoj lokalnih (destinacijskih ali nacionalnih) ponorov, ki omogočajo lokalne izravnave.*

V projektu CRP Podnebne spremembe in trajnostni razvoj slovenskega turizma odgovarjamo predvsem na točki a) in c) predlaganega ukrepa. V delovnih paketih 1 in 3 smo oblikovali model ocenjevanja ogljičnega odtisa slovenskega turizma na ravni destinacij glede na štiri osrednja področja TGP: prevoz, nastanitve, doživetja in prehranski sistemi. Še preden pa preidemo na vprašanje blaženja podnebnih sprememb, pa naslovimo osrednje ugotovitve na področju prilagajanja slovenskega turizma podnebnim spremembam in vprašanju nevarnosti t.i. maladaptacije – oblik prilagajanje, ki bodo pomenile večji ogljični odtis in s tem nasprotje blaženju (z zavedanjem, da je blaženje v prvi vrsti globalen izziv, medtem ko je prilagajanje lahko lokalizirano).

3 Potrebe po prilagajanju slovenskega turizma

Temperatura ozračja v Sloveniji je bila v zadnjem desetletju (2011–2020) za 2,1 °C nad predindustrijsko dobo. Do sedaj je slovenski turizem prepoznal posledice podnebnih sprememb predvsem v (a) potrebah po prilagajanju zimskega turizma, a tudi v (b) pozitivnem trendu podaljšanja sezone poletnega turizma. V prihodnosti lahko slovenski turizem pričakuje še (c) povečanje števila, njihovega trajanja in intenzitete vročinskih valov, (d) povečane izzive upravljanja vodnih virov s povečanimi tveganji za sušo, ter (e) porast vremenskih ekstremov in s tem grožnje varnosti tako turistom kot turističnim delavcem, vključno z gmotno škodo turistični infrastrukturi (Turnšek et al., 2023 (v tisku)).



Slika 2: Število vročih dni v Ljubljani, pretekli trendi. Opomba: upoštevan je odklon od povprečja referenčnega obdobja in prikazana negotovost.

Vir: (Turnšek et al., 2023 (v tisku)); podatki ARSO 2022

Pričakujemo lahko povečanje števila, trajanja in intenzitete vročinskih valov. Ljubljani se bo npr. pričakovano najbolj povečal negativni vpliv kombinacije temperature in vlažnosti, ki ju človeško telo najtežje prenese. Posledice so v prvi vrsti zdravstvene, kar prizadene najbolj ranljive: starejše, otroke in bolne, vendar se morajo tudi sicer zdravi prilagoditi npr. vsaj z izborom aktivnosti ob drugih delih dneva, primernimi oblačili, pitjem dovolj tekočine ipd.

Odgovornost turističnih akterjev presega osnovne ukrepe kot so informiranje, omogočanje primerne števila javno dostopnih pitnikov, skrb za hlajenje prostorov in primerno ozelenitev zunanjih površin. Turizem mora biti aktivnejši pri skrbi za zaposlene v vročini in dosegljivosti zdravstvene oskrbe, tako zdravstvenih ambulant kot dostopnosti defibrilatorjev in primerne znanja o njihovi uporabi. Prav tako je treba izobraževati delavce in turiste o drugih povečanih zdravstvenih težavah, od alergij (npr. na ambrozijo), do zdravstvenih težav s spremembami habitatov insektov (npr. hrastov in pinijev sprevodni prelec) (Turnšek in Pogačar, 2023).

Povišanje temperature v Sloveniji najverjetneje ne bo vodilo do tega, da bi poleti turisti zamenjali Slovenijo za drugo destinacijo. Bolj verjetno se bodo turisti prilagajali vročini z:

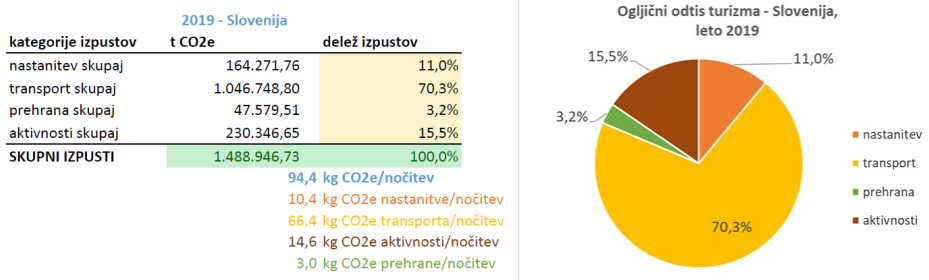
- izogibanjem aktivnostim sredi dneva,
- pričakovanjem hlajenja prostorov,
- prilagoditvijo opreme in oblačil: pričakujemo lahko nadaljnjo rast uporabe e-koles in avtodomov,
- umikom v višje ležeče predele,
- iskanjem doživetij ob vodi.

Temu je treba prilagoditi slovensko turistično ponudbo, marketing, pa tudi organizacijo dela. Ključno vprašanje bo iskanje primerih oblik diverzifikacije turizma, ki pa lahko pomenijo povečanje ogljičnega odtisa (hlajenje prostorov, povečana uporaba avtodomov, umetno zasneževanje) in so s tem potencialno oblike t.i. maladaptacije slovenskega turizma. Hkrati pa lahko slovenski turizem pričakuje največje spodbude s sistemskimi spremembami spodbujanja zelene mobilnosti, kjer sta pohodništvo in kolesarstvo osrednji obliki nizkoogljičnega turizma in ena izmed oblik prilagajanja na pričakovane spremembe zahtev turistov k bolj trajnostni ponudbi.

4 Ogljični odtis slovenskega turizma

Eden izmed osrednjih rezultatov projekta je bilo oblikovanje modela ocene ogljičnega odtisa slovenskega turizma, prilagojenega stanju dostopnih podatkov o turizmu, kot jih zbira Statistični Urad RS (Žnidaršič & Pozvek, 2023 (v tisku)). Analizirana so štiri področja turizma: prevoz do destinacije, nastanitve, doživetja oz. aktivnosti (kamor vključujemo tudi prevoz do doživetij) in prehranski sistemi.

Po modelu CRP projekta je delež prevoza turistov na destinacijo v celotnem ogljičnem odtisu slovenskega turizma za leto 2019 dobrih 70 %, vrednost aktivnosti 15 %, primarno zaradi prevoza po destinaciji, ki ga vključujejo aktivnosti, vrednosti nastanitev pa dobrih 10 %. Prehrana doda v skupni odtis dobre 3 %.



Slika 3: Ogljični odtis turizma Slovenije na letni ravni (2019)

Vir: izračun CRP modela v (Žnidaršič & Pozvek, 2023 (v tisku))

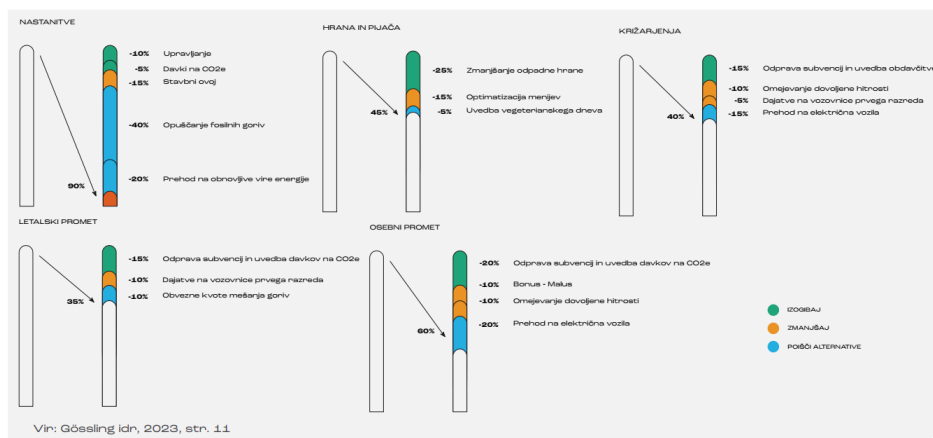
Prevoz do destinacije predstavlja tudi tri četrtine ogljičnega odtisa turistov, odvisno od razdalje in tipa prevoza. Rast turizma torej, ki je izpostavljena tudi v zadnji nacionalni strategiji razvoja turizma, ni združljiva s ciljem razpolovitve ogljičnega odtisa do 2030: vsaj dokler se korenito ne spremenijo sistemski pogoji prevoza turistov na destinacijo.

5 Priporočeni ukrepi blaženja podnebnih sprememb v turizmu

Resnost potreb po prilagajanju slovenskega turizma podnebnim spremembam ni vprašljiva je odvisna od nadaljnjih ukrepov za blaženje podnebnih sprememb, ki bodo določali t.i. scenarije projekcij podnebnih sprememb (RCP). Kateri scenarij se bo v resnici odvil, je odvisno od naporov na svetovni ravni. Če bodo izpusti toplogrednih plinov še naprej neustavljivo naraščali, bo potrebno prilagajanje na podnebne spremembe toliko intenzivnejše.

Rezultati pokažejo, da je potreben predvsem strateški fokus na prevozu turistov, ki zavzame največji delež ogljičnega odtisa slovenskega turizma. Na drugem mestu je potreben fokus na nastanitvah, kjer so pa potenciali hitrega doseganja ciljev do 2030 med vsemi področji turizma največji. Največji potencial za hitre spremembe je pri ogljičnem odtisu nastanitve. Po oceni (Gössling, Balas, Mayer, & Sun, 2023) lahko dosežemo celo do 90 % zmanjšanje ogljičnega odtisa nastanitve v turizmu do leta 2030 z ukrepi zmanjšanja porabe energije z boljšim upravljanjem in stavbnim

ovojem, opuščanjem fosilnih goriv in prehodom na obnovljive vire energije, pa tudi uvedbo obdavčitve izpustov toplogrednih plinov, glej Sliko 6).



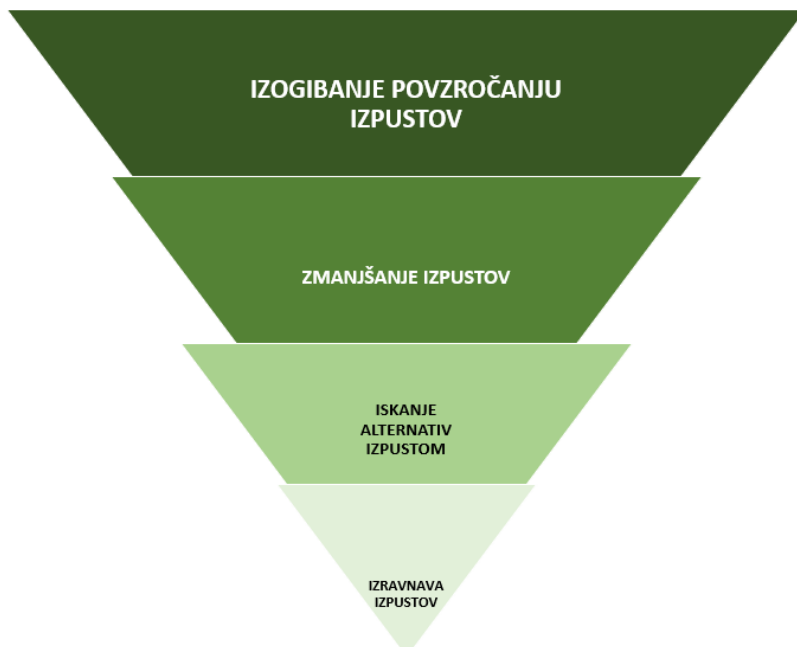
Slika 6: Potenciali ukrepov zmanjšanja ogljičnega odtisa glede na področje turizma

Vir: Gössling idr. 2023 v (Turnšek et al., 2024), str. 56

A največ ogljičnega odtisa turistov doprinese njihov prevoz. Dostopnost z železnico in javnim prevozom je nujna strateška usmeritev, kjer slovenski turizem žal izredno zaostaja in bo tja treba usmeriti največ moči in sredstev. Problem je kompleksen in poln paradoksov. Letala so npr. predstavljena kot del dražjega življenjskega stila, a so zaradi prepletenosti spodbud letalskemu prevozu in podhranjenosti investicij v železniški prevoz v resnici pogosto cenejša od vlakov. Kot je pred kratkim analiziral (Greenpeace, 2023), so vsaj v poletnem obdobju prevozi z vlaki med destinacijami po Evropi v več kot 70 % analiziranih prog dražji od prevozov z letali. Podnebju bolj prijazno potovanje z vlaki je tako žal privilegij: za tiste z več časa, več denarja in če gre za službeno potovanje, tiste z več moči.

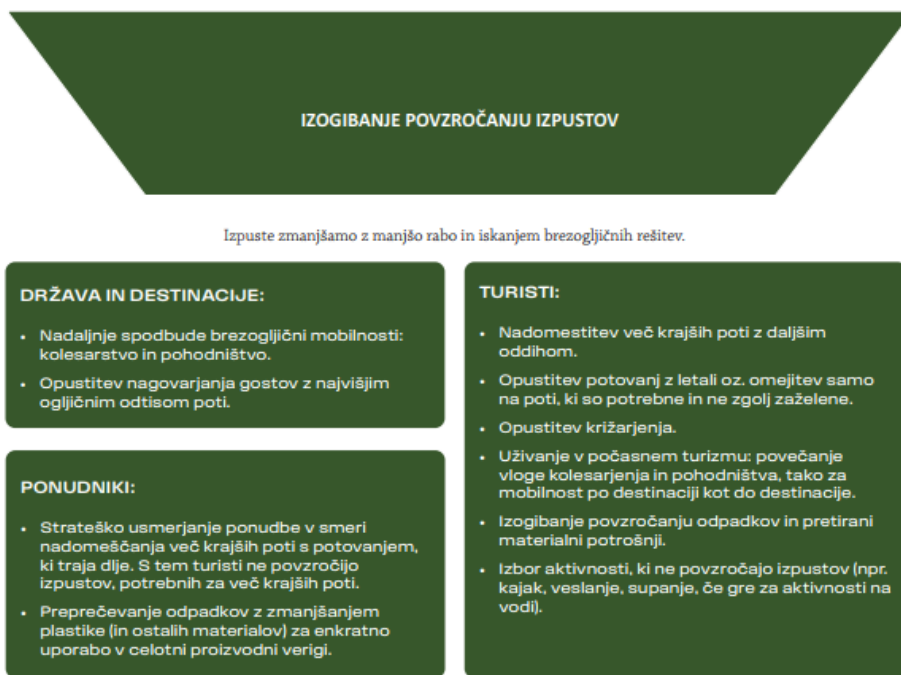
Priporočila za blažnje ogljičnega odtisa za osrednja področja slovenskega turizma, oblikovana v CRP Projektu »Podnebne spremembe in trajnostni razvoj slovenskega turizma« sledijo prioritetenemu vrstnemu redu: 1. izogibanje povzročanju izpustov toplogrednih plinov, (Avoid); 2. zmanjšanje izpustov (Reduce); 3. iskanje alternativ izpustom (Substitute); in 4. izravnava povzročenih izpustov (Remove = Compensate) (glej Sliko 5). Kot alternativo lahko predvsem namesto fosilnih goriv izberemo obnovljive vire energije, uporabljamo trajnostne materiale. Za izravnavo

se odločimo kot zadnjo možnost, če se izpustom res ne moremo izogniti ali jih občutno zmanjšati in poiskati alternativ. Pri tem sami ustvarimo ponore toplogrednih plinov ali plačamo preverjeno storitev, ki to obljublja (glej Slike 7 do 10).



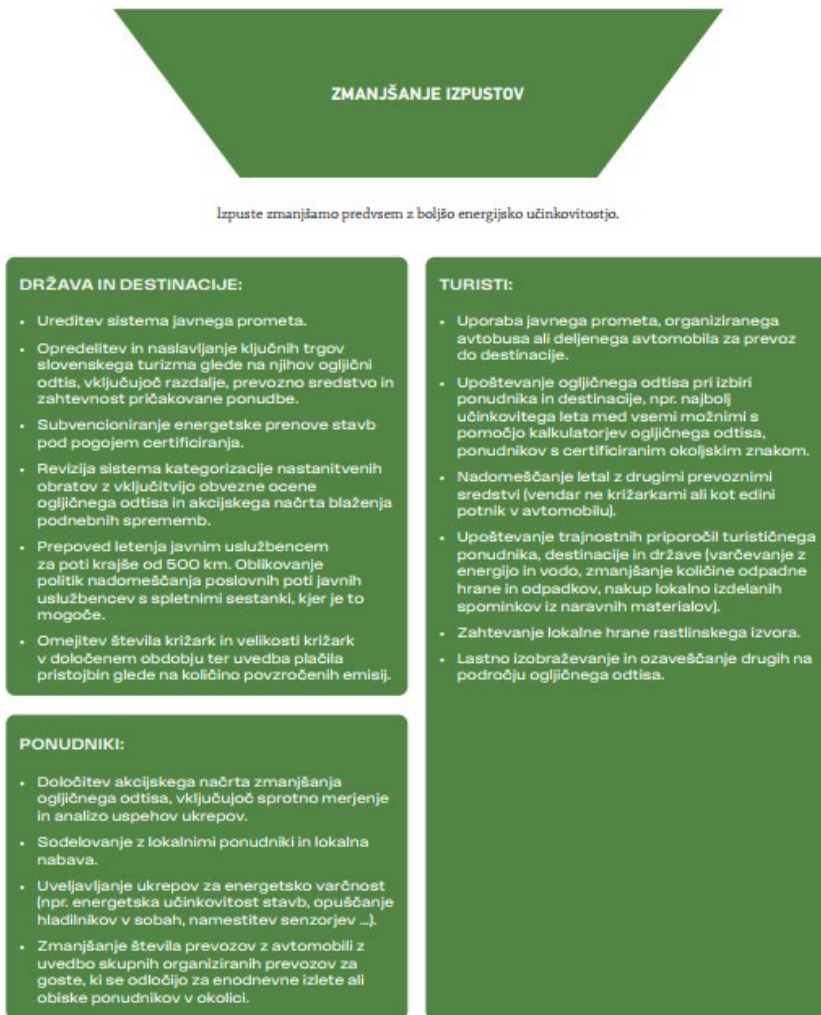
Slika 7: Hierarhija ukrepov blaženja podnebnih sprememb, 2021

Vir: (Turnšek et al., 2024), str. 43



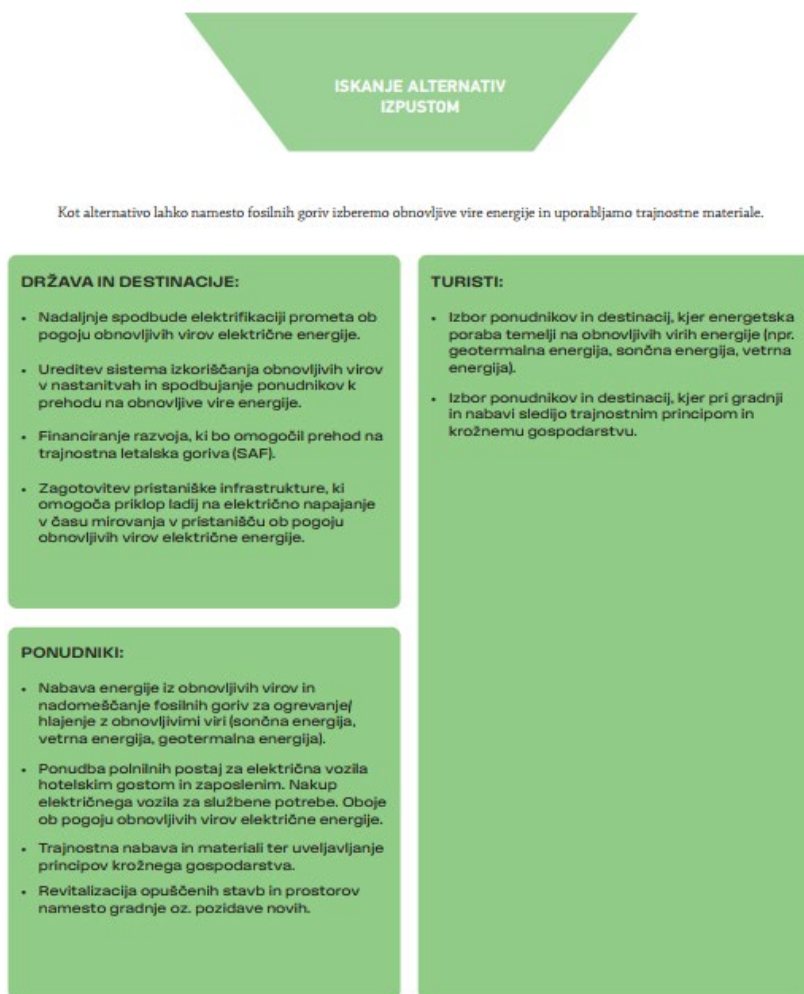
Slika 8: Ukrepi blaženja podnebnih sprememb, kjer se izogibamo povzročanju izpustov toplogrednih plinov v turizmu

Vir: (Turnšek et al., 2024), str. 44



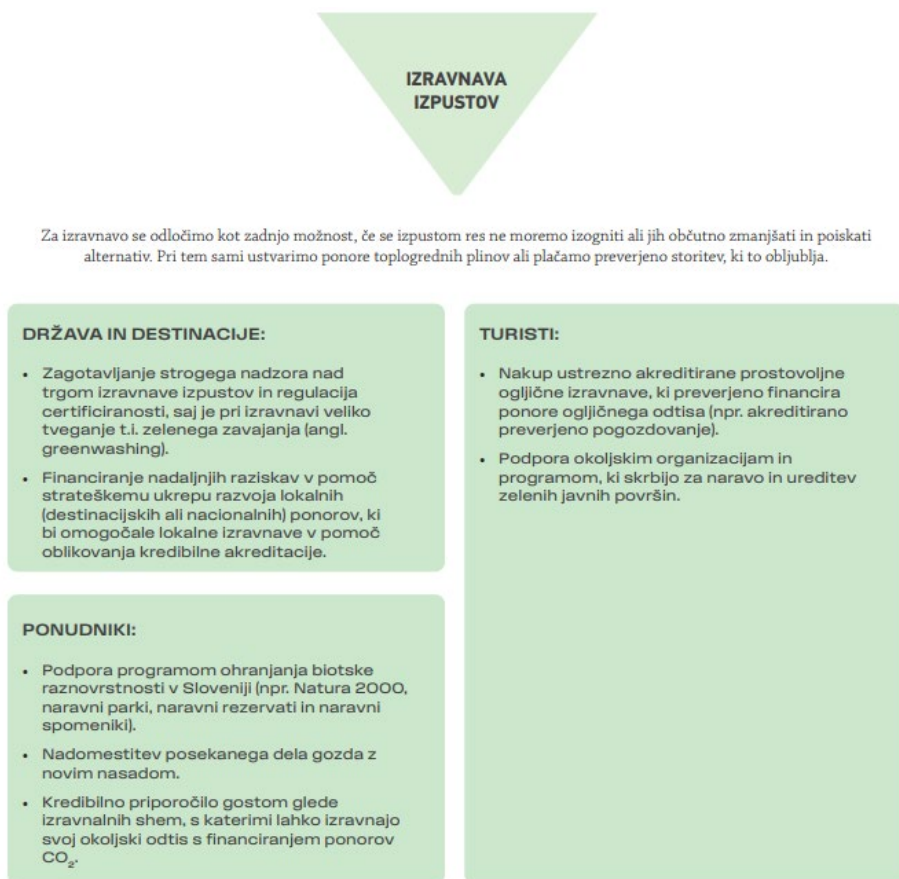
Slika 9: Ukrepi blaženja podnebnih sprememb, kjer zmanjšujemo izpuste toplogrednih plinov v turizmu

Vir: (Turnšek et al., 2024), str. 45



Slika 10: Ukrepi blaženja podnebnih sprememb, kjer iščemo alternative toplogrednim plinom v turizmu

Vir: (Turnšek et al., 2024), str. 46



Slika 10: Ukrepi blaženja podnebnih sprememb, kjer izpuste toplogrednih plinov v turizmu izravnavamo

Vir: (Turnšek et al., 2024), str. 47

Zahvala

Predstavljeni so rezultati CRP projekta »Podnebne spremembe in trajnostni razvoj slovenskega turizma« (ARIS V/7-2128), ki sta ga financirala Agencija za raziskovalno in inovacijsko dejavnost RS in Ministrstvo za gospodarstvo, turizem in šport RS. Zahvala gre v prvi vrsti vsem sodelavcem projekta (izvedba raziskave), Statističnemu Uradu RS (pomoč pri dostopu do podatkov) in Slovenski turistični organizaciji (večina slik uporabljenih v tem referatu je bila oblikovana s strani STO, ki je založila vodnik po podnebnih spremembah za slovenski turizem: »Podnebne spremembe in slovenski turizem: Priporočeni ukrepi prilagajanja podnebnim spremembam in blaženja podnebnih sprememb« (Turnšek et al., 2024).

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RAZISKOVALNA METODA ŠTUDIJA PRIMERA: IZKUŠNJE IZ MEDNARODNE POLETNE ŠOLE

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Organizacija raziskovalne metode študije primere v okviru mednarodnih poletnih šol je kljub številnim prednostim še vedno ena izmed bolj podcenjenih izobraževalnih aktivnosti. Študija primera omogoča delo v skupini, študij realnih problemov, razvoj analitičnega razmišljanja ter veščin javnega nastopanja in drugo. Mednarodne poletne šole se najpogosteje izvajajo s študenti in nudijo interdisciplinarno izobraževanje, mreženje, krepitev kulturnih in jezikovnih veščin, pridobivanje kompetenc, možnosti osebne rasti in drugo. Kljub temu, da imata raziskovalna metoda študija primera in mednarodne poletne šole številne pozitivne lastnosti se omenjeni aktivnosti redko in dokaj nesistematično izvajajo v visokošolskih inštitucijah. Namen članka je predstaviti praktične izkušnje s študijo primera kot raziskovalno metodo v kontekstu mednarodne poletne šole, ki jo Fakulteta za organizacijske vede Univerze v Mariboru izvaja že nekaj let. V prispevku so prikazane praktične izkušnje z organizacijo in izvedbo dogodka, delo s tujimi študenti, tehnične zahteve za izvedbo dogodka, aktivnosti s podjetjem, ki sodeluje na dogodku in drugo. Študija primera v okviru mednarodne poletne šole prinaša številne koristi tako za fakulteto, študente in podjetje, ki sodeluje pri dogodku.

Ključne besede:

mednarodna
poletna
šola,
študija
primera,
raziskovalna
metoda,
izobraževanje,
študentska
izmenjava,
timsko
delo

THE CASE STUDY RESEARCH METHOD: EXPERIENCES FROM AN INTERNATIONAL SUMMER SCHOOL

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Organizing the case study research method in the context of international summer schools is, despite its many advantages, still one of the more underrated educational activities. The case study enables team work, study of real problems, development of analytical thinking and public speaking skills, and more. International summer schools are most often conducted with students and offer interdisciplinary education, networking, strengthening of cultural and language skills, acquisition of competences, opportunities for personal growth and more. Despite the fact that the case study research method and international summer schools have many positive qualities, the aforementioned activities are rarely and rather unsystematically implemented in higher education institutions. The purpose of the article is to present practical experiences with the case study as a research method in the context of the international summer school, which the University of Maribor Faculty of Organizational Sciences has been conducting for many years. The article shows practical experience with the organization and implementation of the event, work with foreign students, technical requirements for the implementation of the event, activities with the company that participates in the event, and more. A case study in the framework of an international summer school brings many benefits for both the faculty, students and the company participating in the event.

Keywords:
international
summer
school,
case
study,
research
method,
education,
cultural
exchange,
teamwork

1 Uvod

Izobraževanje je izredno pomembno za vsakega posameznika in posledično tudi za celotno družbo in njen razvoj. Izobražen posameznik lahko bolje in učinkoviteje rešuje probleme s katerim se srečuje ter s tem poskuša rešiti več problemov kot jih ustvari. Izobraževanje poteka vse življenje. Nove tehnologije, novi zakoni, politične ureditve, kulturne spremembe in drugo so le nekatere zadeve, zaradi katerih se moramo nenehno izobraževati. Tekom izobraževalnega procesa, tako v osnovi in srednji šoli, kot tudi na fakulteti, smo deležni različnih tehnik in metod pedagoškega izobraževanja.

Eden izmed je pedagoških pristopov v izobraževanju je tako imenovano problemsko učenje. Značilnosti problemskega učenja je reševanje problemov, ki se pojavijo v resničnem svetu. Takšen pristop k delu v izobraževalnih institucijah je eden izmed bolj naravnih pristopov k učenju. Problemsko učenje (angl. problem-based learning) Duch, Groh in Allen (2001) opredeljujejo kot metodo, pri kateri se problemi iz resničnega sveta uporabijo za spodbujanje učencev pri učenju. Omenjena metoda spodbuja razvoj kritičnega razmišljanja, sposobnost reševanja problemov in komunikacijskih veščin. Prav tako omogoča delo v skupinah, iskanje in vrednotenje raziskovalnega gradiva in drugo. Razlika med tradicionalnim izobraževanjem in problemskim učenjem je v tem, da pri tradicionalnem (klasičnem) učenju poteka proces tako, da se študentom najprej poda snov. Ta korak se najpogosteje izvede v obliki predavanj. Sledi pomnjenje podane snovi in v nadaljevanju prikaz naučenega v obliki preverjanja znanja (ustno spraševaje, zagovori, izpit, kontrolna naloga, ...). Pri problemskem učenju je proces drugačen. Na začetku je podan problem, ki nudi izhodišče za nadaljnje raziskovalno delo. Nato študenti sami iščejo podatke, dokumente in posledično rešitev. Za razliko od tradicionalnega učenja je pri problemskem učenju profesor le v vlogi mentorja oz. svetovalca. Njegova naloge je zgolj usmerjanje dela in ne sodelovanje pri iskanju rešitve.

Ena izmed izpeljank problemskega učenja je tudi tako imenovana študija primera (angl. case study). Feagin, Orum in Sjoberg (1991) opredeljujejo študijo primera kot detajlno oz. podrobno raziskovanje določenega problema ali problemov, ki se pojavljajo v resničnem svetu. Problemi, ki jih rešujejo študenti so najpogosteje podani s strani podjetja ali pa so predhodno pripravljene in temeljijo na resničnih podatkih. Značilnosti študije primera so delo v skupini, delo pod časovnim pritiskom

oz. omejitvami, analitično razmišljanje in razmišljanje izven okvirjev (angl. out of the box). Študenti, ki sodelovanje pri študiju primera razvijajo veščine in znanja kot so (Rupnik, 2019): boljši razvoj ustnega in pisnega izražanja, krepitev veščin in sposobnost javnega nastopanja, retorične veščine, argumentacijske veščine, natančen razvoj in vpogled v predstavljen problem proučevanja, sposobnost iskanja novih rešitev, sposobnost iskanja virov in informacij, sposobnost dela pod časovnim pritiskom in kreativnost pri reševanju problemov. Klub omenjenim prednostim, pa se omenjena metoda dokaj redko izvaja v izobraževalnih inštitucijah, saj zahteva skrbno organizacijo, pripravo dokumentacije, pogostokrat koordinacijo s podjetjem, tehnično podporo in drugo.

Vse večja raven globalizacije in s tem posledično pomen medkulturnega sodelovanja večja pomen in potrebo po študentih, ki imajo mednarodne izkušnje. Internacionalizacija izobraževanja je logična posledica teh zahtev, ki se kaže v številnih aktivnostih in programih, ki jih izvajajo univerze. Glavna merila internacionalizacije izobraževalnega procesa na univerzah so (Kahanec, 2011): število študijskih programov v tujem jeziku; število gostujočih profesorjev iz tujine; odstotek tujih študentov, vpisanih v programe izmenjave glede na skupno število študentov zavoda; število domačih študentov, ki so v okviru izmenjav obiskali tuje univerze. Ena izmed dejavnosti internacionalizacije izobraževanja je izvajanje mednarodnih poletnih šol, ki nudijo številne prednosti za študent, ki takšno šolo ali program obiskujejo. Kot že samo ime pove se omenjene šole oz. dejavnosti izvajajo predvsem poleti v mesecih (avgust in september). Cooper, Charlton, Valentine in Muhlenbruck (2000) opredeljujejo poletno šolo kot izobraževanje ali program, ki ga najpogosteje sponzorira in organizira izobraževalna inštitucija ali zasebno podjetje in nudi izobraževanje med poletnimi počitnicami. Tako kot za metodo študija primera, lahko tudi za mednarodne poletne šole trdimo, da niso pogosta praksa v izobraževalnih inštitucijah. Mednarodne poletne šole so pomembne za izobraževalno, kulturno in družbeno aktivnost študentov in izobraževalne organizacije. Naj izpostavimo, da mednarodne poletne šole omogočajo udeležencem razvijati in razumeti različne kulture in kulturna okolja. Krepijo razvoj tujega jezika, predvsem angleškega. Z udeležbo na mednarodni poletni šoli udeleženci spoznajo vrstnike s celega sveta, kar jim lahko olajša morebitno mednarodno sodelovanje v kasnejšem poklicem življenju. Programi poletnih šol omogočajo delno simulacijo znanstvenih aktivnosti namenjenim študentom, ki delajo na aktualnih temah s podporo in vključevanjem priznanih profesorjev in strokovnjakov z univerz po

svetu. Značilnost izobraževanja v poletni šoli je uporaba metod in kreativnih tehnik, vključno s skupinskimi projekti, ekskurzijami, razpravami, interaktivnimi predavanji in študijami primerov (Demeshkant, Dankevych in Tuzhyk, 2015).

Izvedba obeh omenjenih izobraževalnih aktivnosti, metode študije primera in mednarodne poletne šole, zahtevata velike organizacijske napore. Poleg tega je potrebno poznati kako se pravilno pripravi študija primera, kar še otežuje njeno uporabo in izvedbo na mednarodnih študentih. Zato je kombinacija obeh precej težka naloga. Namen prispevka je osvetliti, kako raziskovalno metodo študija primera uporabiti v okviru mednarodne poletne šole in ponuditi strokovni in izobraževalni sferi izkušnje, ki si jih je v nekaj letih nabrala Fakulteta za organizacijskem vede Univerze v Mariboru (FOV UM).

2 Raziskovalna metoda študija primera

V McCombes (2023) študijo primera opredeli kot študij določenega problema, ki se lahko navezuje na osebo, skupino, kraj, dogodek, organizacijo ali pojav. Študije primerov se običajno uporabljajo v socialnih, izobraževalnih, kliničnih in poslovnih raziskavah. Najpogosteje vključujejo kvalitativne metode, včasih pa tudi kvantitativne metode. Študije primerov so namenjene za opisovanje, primerjavo, ocenjevanje in razumevanje različnih vidikov raziskovalnega problema. Mesec in Lamovec (1998) v svojem delu razdelita študijo primera na več kriterijev in več različnih vrst glede na: (1) naravo posameznega primera (posameznika, družbe, organizacije, postopkov, kulturnih proizvodov, ...); (2) število primerov, ki jih proučujemo (en ali več primerov); (3) sestavo študije primera, ki se deli na enostavno ali sestavljeno enoto, kjer enostavna enota predstavlja recimo majhno podjetje, sestavljena enota pa večjo organizacijo ali podjetje ipd.; (4) vrsto empiričnega gradiva, ki se deli na: primarno (gradivo dobimo z opazovanjem ali spraševanjem); sekundarno (gradivo predstavljajo objavljeni dokumenti); kombinirano.

McCombes (2023) priporoča, da se študija primera organizira in pripravi v štirih glavnih korakih, ki so: izbira primera problema oz. izziva; izgradnja teoretičnih osnov, ki so potrebne za izvedbo študije primera; zbiranje vse potrebnih podatkov; opisovanje in analiziranje študije primera. V okviru metode študije primera se najpogosteje obravnavajo problemi z izobraževalnega področja, ki ga pokriva neka izobraževalna inštitucija. Obravnavani problemi naj temeljijo na realnih podatkih.

Najbolj priporočljiva pa je organizacija in izvedba študije primera s partnerskim podjetjem, ki predstavi realen problem. Problem je v nadaljevanju ustrezno predstavljen študentom, ki imajo na voljo določen čas za študij problema in oblikovanje rešitve.

3 Študija primera v okviru mednarodne poletne šole

Fakultete za organizacijske vede Univerze v Mariboru je v letu 2023 organizirala že tretji dogodek Študija primera v okviru mednarodne poletne šole. Sodelovanje na mednarodni poletni šoli je brezplačno. V okviru mednarodne poletne šole potekajo različna izobraževanja, katerim skupni imenovalec so odlični profesorji s svojega področja in aktualne ter zanimive tematike. Nekatere izmed področij, ki so bila predstavljena mednarodnim študentom na zadnji poletni šoli v letu 2023 so s področij kot so (Faculty of Organizational Sciences UM, 2023): trendi v informacijskih sistemih, vizualizacija podatkov, izzivi kadrovskega managementa, trendi v organizaciji in managementu, ustvarjalnost v dobi umetne inteligence, kadrovski management in umetna inteligenca, inženiring poslovnih sistemov in umetna inteligenca, čustvena inteligenca in vodenje, trženje v mednarodnem okolju in vedenje potrošnikov, igrifikacija, medkulturna komunikacija in drugo. Poleg naštetih predavanj in izobraževanj se v okviru mednarodne poletne šole študente izobrazijo tudi s področja metode študije primera. Izobraževanje obsega osnovna znanja o tem, kaj je metoda študije primere, kakšno so razlike med klasičnim oz. tradicionalnim učenjem in študijo primera, kakšne so prednosti za študente, fakulteto in partnersko podjetje, vizualni prikaz celotnega dogodka, predlog kako izdelati prezentacijo in kako jo strukturirati in drugo.

Vsak dogodek, ki ga neka izobraževalna organizacija ali podjetje izvede zahteva določen čas in energijo v takšni ali drugačni obliki. Zato je pomembno in potrebno, da se predhodno opravijo analize ali vsaj temeljit premislek o smotnosti in prednostih, ki jih takšen dogodek prinaša. V svoji metaanalizi Cooper, Charlton, Valentine in Muhlenbruck (2000) ugotavljajo, da aktivna udeležba na poletnih šolah v povprečju zviša kasnejše študijske dosežke in uspehe študentov. Poleg omenjenega obstajajo tudi številne druge prednosti za vse udeležence študije v primera v okviru mednarodne poletne šole. Prednosti za študente, ki sodelujejo na študiji primera v okviru mednarodne poletne šole: možnost navezovanja stikov s študenti po svetu; uporaba osvojenega teoretičnega znanja na praktičnem oz. realnem primeru; razvoj

analitičnega razmišljanja in generiranje idej izven okvirjev (out of the box); reševanje konkretnih problemov, ki jih predstavi podjetje; spoznavanje svoje vloge v ekipi, ki rešuje nek problem; delo pod časovnim pritiskom brez dejanskih posledic in drugo.

Omeniti velja, da so za udeležbo študentov na dogodku študija primera v okviru mednarodne poletne šole, izjemno pomembne in motivacijske tudi tako imenovane ECTS točke (angl. European Credit Transfer and Accumulation System). V primeru mednarodne poletne šole, ki jo organizira Fakulteta za organizacijske vede lahko študenti pridobijo 3 ECTS točke. ECTS točke so opredeljene kot (European Commission, 2023): »Evropski sistem prenašanja in zbiranja kreditnih točk (ECTS) je orodje evropskega visokošolskega prostora, ki zagotavlja večjo preglednost študijskih programov in tečajev. Z njegovo pomočjo se študenti lažje premikajo med državami in dosežejo priznanje svojih akademskih kvalifikacij in študijskih obdobj in v tujini. ECTS omogoča, da se kreditne točke, zbrane na eni visokošolski instituciji, upoštevajo pri študiju na drugi. Kreditne točke predstavljajo učne rezultate na podlagi opredeljenih učnih dosežkov in povezane delovne obremenitve.«

Prednosti za fakulteto, ki organizira študijo primera v okviru mednarodne poletne šole so: večja vpetost v mednarodno okolje; boljša prepoznavnost fakultete v svetu; sodelovanje s podjetjem oz. gospodarstvom daje fakulteti večji ugled; razvoj organizacijskih sposobnosti zaposlenih na fakulteti; krepitev mednarodnega sodelovanja; povezovanje z drugimi profesorji in/ali mentorji; prednosti in ugodnosti pri akreditaciji programov in drugo.

Prednosti za podjetje ali organizacijo, ki je sponzor oz. partner tekmovanja v študiju primera v okviru mednarodne poletne šole so: večja prepoznavnost podjetja tako v domačem kot mednarodnem prostoru; večja prepoznavnost izdelkov in storitev, ki jih ponuja podjetje; možnost identifikacije, selekcije in nabora najboljših študentov; identifikacija in nabiranje idej, ki jih pokažejo študenti; druge možnosti sodelovanja podjetja in fakultete; sodelovanje v raziskavah in drugo.

V nadaljevanju so prikazani najpomembnejši vidiki, ki so pomembni pri organizaciji študije primera.

3.1 Konceptualni vidik

Celoten dogodek študija primera, ki se odvija v okviru mednarodne poletne šole je razdeljen na dva dela in sicer na izobraževanje in tekmovanje. Prvi del je izobraževanje, ki poteka v predavalnici in sicer v živo, kjer se mednarodnim študentom predstavi oz. poda osnovna znanja o tem kaj je metoda študije primera, kakšno so razlike med klasičnim oz. tradicionalnim učenjem in študijo primera, kakšne so prednosti za študente, fakulteto in partnersko podjetje, vizualni prikaz celotnega dogodka, predlog kako izdelati prezentacijo in kako jo strukturirati in drugo. Izobraževanje poteka v angleškem jeziku in je omejeno na nekaj ur. Sledi žreb vrstnega reda ekip, po katerem bodo na dan tekmovanja študenti predstavljali svoje rešitve. Po koncu izobraževanja, podjetje, ki je partner dogodka predstavi problem oz. izziv. Problemi so najpogosteje s področja nabave, prodaje, marketinga ali digitalnega marketinga, organizacije, planiranja, vodenja, odnosi z javnostmi, motiviranja in drugo.

Drugi del dogodka, torej tekmovanje, je namenjen predstavitvi končnih rezultatov oz. izdelkov študentov. Tekmovanje je izvedeno na daljavo in sicer s pomočjo orodja MS Teams. Študentske ekipe predstavljajo svoje rešitve glede na vrstni red, ki je bil predhodno določen v žrebu. Minimalno število študentov v ekipi je tri, maksimalno pa pet. Vsaka ekipa ima na voljo 15 minut za predstavitev svoje ideje. Zaradi časovne vzdržnosti pa je število ekip omejeno na osem. Za predstavitev se najpogosteje uporablja PowerPoint. Po koncu vsake predstavitve ima ocenjevalna komisija čas za postavitev vprašanj. Komisija je sestavljena iz predstavnikov podjetja in članov fakultete. Ocenjevalna komisija ocenjuje predstavljene izdelke študentov po štirih kriterijih in sicer: realna izvedljivost predstavljene rešitve, razumevanje problema študije primera, struktura in kvaliteta prezentacije in znanje in odgovori na vprašanja. Po koncu zadnje predstavitve se komisija umakne v poseben MS Teams kanal, kjer se pogovori in določi zmagovalne tri ekipe. Po končanem posvetovanju se komisije zoper vrne v glavni kanal, kjer je potekalo tekmovanje, ter razglasi zmagovalne ekipe.

3.2 Tehnični vidik

Za uspešno organizacijo dogodka je potrebno suvereno obvladovati tehnologijo, ki omogoča organizacijo celotnega dogodka in delo na daljavo. Za potrebe komunikacije z ekipami se uporablja elektronska pošta in uradna spletna stran dogodka, ki je v angleškem jeziku. Komuniciranje preko elektronske pošte poteka s posamezniki ali ekipami. S pomočjo pošte se jih obvešča o pomembnih datumih, aktualnih spremembah in drugo. Prav tako se jim preko pošte pošilja vsa potrebna dokumentacija. Študentom je omogočeno tudi delo v računalniških učilnicah, kjer lahko pripravijo svoje prezentacije. Najpogosteje se za ta del uporablja PowerPoint. Za delo na daljavo (npr.: faza tekmovanja) pa je nujno potrebno obvladovanje programskega orodja MS Teams. Pomembno je, da se predhodno ekipam pove, da je potrebno osnovno znanje dela z MS Teams, kot je prijava v sistem, delitev ekrana, pisanje v klepet in drugo. Fakulteta ima na voljo tudi tehnično podporo z izkušenimi strokovnjaki, ki ob morebitnih težavah priskočijo na pomoč.

3.3 Pravni vidik

Organizacija vsakega dogodka nosi s seboj določeno odgovornost in odgovorne osebe. Dogodek, ki ga opisujemo je izobraževalni dogodek in zato ni velikega tveganja za probleme ali težave, ki lahko nastopijo pri drugih dogodkih. Zaradi velikega števila udeležencev, zbiranja podatkov, postopka fotografiranja in objavljanja fotografij na spletu je izredno pomembno, da so udeleženci seznanjeni s pogoji in se z njimi strinjajo, kar je urejeno z GDPR uredbo. Vsake udeleženec se strinja s pogoji sodelovanja, kar se potrdi z njegovim podpisom. V vsaki predavalnici, kjer potekajo izobraževanja pa so obešene informacije z listi, ki pravno opredeljujejo dogajanje v prostoru, skladno z GDPR uredbo oz. Splošno uredbo o varstvu podatkov, ki je znana pod kratico GDPR (angl. General Data Protection Regulation), ki je namenjena oblikovanju pravil povezanih z varstvom osebnih podatkov v Evropski uniji (UREDBA (EU) 2016/679 EVROPSKEGA PARLAMENTA IN SVETA, 2016).

3.4 Organizacijski vidik

Za potrebe organizacije dogodka, se imenuje in sestavi organizacijski odbor, ki ima svojega predsednika ali predsednico. Osebe, ki sodelujejo v odboru skrbijo za pravne, tehnične, administrativne, organizacijske in druge zadeve, ki so potrebne za organizacijo in izvedbo dogodka. Poleg organizacijskega odbora je z vidika organizacije pomembna tudi sestava ocenjevalne komisije, ki je najpogosteje sestavljena iz predstavnikov podjetja in fakultete. Vsi našteti, morajo zaradi narave dogodka, obvladati tuj jezik, ki je v našem primeru angleški.

4 Zaključek

V prispevku je prikazana metoda študije primera, ki jo izvaja Fakulteta za organizacijske vede Univerze v Mariboru v sklopu svoje mednarodne poletne šole. Namen celotne aktivnosti je ponuditi mednarodnim študentom boljši vpogled in razumevanje medkulturnih razlik, načinov izobraževanja in sodelovanja v mednarodnih skupinah. Študija primera kot izobraževalna metoda ima številne prednosti tako za študente, profesorje in podjetja, ki sodelujejo pri tem dogodku. Kot je že bilo omenjeno v prispevku se v okviru mednarodne poletne šole, ki je namenjena tujim študentom in profesorjem, odvijajo različna predavanja, ki jih izvedejo tako domači kot tuji strokovnjaki in profesorji. S tem si študenti pridobijo bogate in neprecenljive mednarodne izkušnje, saj je mednarodna šola za nekatere edini način, da se udeležijo mednarodne izmenjave med študijem. S takšno izkušnjo se krepi tako teoretično kot praktično znanje. Študenti, ki obiskujejo takšne poletne šole so bolj konkurenčni na trgu zaposlitve. Z aktivnim delom na dogodku študija primera se študentom razvijajo številne kompetence in veščine, ki so specifične za mednarodna okolja. Prav tako se krepijo medosebni odnosi in stiki s študenti ter profesorji po vsem svetu, kar ima lahko veliko pozitivno vlogo v kasnejšem poklicnem življenju. Z aktivno udeležbo in sodelovanjem pri študiju primera se študenti srečajo z dokaj novimi metodami poučevanja in raziskovanja, kamor metoda študija primera zagotovo spada.

Dogodek študija primera v okviru mednarodne poletne šole pa ima prednosti tudi za profesorje. Splošno znano je in to ugotavlja tudi strokovna in znanstvena literatura, da se izobraževalni dosežki pri študentih, ki imajo slabši uspeh med poletnimi počitnicami še poslabšajo (McCombs in drugi, 2011). Udeležba na poletni

šoli omogoča vključevanje študentov med poletnimi počitnicami v aktivnosti, ki krepijo njihovo izobraževalno aktivnost. Vodstva izobraževalnih institucij lahko izrabijo organizacijo poletne šole kot ogrodje za pomoč študentov s slabšim uspehom kot dodatno podporno okolje in program, ki takšnim študentom pomaga (McCombs in drugi, 2011). Vključevanje študentov v poletno šolo pa samo po sebi še ne zagotavlja boljših izobraževalnih rezultatov. Zato je pomembno, da so študenti ustrezno motivirani (Borman, Benson in Overman, 2005).

Organizacija študije primera v okviru mednarodne poletne šole je koristna tudi za osebe, ki na fakulteti sodelujejo pri organizaciji in izvedbi celotnega dogodka z vidika razvoja organizacije dogodkov. Organizacija dogodka, kjer sodelujejo tuji študenti in profesorji zahteva bistveno več načrtovanja in aktivnosti kot običajni dogodki, kjer sodelujejo domači študenti, ki so seznanjeni z jezikom, okoljem in običaji. Zato so takšni dogodki odlično izhodišče za nabiranje izkušenj glede organizacije, razumevanja tehničnih in pravnih zahtev za podporo takih dogodkov.

Vsek dogodek ima svoje pozitivne in negativne vidike, ki vplivajo na izkušnjo udeležencev. Zato je priporočljivo, da se, tekom dogodka ali po dogodku, zbere čim več povratnih informacij, ki jih posredujejo udeleženci. V ta namen se priporoča anketiranje po koncu dogodka. V anketnih listih se naj zajame zadostno število vprašanj, ki pokrivajo širok spekter dogodka. In sicer z vidika organizacije, tehnične podpore, namestitve, prehrane, ob študijske dejavnosti in drugo. Zbrane informacije nam lahko služijo kot evalvacija za izboljšanje naslednjega dogodka. Poleg anketiranja je priporočljivo zbirati informacije o udeležencih tudi na druge načine. Eden takšni je izvajanje neformalnih razgovorov tekom dogodka, kar zahteva angažiranost zadostnega števila oseb in empatijo. Znano je, da v anketah udeleženci zaradi vljudnosti pogosto ne povedo vseh negativnih zadev. V osebni komunikaciji pa lahko takšne negativne izkušnje udeležencev bolje zaznamo oz. opazimo.

Izkušnje, ki smo jih v preteklih letih dobili pri organizaciji raziskovalne metode študije primere v okviru mednarodnih poletnih šol, omogočajo razvoj oz. nadgradnjo omenjenega dogodka. Boljša utečenost in usklajenost organizacije dogodka (hitrejša administracija, boljša tehnična podpora, vključenost v družbeno okolje in drugo) omogočajo, da lahko na bodoče dogodek povabimo oz. sprejmemo večje število udeležencev kot v preteklosti. Zaradi fleksibilnosti, ki jo omogoča informacijsko komunikacijska tehnologija bi lahko, razvojno gledano, določene

aktivnosti prenesli na daljavo, kar ima za posledico manjše stroške nastanitve in manjšo obremenjenost osebja, ki sodeluje pri organizaciji. Analiziranje podatkov pridobljenih iz anket in razgovorov ter interpretacija rezultatov pa lahko nudijo osnovo za prilagajanje programov pri organizaciji celotne mednarodne poletne šole. Z razvojnega vidika dogodka pa je priporočljivo aktivno spremljanje in primerjanje z drugimi mednarodnimi poletnimi šolami, ki se organizirajo po svetu.

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THE IMPACT OF THE COVID-19 PANDEMIC ON LIQUIDITY LOAN DEMAND AT THE CROATIAN BANK FOR RECONSTRUCTION AND DEVELOPMENT

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The sudden outbreak of the COVID-19 pandemic in March 2020 had negative effects on almost all aspects of life. In addition to health and social sectors, the most significant consequences were experienced in the economy, as tight restrictions to curb the spread of the pandemic were implemented worldwide. Due to a significant decrease in business activities and a lack of income, most entrepreneurs encountered serious problems in maintaining liquidity and preserving their business. To mitigate the adverse impacts of the pandemic, the Government of Croatia implemented a series of measures to assist entrepreneurs, and the support for liquidity financing through loan programs offered by the Croatian Bank for Reconstruction and Development (HBOR) was one of the most crucial initiatives. The aim of this work was to investigate the impact of the COVID-19 pandemic on liquidity loan demand at the Croatian Bank for Reconstruction and Development (HBOR). More precisely, the intention was to examine the extent to which the pandemic influenced the allocation of liquidity loans with the HBOR, which as a state bank played a key role in providing financial support to entrepreneurs during those challenging times. The research was conducted on two groups of entrepreneurs in the period from 2019 to 2020. Descriptive statistics methods and F-test were used in the analysis, and the Student's t-test was employed to test the hypothesis.

Keywords:
HBOR,
COVID-19,
liquidity,
demand,
entrepreneur

1 Introduction

With the onset of the COVID-19 pandemic in March 2020, Croatia and the rest of the world faced a problematic situation which had adverse effects on health, economy and social aspects of life. In addition to the immediate impact of the pandemic itself, almost all countries had to introduce additional restrictive measures, including the closure of entire economic sectors, which intensified the negative effects that the pandemic exerted on local economies (Vareško, Zubin 2021).

The impact of the pandemic, coupled with the introduction of restrictive measures, created economic uncertainty among entrepreneurs, and economies around the world faced very demanding economic challenges. Business closures, reduced spending and supply chain disruptions resulted in a drop in demand and a significant decrease in business activity across many sectors, and an added pressure was placed on corporate liquidity, reducing the companies' ability to meet short-term liabilities.

Companies faced a decline in income, which led to problems in loan repayment. Consequently, financial institutions became more cautious and stringent in granting new loans, fearful of the heightened risk of non-payment during the pandemic.

In this new situation, companies found it difficult to access additional capital. At the same time, there was a significant increase in demand for short-term liquidity loans and financial support, in order to overcome problems with liability payments resulting from restrictions and a decline in income.

Commercial banks almost stopped granting new loans, offering only moratoriums on the existing ones, while liquidity loans in commercial banks became almost inaccessible to entrepreneurs.

In addition, banks were forced to ensure specific strategies so that economic and financial mechanisms can continue to function, both during the pandemic and in the post-pandemic period (Marcu 2021).

In response to the emerging crisis, governments and central banks in many countries, including Croatia, took certain measures to facilitate access to finance and provide liquidity in the financial sector. The aim was to support entrepreneurs in

overcoming liquidity problems caused by restrictions and business decline. In Croatia, financial support to entrepreneurs was provided by the Government in cooperation with competent state agencies and development banks, which means that the provision of liquidity for the economy was largely carried out through the HBOR. The Croatian Bank for Reconstruction and Development (HBOR) is a development bank and export credit agency of the Republic of Croatia whose main task is to stimulate the development of the Croatian economy. It was founded in 1992 and is entirely owned by the Republic of Croatia (“HBOR”, date not specified).

Despite its primary orientation to financing investments and development of businesses, the HBOR had to modify its lending programs and procedures quickly in order to address the urgent needs of entrepreneurs affected by the COVID crisis. The implementation of more flexible lending conditions, expedited loan approval processes and the extension of repayment periods were the key instruments that enabled companies to adapt their financial obligations to the new circumstances. Therefore, the HBOR played a crucial role in providing financial support to companies during the pandemic.

For that reason, the aim of this article was to explore how the pandemic affected liquidity loan demands at the HBOR, i.e. to examine if there was any significant increase in demand and allocation of the HBOR’s liquidity loans.

2 Previous research

There is a limited number of research articles examining the impact of COVID-19 on the banking and liquidity lending segment in Croatia, particularly with regard to the HBOR, which has not been the subject of research in Croatian scientific literature thus far. Therefore, this work aims to contribute to research that explores the impact of the pandemic on the demand for loans to finance the liquidity of entrepreneurs in the Republic of Croatia, as liquidity was the most affected aspect of business operations of the Croatian entrepreneurs during the COVID-19 pandemic.

A larger number of the Croatian authors concentrated on examining the impact of the pandemic on the Croatian economy and economic segments such as tourism, trade and transport, while only a small proportion of authors explored the urgent needs of entrepreneurs for liquidity financing to sustain their business.

Čavrak (2020) was one of the first authors who analyzed the influence of the pandemic on the Croatian economy, investigating the macroeconomics of the crisis caused by the COVID-19 and proposing potential solutions. His paper describes and clarifies the modalities of the impact of the health shock on the economy, as well as the macroeconomic mechanisms for recovering from the crisis. Rogić Dumančić, Bogdan and Raguž Krištić (2020) provided a valuable insight into the main macroeconomic effects of the COVID-19 shock in Croatia, but also in other EU member states. Their paper analyzed the impact of the pandemic on the GDP, delving into its most important components. In addition, it examined the effects of the pandemic on the Croatian banking and public sector.

Roška, Buneta and Papić (2021) analyzed the effect of COVID-19 on the Croatian economy on a sample of 358 entrepreneurs from private and public sectors, focusing on the decline in employment, the number years required for recovery, and the decline in GDP. They also examined the differences and similarities with the global economic crisis of 2008.

Some authors researched how the COVID-19 pandemic in Croatia affected various economic aspects. For instance, they analyzed the impact on consumption in retail trade (Končar et al., 2020), and the impact on the tourism sector including the resilience of tourism to pandemic events (Payne et al., 2020).

Vareško and Zubin (2021) examined the impact of the COVID-19 pandemic on hospitality sector in the County of Istria. The research was conducted on a sample of 60 micro and small hospitality entrepreneurs in the period from 2018 to 2020. The findings pointed to significant deterioration in businesses in 2020, which was attributed to the impact of the pandemic.

Kunji and Stojanović (2021) gave an overview of the impact of the pandemic on particular economic indicators at the international and national level, including gross domestic product, international trade, tourism, etc.

Žunić Kovačević (2021) explored the impact of the pandemic on the fiscal system and taxation in Croatia, examining also the consequences of the anti-pandemic measures.

Arčabić (2021) conducted research simulating the foreign shock and assessing the recession's impact on the national GDP across various industry sectors. The research demonstrated that the foreign shock on the GDP was most pronounced in sectors such as construction, trade, transport and warehousing, tourism and hospitality, and the manufacturing industry. It had a weaker impact on the agriculture and forestry sectors, and the lowest impact on public sector, real estate business, finance and insurance.

The COVID-19 period also exerted damaging effects on the business continuity of banks, which was examined in some of the research.

Muparadzi and Rodze (2021) showed that interruptions in the business continuity within the banking sector had varying effects, which were more serious than in other sectors. The reason is that interruptions in banking operations during the periods of crisis can shake up the entire financial system of a country and, consequently, the global financial system.

Manovelo (2020) analyzed the recommendations issued by the Government of Croatia at the onset of the pandemic, which had been accepted by the majority of banks on the Croatian market, such as: moratorium on loan repayment, introduction of additional liquidity loans, refinancing of existing loans, etc.

3 Sampling method

In this research, we analyzed two samples, i.e., two groups of business entities that used the HBOR loans during 2019 and 2020. The purpose of this research was to determine the impact of the COVID-19 pandemic on liquidity loan demand at the Croatian Bank for Reconstruction and Development (HBOR). More precisely, it aimed to examine whether the demand increased in 2020 as compared to the pre-pandemic year of 2019. The first sample consisted of 227 business entities that used the HBOR loans in 2019, and the second sample consisted of 196 business entities that used the HBOR loans in 2020. The research was thus carried out on two

independent samples of different sizes; the first included 227 out of 1,740 (13%) of loans granted in 2019, and the other included 196 out of 1,209 (16%) of loans granted in 2020. Data on the number, type and amount of loans granted, which had been provided by the Croatian Bank for Reconstruction and Development, were used for the analysis and calculation (HBOR, 2023).

4 Research methods and hypothesis

The empirical research relied on the data on the HBOR loans used during 2019 and 2020. Analysis and comparison of the results was carried out using descriptive statistics methods, while hypothesis testing was performed using the Student's t-test. After calculating the arithmetic mean, standard deviation and variance for both samples, the resulting measures were analyzed and tested to determine whether there was a deviation of the mean values, and if so, whether the deviation was statistically significant. The available literature, as well as some secondary sources, suggested that the COVID 19 pandemic had negative effects on the liquidity of business entities in Croatia. Given these findings, the analysis was carried out to determine whether the COVID-19 pandemic resulted in an increase in liquidity loan demand at the Croatian Bank for Reconstruction and Development (HBOR), as it was a bank that played a key role in supporting entrepreneurs in Croatia during the pandemic. A two-way t-test for two independent samples was used to test the hypotheses.

4.1 Hypotheses

In the research process, the following hypotheses were established:

H0: The liquidity loan demand at the HBOR did not change due to the impact of the COVID 19 pandemic.

H1: The liquidity loan demand at the HBOR changed or increased as a result of the COVID-19 pandemic.

5 Results and discussion

First, a summary was made of the total approved loans during the observed period, categorizing business entities based on the purpose, amount, and number of loans used. The categorizing was carried out to gain a deeper insight and determine the number of loan users as well as the volume of liquidity loans in comparison to other types of loans. The summary is given in the following tables.

Table 1: Overview of approved loans in 2019 and 2020

Investments / working capital	Year 2019			Year 2020		
	Number of loans	millions of EUR	(%)	Number of loans	millions of EUR	(%)
Investments	1526	588	80%	702	358	51%
Liquidity	214	147	20%	507	346	49%
Total:	1,740	735	100%	1,209	704	100%

Source: author's work

These data suggest that the total number of loans decreased in 2020 when compared to 2019, with only a minimal difference in the amounts allocated in the observed years. There was also a smaller number of approved investment loans in 2020, with a simultaneous increase in liquidity loans, while in 2019 the amount of investment loans was significantly higher.

These data unequivocally show that the structure of realized loans at the HBOR underwent a change due to the impact of the COVID-19 pandemic. Specifically, there was a decrease in the number and amount of investment loans, accompanied by an increase in both the number and amount of liquidity loans.

Therefore, in just a few months, the HBOR was forced to change its long-standing business orientation, and turn from an investment bank into a bank that primarily supports liquidity. These efforts required additional engagement of employees at all levels.

For the purpose of further research, Tables 2 and 3 present an overview of the loans used. To ensure data transparency, loans were categorized by type and amounts per each year. Table 2 presents investment loans for 2019 and 2020, while Table 3 shows liquidity loans in the same period.

Table 2: Overview of investment loans from 2019 and 2020 samples

Investment loans			
2019		2020	
loan amount in thousands of EUR	number of loans	loan amount in thousands of EUR	number of loans
4,562	5	7,961	3
6,651	6	10,614	3
8,652	5	19,902	4
11,617	5	26,536	3
13,436	5	79,608	3
15,000	11	92,876	4
16,123	9	159,217	4
20,446	5	199,021	4
23,093	9	265,361	5
30,000	5	398,042	4
40,309	6	2,653,612	3
67,181	5	4,776,501	3
82,010	5		
94,053	10		
134,362	7		
201,543	5		
268,724	8		
335,905	5		
671,810	5		
1,074,896	5		
TOTAL	126		43

Source: author's work

This research and analysis focused only on liquidity loans, while investment loans were not examined. For this reason, samples of liquidity loans are presented separately in Table 3.

Table 3: Overview of liquidity loans in the 2019 and 2020 samples

Liquidity loans			
2019		2020	
loan amount in thousands of EUR	number of loans	loan amount in thousands of EUR	number of loans
13,436	10	6,634	7
20,154	11	13,268	12
26,872	18	19,902	11
30,231	4	26,536	13
33,591	5	33,170	10
40,309	13	39,804	11
47,027	7	49,092	10
49,714	4	53,072	11
53,745	9	100,000	41
67,181	10	106,144	7
107,490	4	132,681	6
134,362	6	200,000	8
		1,250,000	6
TOTAL	101		153

Source: author's work

After the grouping of data from the samples, the calculation of the arithmetic mean, standard deviation and variance was carried out, the values of which are shown in Table 4.

Table 4: Descriptive statistics indicators

Year/ Indicator	Arithmetic mean	Standard deviation	Variance
2019	40,651.0129	28.180	794132420
2020	85.832,9190	160.609	25795351642

Source: author's work

The arithmetic mean values reveal that, alongside the rise in the number of executed loans due to the onset of the COVID-19 pandemic in 2020, the average amount of realized liquidity loans doubled compared to the previous year. In addition, Table 4 suggests that the variance of the samples is noticeably different, which is confirmed by the standard deviation values.

For the purpose of applying the appropriate t-test, it was necessary to determine if the variances were equal or different. Although the previous calculation indicated that the arithmetic mean and variance of the samples were different, to ensure the reliability of the further research procedures, the F test was conducted to assess their equality. The F test is the most appropriate tool for examining the equality of variances between two groups. The hypothesis of equal variances is accepted if the obtained F value is lower than the F critical value, otherwise it is rejected (i.e. the difference between them is considered significant).

Table 5: F-test for the two samples

Indicator	2019	2020
Mean	40651.0129	85832.91901
Variance	794132420	25795351642
Observations	100	152
df	99	151
F	0.030785873	
F Critical one-tail	0.735242216	

Source: author's work

The F test was performed at a significance level of 5% (0.05). By analyzing the F test indicators, it can be concluded that the obtained F value of 0.0307 is lower than the critical value of 0.735. This suggests that the variances are not significantly different

or that they are equal. Since the F test indicated that variances did not differ significantly, a two-way t-test for two independent samples of equal variances was used to test the hypotheses. The T-test served to determine whether there was a change or increase in liquidity loan demand at the HBOR due to the outbreak of the pandemic in 2020, and whether this change was statistically significant. The testing was carried out with a degree of certainty of 95% or a significance level of 5% ($\alpha=0.05$).

Table 6: T-test for two independent samples of equal variances

	2019	2020
Mean	40651.0129	85832.91901
Variance	794132420	25795351642
Observations	100	152
Degrees of Freedom	250	
t Critical one-tail	-2.783284482	
P(T<=t) two-tail	0.005792105	
t Critical two-tail	1.969498393	

Source: author's work

The results of the t-test shown in Table 6 point to a statistically significant difference in the use of liquidity loans before and after the onset of the pandemic, as the resulting value p (0.0057) was lower than the significance level of 0.05. Since p value was 0.0057, i.e. higher than 0.05, the H0 hypothesis, proposing that liquidity loan demand at the HBOR in 2020 did not change significantly as compared to the year before, was rejected. The second hypothesis, H1, suggesting that there was a statistically significant change in liquidity loan demand at the HBOR in 2020, was confirmed. Likewise, the resulting t value was -2.78, which was greater than the (critical) t value, i.e., it falls outside the -1.969 to 1.969 interval. This also suggests rejecting the null hypothesis (H0) in favor of the alternative hypothesis (H1).

The analysis results ultimately confirm that the outbreak of the COVID-19 pandemic in 2020 led to a significant increase in the demand and allocation of liquidity loans at HBOR.

Following this research, it may be assumed that in a broader sense, the liquidity financing through the HBOR enabled a large number of entrepreneurs to maintain their business in the times of crisis, and indirectly contributing to the gradual recovery and sustainable growth of the Croatian economy.

6 Conclusion

The COVID-19 pandemic posed numerous challenges to businesses in Croatia, severely impacting their liquidity and operational capacities. The demand for liquidity loans increased significantly in response to the economic obstacles and weakened paying capacity of entrepreneurs. At the same time, the financial sector was expected to react quickly and adapt its services to the new situation. However, not all banks reacted in the same way. Private capital-owned commercial banks only partially met entrepreneurs' needs, through measures of granting moratoriums or refinancing of the existing loans, and they were hesitant to provide new loans due to repayment risks.

Owing to this fact, the entire burden of supporting entrepreneurs in liquidity financing fell on the Croatian Government. In such situation, the HBOR, as the state-owned bank, played a key role in supporting entrepreneurs through tailored lending programs with the objective of making capital more accessible during this challenging period. This research was therefore focused on examining the impact of the COVID-19 pandemic on liquidity loan demand at the HBOR. The analysis of the bank's loan portfolio through two independent samples of entrepreneurs who used the HBOR loans during 2019 and 2020 demonstrated a significant increase in demand and allocation of liquidity loans in 2020. The hypotheses were tested using a t-test for two independent samples, the result of which confirmed the conclusion of the research that the COVID-19 pandemic led to a significant increase in the demand and allocation of liquidity loans at the HBOR.

These efforts not only helped enterprises in weathering the crisis, but also demonstrated how important it is that a state and its financial institutions be flexible in dealing with emergencies.

Since the liquidity financing was carried out exclusively through state-owned banks, primarily the HBOR, the results and conclusions derived in this research can to some extent be applied to the entire Croatia. In addition, they can be used as a foundation for future research of similar topics. In the coming years, further research and analyses are expected to offer a deeper insight into the specific effects of the pandemic on lending to small and medium-sized enterprises, both in Croatia and other countries.

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PARTICIPACIJA PRI UDEJANJANJU UKREPOV NA EKOSISTEMIH TEMELJEČEGA PRILAGAJANJA OBALNIH OBMOČIJH: PREGLED LITERATURE IN ANALIZA PRIMERA IZ PRAKSE

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Podnebne in okoljske spremembe predstavljajo vse večje tveganje za ekosisteme in človeštvo. Koncept na ekosistemih temelječega prilagajanja na podnebne spremembe zajema vključitev ukrepov za ohranjanje biotske raznovrstnosti in ekosistemskih storitev v strategije prilagajanja na podnebne spremembe na več ravneh in v različnih sektorjih. Namen teh ukrepov je povečati odpornost, zlasti ranljivih ekosistemov in skupnosti. Obalna območja Sredozemlja so posebej ogrožena zaradi dviga gladine morja in stopnjevanja ekstremnih vremenskih dogodkov, ki so posledica podnebnih sprememb. S tem se povečuje tudi tveganje za poplave, vdor slane vode in erozijo obale. Z integracijo ukrepov za prilagajanje in zmanjševanje tveganja nesreč na lokalni, nacionalni in makroregionalni ravni je mogoče doseči številne družbeno-gospodarske in okoljske koristi. Uspešnost ukrepanja je odvisna predvsem od participacije skupnosti ter vzpostavljanja globlje ravni sodelovanja pri sooblikovanju in soupravljanju ukrepov. Na osnovi analize literature smo v prispevku poudarili pomanjkanje raziskav o participaciji deležnikov pri udejanjanju ukrepov na ekosistemih temelječega prilagajanja. Z analizo praktičnega projekta pa smo prikazali uporabnost pristopa participacije pri načrtovanju prilagajanja obalnih zavarovanih območij in lokalnih skupnosti.

Ključne besede:

ekosistemi,
prilagajanje,
participacija,
podnebne
spremembe,
obalna
območja

PARTICIPATION IN THE IMPLEMENTATION OF ECOSYSTEM-BASED ADAPTATION MEASURES IN COASTAL AREAS: A REVIEW OF LITERATURE AND ANALYSIS OF EXAMPLE FROM PRACTICE

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Climate and environmental changes pose an increasing threat to ecosystems and humanity. The concept of ecosystem-based adaptation to climate change involves the integration of measures to conserve biodiversity and ecosystem services into climate change adaptation strategies at several levels and in different sectors. The aim of these measures is to increase resilience, especially of vulnerable ecosystems and populations. The coastal areas of the Mediterranean are particularly at risk due to rising sea levels and the intensification of extreme weather events as a result of climate change. This also increases the risk of flooding, saltwater intrusion and coastal erosion. Many socio-economic and environmental benefits can be achieved by integrating disaster risk reduction and climate change adaptation measures at local, national and macro-regional levels. However, the success of these measures depends primarily on community participation and the establishment of closer cooperation in the co-design and co-management of measures. Based on the literature review, the lack of research on stakeholder participation in the implementation of ecosystem-based adaptation measures was highlighted. Based on the analysis of a practical project, we highlighted the usefulness of participatory approach in planning the adaptation of coastal protected areas and local communities.

Keywords:
ecosystems,
adaptation,
participation,
climate
change,
coastal
areas

1 Uvod

Poročilo o globalnih tveganjih Svetovnega gospodarskega foruma (WEF, 2022) uvršča podnebne spremembe med največje grožnje človeštvu. Kot najverjetnejša okoljska tveganja v naslednjih desetih letih, ki lahko povzročijo največjo škodo v globalnem merilu, so poudarjeni predvsem neuspešni podnebni ukrepi, ekstremni vremenski dogodki in izguba biotske raznovrstnosti. Pogloblja se predvsem dvom v sposobnost družb za premostitev razlik in družbeno-gospodarskih konfliktov za vzpostavitev učinkovitega sodelovanja in skupnega ukrepanja pri omejitvi tveganj, povezanih s podnebnimi spremembami. Zato sta v poročilu poudarjeni potreba po okrepitvi skupnih prizadevanj za boj proti podnebnim spremembam in njihovim posledicam ter potreba po povečanju odpornosti družbe in ekosistemov.

Tudi v poročilu IPCC (IPCC, 2023) je poudarjeno, da podnebne spremembe, ki jih povzroča človek, že vplivajo na številne vremenske in podnebne ekstreme v vseh regijah po svetu. To ima škodljive učinke za naravo in ljudi. Povišanje temperatur bo marsikje po svetu prispevalo k večji verjetnosti poletnih suš in vročinskih valov s posledicami, kot so pomanjkanje pitne vode, prehranska negotovost, požari v naravi ter drugi negativni vplivi na zdravje ljudi in ekosistemov. Hkrati se bo povečalo tudi tveganje za poplave, saj bodo padavine v prihodnje sicer manj pogoste, toda intenzivnejše, npr. močno deževje in nevihte. Ker je človek del ekosistema in je odvisen od ekosistemskih storitev za preživetje, je ranljivost družb in ekosistemov soodvisna. Ocenjuje se, da od 3,3 do 3,6 milijarde ljudi živi v okolju, ki je zelo ranljivo za podnebne spremembe. Še posebej so ranljive revnejše skupnosti v Afriki, Aziji in Južni Ameriki, ki niso med glavnimi povzročitelji podnebnih sprememb, vendar v nesorazmerno večji meri občutijo posledice teh, na primer povečevanje negotovosti, povezane z varnostjo preskrbe s hrano in pitno vodo. Posledično se bodo povečevale okoljske migracije.

Tako neposredno kot posredno bodo posledice podnebnih sprememb v obliki pogostejših ekstremnih vremenskih dogodkov, povečanja geopolitične negotovosti in pritiska migracij ter drugih okoljskih in družbeno-gospodarskih tveganj vplivale tudi na življenje v Evropi in Sloveniji.

Izgubi življenj in materialni škodi na infrastrukturi se ne bo mogoče popolnoma izogniti, saj se bosta obseg in razsežnost vplivov podnebnih sprememb v prihodnosti prav gotovo povečala (Bouwer et al., 2019).

Vse več je dokazov, da bodo ta tveganja pomembno vplivala na življenja posameznikov in potisnila najranljivejše skupine prebivalstva do njihovih fizičnih in socialno-ekonomskih meja prilagajanja (Benevolenza in DeRigne, 2019). Ranljive skupine prebivalstva so predvsem starejši, nosečnice in dojenčki, revni in bolniki z že obstoječimi in kroničnimi zdravstvenimi težavami. Zato je prilagoditvene ukrepe treba posebej usmeriti tudi k tem ciljnim skupinam. Najbolj izpostavljeni bodo tisti, ki so že prikrajšani zaradi pomanjkanja zatočišč, čiste vode, energije ali hrane, na primer revnejši sloji populacije, ki so tako posledično bolj izpostavljeni ekstremnim vremenskim dogodkom.

Prvo poročilo o oceni stanja okoljskih in podnebnih sprememb v Sredozemlju (MedECC, 2020) ugotavlja, da se ta regija, v kateri živi približno 510 milijonov prebivalcev, segreva za 20 % hitreje od globalnega povprečja. Trenutno se je povprečna temperatura zraka v Sredozemlju povečala za 1,54 °C v primerjavi s predindustrijsko dobo, tj. za 0,4°C več od globalnega povprečja. Zvišujeta se tudi povprečna temperatura in gladina morja. To bo povzročilo dodatne pritiske na ekosisteme, ki so zaradi součinkovanja onesnaževanja in čezmerne rabe naravnih virov že tako preobremenjeni. Posledično bo to neposredno vplivalo tudi na ranljiva gospodarstva in družbe, ki so najbolj odvisni od ekosistemskih storitev. Pričakujejo se negativni vplivi predvsem v sektorjih kmetijstva (oskrba s hrano), gozdarstva in turizma, kar lahko poveča ekonomsko ranljivost populacij oz. nekaterih specifičnih ciljnih skupin.

Ekosistemski pristopi prilagajanja lahko v kombinaciji z drugimi ukrepi pomembno prispevajo k zmanjševanju tveganj nesreč (Munang et al., 2013). Zato je bistveno ozaveščati prebivalstvo o pomenu sonaravnih rešitev ter spodbujati njihovo aktivno vključevanje, soudeležbo oziroma participacijo v skupno načrtovanje (ang. *co-planning*), oblikovanje (ang. *co-design*) in upravljanje (ang. *co-management*) teh ukrepov (Emilsson in Sang, 2017).

Namen prispevka je analiza različnih oblik participacije udeležencev pri udejanjanju na ekosistemih temelječih ukrepov prilagajanja na podnebne spremembe obalnih območij v Sredozemlju. V ta namen bomo proučili objavljene raziskave, da bi ugotovili pogostnost povezovanja koncepta na ekosistemih temelječega prilagajanja in participacije deležnikov ali državljanov pri udejanjanju teh ukrepov. Poleg tega bomo proučili poročila že izvedenih čezmejnih Interreg projektov, da bi na osnovi analize primera iz prakse prikazali celosten in večravni pristop participacije deležnikov.

1.1 Koncepti na ekosistemih temelječega prilagajanja in zmanjševanja tveganja nesreč

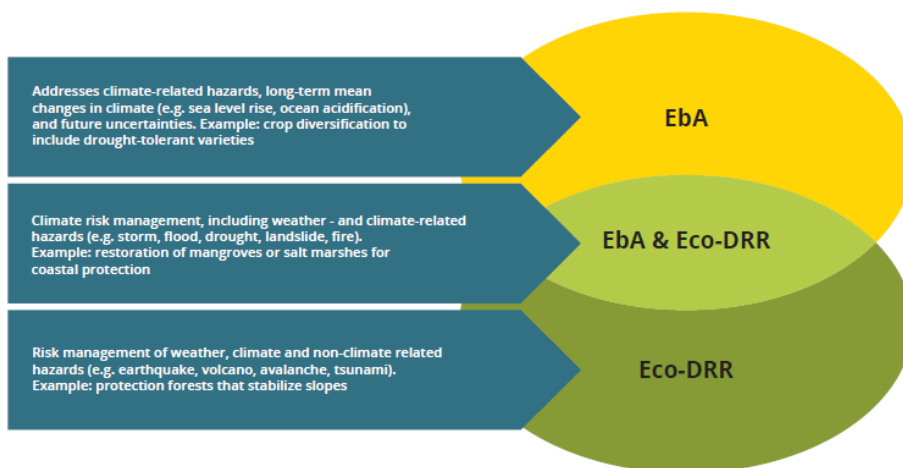
Koncept »na ekosistemih temelječega prilagajanja« (ang. *Ecosystem-based adaptation*, v nadaljevanju: EbA) omogoča različno interpretacijo, na splošno pa je povezan s trajnostnim upravljanjem, obnovo in varovanjem ekosistemov v sklopu strategij prilagajanja na podnebne spremembe.

Koncept EbA je bil prvič bolj poglobljeno razložen leta 2009, in sicer: »... *EbA je uporaba biotske raznovrstnosti in ekosistemskih storitev kot del širših strategij prilagajanja za pomoč ljudem pri prilagajanju na škodljive učinke podnebnih sprememb. EbA temelji na različnih priložnostih za trajnostno upravljanje, obranjanje in obnovo ekosistemov za zagotavljanje storitev, ki ljudem omogočajo prilagajanje na vplive podnebnih sprememb. Namen EbA je ohraniti, povečati odpornost in zmanjšati ranljivost ekosistemov in ljudi pred škodljivimi učinki podnebnih sprememb. EbA je najprimerneje vključiti v širše strategije prilagajanja in razvoja ...*« (SCBD, 2009).

EbA spada med »na naravi temelječe rešitve« (ang. *Nature-based Solutions*, v nadaljevanju: NBS). Te inovativne, sonaravne rešitve je IUCN opredelil kot dejanja za varovanje, trajnostno upravljanje in obnavljanje naravnih ali antropogenih ekosistemov, ki učinkovito in prilagodljivo obravnavajo družbene izzive (npr. podnebne spremembe, varnost preskrbe s hrano in pitno vodo, naravne nesreče), hkrati pa zagotavljajo blaginjo za človeštvo iz ohranjanja biotske raznovrstnosti (Cohen-Shacham et al., 2016; Sowińska-Świerkosz in García, 2022). Lahko se uporabljajo na različnih ravneh, od lokalne do nacionalne in makroregionalne, so stroškovno učinkovite ter hkrati zagotavljajo številne okoljske, družbene (tudi kulturne) in gospodarske koristi. S tem prispevajo k odpornosti ekosistemov in skupnosti. Poleg tega prispevajo tudi k integraciji lokalnega znanja in vrednot pri

sooblikovanju skupnih rešitev in pripomorejo h kolektivnemu učenju. Zato je pomembno, da se odločitve o implementaciji NBS sprejemajo v sodelovanju z deležniki, in sicer z uporabo pristopa adaptivnega upravljanja, ki lahko izboljša odločitvene procese in prispeva k manjši konfliktnosti pri izvedbi.

Nova strategija EU za prilagajanje podnebnim spremembam ugotavlja, da morajo ukrepi za prilagajanje podnebnim spremembam spodbujati sinergije s širšimi prizadevanji za preprečevanje in zmanjšanje tveganja nesreč, saj oboje zagotavlja nabor dopolnilnih pristopov k obvladovanju podnebnih tveganj, da bi se lahko vzpostavile odporne družbe. Pri tem še posebej poudarja pomen NBS, da bi s tem ustvarili koristi za prilagajanje, blaženje, zmanjševanje tveganja nesreč, biotsko raznovrstnost in zdravje (EC, 2021).



Slika 1: Povezava med EbA in Eco-DRR


Vir: EEA, 2017

Na ekosistemih temelječe zmanjševanje tveganja nesreč (ang. *Ecosystem-based disaster risk reduction*, v nadaljevanju: Eco-DRR) je opredeljeno kot trajnostno upravljanje, ohranjanje in obnova ekosistemov za zmanjšanje tveganja nesreč, da se dosežeta odpornost in trajnostni razvoj (Estrella in Saalismaa, 2013). Temelji na upoštevanju trenutne in prihodnje potrebe ljudi po preživetju, hkrati pa tudi biofizičnih vidikov dobrega delovanja ekosistemov, saj se s tem priznava bistvena vloga ekosistemov pri

podpori razvoja in preživetja skupnosti. S tem zagotavljamo dobro osnovo za pripravo na naravne nesreče, soočanje z njimi in okrevanje po njih. EbA in Eco-DRR se vsebinsko dopolnjujeta in ju je treba integrirati (Estrella in Saalismaa, 2013; Lo, 2016; UNDRR, 2020, 2021). Na sliki 1 je prikazana povezava med EbA in Eco-DRR.

1.2 Soudeležba v procesih upravljanja sonaravnih rešitev

Sonaravne rešitve zahtevajo sodelovanje različnih akterjev pri snovanju, izvedbi in ovrednotenju projektov (Toxopeus et al., 2020). Upravljanje z vključevanjem več akterjev ali »hibridno« upravljanje se nanaša na način upravljanja, pri katerem odločevalci in oblikovalci politik sodelujejo z nevladnimi organizacijami, akterji iz zasebnega sektorja (na primer gospodarstva) in državljani, kar se sklada tudi z načelom upravljanja na več ravneh, na primer za doseganje ciljev trajnostnega razvoja (OECD, 2020). Podobno temu je tudi sodelovalno upravljanje (ang. *collaborative governance*) sonaravnih rešitev (Frantzeskaki, 2019). Prav vidiki participacije državljanov pri snovanju ter rešitev omogočajo pravično porazdelitev družbenih koristi med različnimi deležniki in tudi hkratno zagotavljanje koristi za naravo (Kotsila et al., 2021; Toxopeus et al., 2020; Cooper et al., 2023).

		INCREASING IMPACT ON THE DECISION 				
		INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL		To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
	PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

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Slika 2: Stopnje participacije po IAP².

Vir: IAP², 2018

Načini soudeležbe in/ali participacije državljanov v procesih prilagajanja so lahko različni, in sicer od pasivnih do aktivnih. Po lestvici vpliva javnosti na oblikovanje odločitev (IAP², 2018) ločimo različne stopnje participacije, in sicer: 1. obveščanje (ang. *inform*), 2. posvetovanje (ang. *consult*), 3. vključevanje (ang. *involve*), 4. sodelovanje (ang. *collaborate*) in 5. opolnomočenje (ang. *empower*) (slika 2). Le pri najvišji stopnji aktivne udeležbe lahko deležniki sami sprožijo in oblikujejo proces prilagajanja (Conde in Lonsdale, 2004).

2 Metoda

Pri pregledu raziskav je bil uporabljen iskalnik Web of Science¹ (v nadaljevanju: WoS). Gradivo je bilo pregledano z iskalnim nizom, in sicer: »ecosystem-based adaptation (Topic) AND citizen* OR stakeholder* participation (Topic)«. Pridobljen seznam gradiva je bil vsebinsko analiziran.



Slika 3: Povzetek iskalnih nizov in filtrov, uporabljenih pri iskanju v portalu Keep.eu.

Vir: Portal Keep.eu

¹ Dostopno na: <https://www.webofscience.com/wos/woscc/>

Pri iskanju praktičnih primerov EbA z uporabo participativnih pristopov je bil uporabljen iskalnik spletne strani Keep.eu², kjer so objavljeni rezultati projektov, ki se izvajajo v sklopu Interreg programov. Iskalni niz in filtri so predstavljeni na sliki 3. Pri iskanju po podatkovni bazi Keep.eu smo pridobili seznam 30 projektov v Excelovi datoteki. Pregledali smo objavljene rezultate/dokumente vseh projektov na seznamu in izločili tiste, za katere rezultati še niso bili objavljeni na portalu ali so bili objavljeni v drugih tujih jezikih (zaradi jezikovnih omejitev smo pregledovali samo datoteke, objavljene v slovenskem, italijanskem ali angleškem jeziku). Izločili smo tudi projekte, ki se niso nanašali na prilagajanje obalnih območij Sredozemlja.

3 Rezultati in razprava

3.1 Pregled raziskav na temo participacije pri EbA

Pri pregledu raziskovalne literature je bilo pridobljenih 31 enot/zadetkov, od tega 22 raziskovalnih člankov in pet preglednih člankov, tri objave povzetkov na konferenci in ena objava »*Early Access*« (slika 4). Iskalni niz »*ecosystem-based adaptation*« je sicer dal 646 zadetkov, kar pomeni, da se le manjši delež raziskav o EbA natančneje nanaša na participacijo udeležencev.

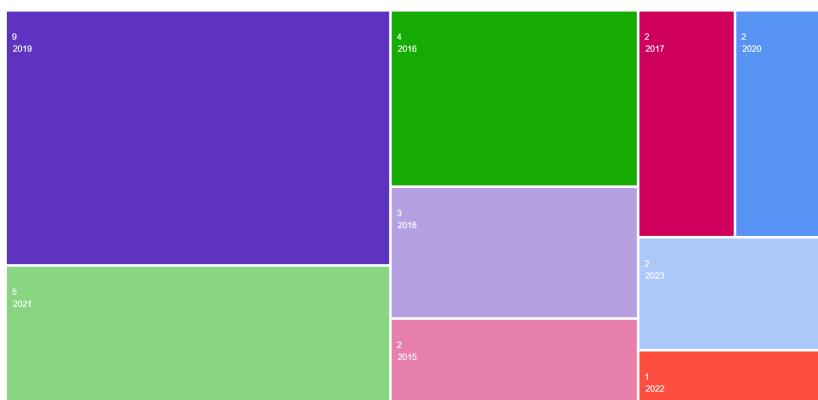
Pri analizi gradiva je bilo ugotovljeno, da je bilo največ raziskav objavljenih leta 2019 (8), sledita leti 2021 (5) in 2016 (4) (slika 5). Iz tega lahko razberemo, da pandemija covid-19 ni bistveno vplivala na upad teh raziskav v obdobju 2020–2022. Nasprotno, Pantić et al. (2021) ugotavljajo, da je pandemija spodbudila prehod v druge, tudi virtualne oblike participacije, kot so virtualne platforme za sodelovanje pri prostorskem načrtovanju. Predlaga, da se kombinirane metode participacije, ki vključujejo tradicionalne in virtualne metode, ohranijo tudi v času po pandemiji, saj omogočajo sodelovanje s širšim krogom deležnikov.

² Dosegljivo na: <https://keep.eu/>



Slika 4: Razdelitev zadetkov po tipologiji objave.

Vir: WoS



Slika 5: Leto objave raziskave.

Vir: WoS

Največ raziskav, ki smo jih pridobili z analizo (slika 6), se nanaša na področje okoljskih znanosti (17), sledijo okoljske študije (9) in vodni viri (7), kar dokazuje, da so okoljske raziskave ključnega pomena v primeru pristopa EbA. Ladekjær Gravesen in Funder (2021) pri tem ločujeta med: (1) »čistimi« pristopi EbA (ang. *pure EbA approaches*), pri katerih je v ospredju doseganje integriranih družbenih in okoljskih koristi (npr. ukrepi za varovanje ekosistemov in krepitev biotske raznovrstnosti ter v okviru tega posredno pridobivanje koristi za prilagajanje skupnosti prek

okrepljenih ekosistemskih storitev), in (2) ostalimi ustreznimi EbA intervencijami (ang. *EbA relevant interventions*), pri katerih so v ospredju družbeni vidiki prilagajanja, posredno pa se preprečijo negativni vplivi na ekosisteme in biotsko raznovrstnost po načelu DNSH (tj. načelo »da se ne škoduje bistveno«).



Slika 6: Znanstveno področje raziskave (vsebinske kategorije WoS).

Vir: WoS

Z analizo smo tudi ugotovili, da je sredozemsko obalno območje v raziskavah manj obravnavano (slika 7). Tudi Brink et al. (2016) ugotavljajo, da se v globalnem merilu večina študijskih primerov urbanih implementacij EbA nanaša na obalna območja, ampak v primeru EU so to večinoma mesta na obalah Severne Evrope.



Slika 7: Analiza zadetkov po regijah/državah.

Vir: WoS

V nadaljnjo vsebinsko analizo so bili vključeni le raziskovalni članki, do katerih smo lahko dostopali v celoti. Ugotovili smo, da se večina raziskav nanaša na analizo javnega mnenja glede participacije državljanov v EbA. Na primer Faivre et al. (2017) navajajo, da večina respondentov iz EU podpira promocijo, načrtovanje in implementacijo sonaravnih rešitev za uspešno soočanje z družbenimi, gospodarskimi in okoljskimi izzivi in da je pripravljena sodelovati pri teh rešitvah, večkrat s prostovoljnim posvečanjem svojega časa tem dejavnostim. Toda Brink in Wamsler (2019) ugotavljata, da se deklarativna podpora ali motiviranost državljanov za sodelovanje v prilagajanju ne pretvori vedno v aktivno soudeležbo. Zato je treba raziskati inovativne načine za aktivacijo državljanov, in sicer ne samo pri ukrepih blaženja, kjer je to pogostejše, ampak tudi pri procesih prilagajanja na podnebne spremembe. Zadnje je treba povezati tudi z zmanjševanjem podnebnih tveganj, ki jih državljanji najmočnejše občutijo, in kulturnim ozadjem, v katerem se vodijo procesi EbA. Frantzeskaki (2019) poudarja pomen sodelovalnega upravljanja EbA, saj to omogoča uporabo lokalnega znanja. To sproži kolektivno učenje in posledično vodi do transformativnega učinka na skupnosti. V tem kontekstu tudi Murtia in Mathez-Stiefel (2019) poudarjata pomen soustvarjanja znanja, krepiteve kolektivnega razumevanja potrebnih ukrepov in pripravljenosti za skupno delovanje v primeru načrtovanja EbA ali EcoDRR. Kljub temu obstajajo omejitve in ovire, ki jih je treba upoštevati in premostiti, predvsem tiste, ki bi lahko vodile do nastajanja ali krepitev konfliktov med različnimi deležniki. Zato je veliko pozornosti treba posvetiti predvsem krepitevi zaupanja in spoštovanja med deležniki. Tudi Wamsler et al. (2020) ugotavljajo, da ključnim akterjem za uspešen participativni proces EbA večkrat primanjkuje kognitivnih in čustvenih kompetenc ter sposobnosti za ustvarjanje družbenih vezi. Zato je treba okrepiti individualne in institucionalne zmogljivosti ključnih akterjev, ki sodelujejo v procesih prilagajanja.

Še posebej glede upravljanja obalnih območij Areia et al. (2023) ugotavljajo, da je EbA primerna platforma za povečanje soudeležbe državljanov pri integriranih ukrepih blaženja in prilagajanja, saj si ti želijo prehod s tehnokratskega upravljanja obale na participativno, v katerem so preference javnosti legitimirane. V primeru decentralizacije obalnega upravljanja so respondenti izrazili proaktivno pripravljenost za aktivno vključitev v upravljanje obale in v procese prilagajanja.

3.2 Pregled Interreg projektov s participacijo deležnikov pri EbA

Po poglobljenem pregledu na portalu Keep.eu je bilo ugotovljeno, da samo štiri projekti vključujejo participativni pristop pri načrtovanju ali implementaciji EbA, in sicer ECO-SMART, CHANGE WE CARE, RESPONSE in MPA ENGAGE. Podrobneje je v nadaljevanju kot študija primera opisan način participacije deležnikov v okviru projekta ECO-SMART. Ta projekt smo izbrali predvsem zaradi dostopnosti podatkov in informacij o načinu vključevanja deležnikov. Treba je poudariti, da je to edini projekt, za katerega je metodologija participacije zelo podrobno opisana v poročilih³ na portalu Keep.eu.

3.2.1 Izkušnje iz projekta ECO-SMART

Namen projekta *Tržišče ekosistemskih storitev za napredno politiko zaščite območij Natura 2000* (v nadaljevanju: ECO-SMART), program sodelovanja Interreg V-A Italija-Slovenija 2014–2020, je bila analiza učinkov podnebnih sprememb na skupaj šestih pilotnih območij Natura 2000 programskega območja v Sloveniji in Italiji, da se omilijo vplivi na biotsko raznovrstnost. Partnerstvo ECO-SMART je oblikovalo inovativno metodologijo vključevanja deležnikov (Simionato et al., 2022), ki je temeljila na začetni analizi lokalnih deležnikov za vsako pilotno območje posebej. Po razvrstitvi deležnikov glede na njihov interes/moč vplivanja je bil izbran način njihovega vključevanja, npr. obveščanje prek medijev in družbenih omrežij, usposabljanje in ozaveščanje na delavnicah, posvetovanje, aktivno vključevanje in sodelovanje pri izvajanju analiz in načrtovanju. Namen je bil prilagojeno in celovito vključevanje deležnikov (slika 8) v izvajanje projektnih dejavnosti za izbiro in načrtovanje ukrepov EbA na posameznih pilotnih območjih.

³ Dosegljivo na: keep.eu/projects/24031/Market-of-Ecosystem-service-EN/



Slika 8: Nameni celovitega vključevanja deležnikov v sklopu projekta ECO-SMART.

Vir: Simionato et al., 2022

Analize za vsako pilotno območje so bile opravljene v sodelovanju z lokalnimi deležniki, in sicer na podlagi pregleda številnih kategorij ekosistemskih storitev (po klasifikaciji CICES v5.1⁴), ki so bile navedene na obrazcu za kategorizacijo in kartiranje in nato strnjeno prikazane v poročilu. Po opredelitvi ekosistemskih storitev za vsako pilotno območje je bila v naslednji fazi opredeljena ranljivost, da bi lahko oblikovali ustrezne ukrepe za krepitev odpornosti in prilagajanje območij Natura 2000 na podnebne spremembe. Za izvedbo teh ukrepov so bili opredeljeni primerni finančni mehanizmi kot na primer plačila za ekosistemske storitve (ang. *Payment for Ecosystem Services*, v nadaljevanju: PES). Vsi navedeni postopki so bili izvedeni v sodelovanju z lokalnimi deležniki, ki so pomembno prispevali k zasnovi in izvajanju vseh faz projekta (slika 9).

Ker se je večina projekta izvajala med pandemijo covid-19, so se uporabljale predvsem inovativne metode participacije (spletni vprašalniki, spletne delavnice in sestanki z deležniki).

⁴ Dosegljivo na: <https://cices.eu/>.



Slika 9: Vključevanje deležnikov v vse faze izvajanja projekta ECO-SMART.

Vir: Simionato et al., 2022.

Priprava operativnih načrtov EbA in študija ekonomske izvedljivosti sta omogočili bolj poglobljen vpogled v učinkovitost ukrepov z ekološkega, okoljskega, družbenega in gospodarskega vidika. To je upravljalcem zavarovanih območij skupaj z drugimi deležniki (odločevalci in oblikovalci politik na lokalni in regionalni ravni, nevladne organizacije, raziskovalne organizacije, splošna javnost ...) olajšalo izbiro ukrepov, ki se bodo izvedli na posameznem območju. Študija izvedljivosti je temeljila na analizi več meril (ang. *multi-criteria analyses*, MCA), pri kateri so sodelovali deležniki. Ta metodologija temelji na ocenjevanju različnih kvalitativnih in kvantitativnih meril, ki omogočajo, da se poudarijo morebitne ekološke, družbene in gospodarske koristi, finančna učinkovitost, časovni razpored operativnih načrtov, ustreznost, nujnost, zanesljivost in prilagodljivost predlaganih ukrepov ter tudi sinergije z lokalnimi in regionalnimi politikami. Inovativni finančni mehanizmi, kot so PES so ponudili priložnost zagotavljanja dodatnih sredstev za vzdrževanje in izvedbo prilagoditvenih ukrepov. Seme PES so bile prav tako izbrane v sodelovanju z lokalnimi deležniki. Učinkovitost pilotnih primerov so ocenili projektni partnerji in tudi zunanji ocenjevalci (Simionato et al., 2022; Visintin, 2022).

Partnerstvo projekta je prišlo do zaključka, da izvajanje ukrepov EbA in PES vodi ne samo do pozitivnih okoljskih učinkov (na primer v biotski raznovrstnosti, habitatih), ampak tudi do družbeno-gospodarskih (na primer k povečanju ponudbe zelenih delovnih mest v lokalnem okolju). Vsi projektni partnerji pa so opazili tudi pomanjkanje interesa državljanov in določenih ciljnih skupin deležnikov (NVO, upraviteljev zavarovanih območij, gospodarskih subjektov na področju ribištva, kmetijstva in turizma) za aktivno vključevanje v postopke za načrtovanje in

implementacijo EbA z uporabo inovativnih finančnih mehanizmov. Projekt je z inovativnim čezmejnimi pristopom, ki so ga projektni partnerji prvič preizkusili na izbranih obalnih zavarovanih območjih, omogočil tudi postavitev temeljev za spodbujanje nadaljnje participacije deležnikov pri ohranjanju biotske raznovrstnosti, katere ekološka, okoljska, estetska, družbena in gospodarska vrednost pomembno prispeva k blaginji lokalnih skupnosti (Simionato et al., 2022).

Pri projektu ECO-SMART se je razvila dobra praksa, ki je bila uporabljena tudi v projektu ECO2SMART⁵, program sodelovanja Interreg VI-A Italija-Slovenija. Ta je namenjen ponovni uporabi, povečanju prepoznavnosti in razširitvi rezultatov projekta ECO-SMART. Na osnovi tega bo mogoče izboljšati učinke ECO-SMART, to so trajne spremembe, ki smo jih želeli doseči s projektnimi dejavnostmi in rezultati. Glavni predvideni dosežki projekta ECO2SMART so: implementacija ukrepov EbA/EcoDRR v obalnih delih programskega območja Slovenije in Italije, širjenje znanja o dobrih praksah EbA/EcoDRR, ozaveščanje in izobraževanje, priprava skupne strategije in akcijskega načrta za spodbujanje participacije deležnikov pri načrtovanju in izvajanju EbA/EcoDRR.

4 Sklepi

Participacija državljanov in/ali deležnikov pri prilagajanju na osnovi ekosistemskih pristopov je gotovo pomemben vidik, ki pa še ni poglobljeno raziskan niti dovolj uporabljen v praksi. Za zagotavljanje pravičnega prehoda na podnebno nevtralnost ter zmanjševanje podnebnih in okoljskih tveganj je pomembno, da predvsem na lokalni ravni spodbujamo participacijo pri sooblikovanju in soupravljanju ukrepov prilagajanja, ki so bistveni za krepitev odpornosti skupnosti in ekosistemov na podnebne spremembe. To je pomembno, saj vpliva na kolektivno učenje, aktivacijo državljanov, spremembo vrednot in stališč posameznikov in posledično tudi na večjo sposobnost prilagajanja. S tem zagotavljamo širši družbeni učinek ter tudi prednosti za ohranjanje biotske raznovrstnosti in vzdržni razvoj v okviru planetarnih omejitev. Pomembno je tudi, da se za participacijo in premagovanje ovir pri sodelovanju ne uporablja samo tradicionalne pristope, ampak tudi inovativne, saj s tem spodbudimo sodelovanje številnejših in raznolikih deležnikov.

⁵ Dosegljivo na: www.ita-slo.eu/eco2smart.

Zahvale

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LEADERSHIP FOR SUSTAINABLE DEVELOPMENT: A REVIEW OF EMERGING DIMENSIONS OF SUSTAINABLE LEADERSHIP AND OPPORTUNITIES FOR FUTURE RESEARCH

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The aim of the research is to review the narrative of sustainable leadership in the light of current challenges such as geopolitical over composition, economic risk, supply chain disruption and inflation, and to provide guidance for future research and practical implementation. We conducted the research by examining the documents in the Scopus database that specifically address sustainable leadership in industry. In doing so, we determined intensity of research, geographical research presence, the most explored country industries and prevalence by type of research. It became apparent that despite its almost 20-year presence in the academic literature, sustainable leadership as an independent research construct is still in the development phase and has much potential for further progress. This is confirmed by the small number of articles, authors and geographical absence in most parts of the world. Accordingly, further research on sustainable leadership is needed to achieve greater currency and in-depth understanding both in the academic field and in business. In this sense, we propose constructive interaction of researchers from the fields of business and management with researchers from the field of education.

Keywords:

sustainable development, sustainable leadership, sustainability leadership, corporate sustainability, business and management

1 Introduction

In recent years, institutional pressure from governments, civil societies and non-governmental organizations has encouraged many companies to address the challenges of sustainable development by integrating environmental and social considerations into their business operations (Li et al., 2019). As it is difficult for companies to integrate the concept of sustainable development into their operations, scholars are actively seeking solutions, noting that introducing the concept of sustainable development into leadership is key to changing the situation and building a sustainable organization (Gerard et al., 2017; Di Fabio and Peiró, 2018). For this reason, sustainable leadership (hereafter: SL), which encourages organizations to adopt sustainable development, has attracted much attention (Dalati et al., 2017; Piwowar-Sulej et al., 2021).

Lambert (2011) and Hargreaves and Fink (2011) postulate that SL should honor the past and the present in order to develop the future; therefore, they should adopt the principles of sustainability. In the context of current challenges - geopolitical over-compositions, economic risks, supply chain disruptions and inflation - this is all the more challenging. In terms of sustainable development, the assertions of some scholars (Tideman, Arts and Zandee, 2013; Daly and Cobb, 1989) who believe that the fundamental problem lies in outdated economic models that use simplistic assumptions about the human view of the world are therefore all the more relevant. This is because the aforementioned worldview ignores human psychology, sociology, biology and ecology and is therefore no longer appropriate. Our ability to meet these challenges depends on an urgent generational shift in beliefs, attitudes and behaviors at the individual, organizational and societal levels (Taşçi and Titrek, 2020).

Therefore, businesses cannot operate independently of the environment and society, so adopting a model of sustainable development requires a deeper review of economic fundamentals that would enable leaders to make decisions that are good for business, society and the environment (Tideman, Arts and Zandee, 2013). In this sense, adopting sustainability concepts allows an organization a competitive advantage and a way to continuously improve efficiency. The real value lies in using sustainability as a driver for new innovations, technologies or business processes that seek a better way to run a business (Slankis, 2006: 2).

In line with the above, we aim to answer the following questions in the research:

1. To what extent is SL studied and practiced as an independent construct?
2. What are the main characteristics of the study of SL?
3. What are the trends and guidelines for the study of SL in the future?

Accordingly, we would like to point out that previous research of this kind has been quite general, whereas our research will focus on the study of SL in the area of different industries (agriculture and food, consumer goods, financial services, real estate and construction, manufacturing, resources, technology). This seems particularly important as industrialization has traditionally been the growth engine of economic development, which is why the United Nations (2023) calls for a "new generation of sustainable industrial policies" based on integrated national planning to increase investment and build a foundation for the future.

2 Evolution of sustainable leadership

A leader is someone who can formulate a vision and inspire people to work together to realize it, responding to any changes and challenges that arise along the way (Peters, 1989). While sustainable leaders additionally care about the welfare of humanity and act according to moral principles. Their typical characteristics are inclusion (Visser and Courtice, 2011), which is based on empathy, respect for all employees, their personality and specific talents, an environment where each individual can express their ideas and suggestions without fear (Vladić, Maletič, D. and Maletič, M., 2021). In addition, sustainable leaders focus on capacity building, sustainable change, and long-term results, which makes them look beyond immediate short-term benefits to a broader context (Hallinger and Suriyankietkaew, 2018). A key objective of SL is to achieve a balance between people, the environment and revenue in the current life of the company, thereby ensuring that the company creates the necessary social capital to survive the crisis (Avery, 2005).

Reddin (1977) synthesized a number of leadership typologies and concluded that distilling existing knowledge in this way provides clarity and allows scholars to better analyze different leadership behaviors. Based on this, for example, Pearce et al. (2003) described different leadership models (directive, transactional, transformational, and empowered). On the other hand, SL has not been given the

epithet of its own leadership model in the past. For example, Poff (2010) saw sustainability leadership simply as a form of ethical leadership, while McCann and Holt (2010) saw it more as servant leadership. Tideman, Arts and Zandee (2013) see SL as an extended form of transformational leadership with an additional emphasis on values, while Schüz (2016) prioritizes responsible leadership and links it to the dimensions of sustainable corporate responsibility. A recent study of Di Fabio and Peiró (2018) argued about a new integrated SL concept, i.e. human capital sustainability leadership (HCSL) which integrates four dimensions of leadership styles, such as ethical, servant, mindful and sustainability leadership to provide a holistic view of SL for sustaining human capital.

According to the Tideman, Arts and Zandee (2013), more research will be needed, with the aim of verifying and validating the model of SL in practice and establishing best practices for managers to develop the necessary qualities. A literature review by Santana and Lopez-Cabrales (2019) on the performance of sustainable human resource management found that SL is an underdeveloped and marginalized topic. Leadership in general is a multifaceted phenomenon that needs to be explored in more detail (Kjellström et al., 2020).

3 Methodology

For the needs of the research, we will use bibliometric analysis as it is an appropriate method to address the set objectives of this work, as it can help to understand the complexity of SL literature and analyze a large amount of scientific data (Donthu et al., 2021) in an organized way to generate new knowledge, research directions and insights (Massaro et al., 2016).

3.1 Data searching

Study follows other relevant studies in the sustainable development field who mainly adopted Scopus as the preferred database to conduct bibliometric analysis based on the co-occurrence terms (Hallinger and Suriyankietkaew, 2018; Ligorio, 2022; Eustachio, 2023). Accordingly, we searched for relevant studies in the scientific literature represented by journal articles. The Scopus database was searched for keywords related to "sustainable leadership" OR "sustainability leadership" which produced 531 initial documents. In the additional search string, we used the

keywords "sustainable development" AND "leadership" with 4384 hits. Searching process and the selection process were performed between January 2007 and December 2023.

3.2 Data screening

Table 1 lists the inclusion and exclusion criteria used to screen article titles and abstracts. The authors followed a two-stage approach to screening and quality assessment of the documents. First, the authors read the documents' titles and abstracts. After performing the analysis and excluding inappropriate articles, we found that our criteria coincide with the subject area "Business, Management and Accounting", and that articles from the criterion "sector" are not found in other subject areas. In the first review, there were a total of 151 mentioned articles. In the next stage, the documents selected in the first stage, the authors read the full-length papers. Thus, after a careful review and reading, we additionally eliminated articles not related to our research questions: eco-effectiveness, climate change, corporate social responsibility, morality, total quality management, benchmarking.

Table 1: Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Study type	Peer reviewed empirical and theoretical/conceptual studies; conference articles included if high quality	
Language	English	Any other language
Sector	Industry	Medicine, Agricultural Sciences, Physics and Astronomy, Computer Science, etc.
Relevance	Sustainability leadership Addresses sustainability leadership Level of analysis: firm level practices and processes	Not directly relevant to the research question Level of analysis: not firm-level practices and processes Technical research on predictive maintenance

3.3 Data extraction and synthesis

In order to obtain as much in-depth information as possible, we approached the analysis from two sides. First, we obtained bibliometric data from 25 articles exported from Scopus database into a .csv file. We analyze the data using R software and Biblioshiny which connects with the Scopus API to automatically collect metadata regarding scholars' complete scientific production list (Aria and Cuccurullo, 2017; Derviş, 2019). This was followed by the second phase of the research, where this time we exported the .csv file to Excel. Given that the data set from the selected articles was heterogeneous, from multiple contexts and contained a mix of empirical (qualitative and quantitative) and conceptual articles, we used an integrative and qualitative cross-case analysis approach to synthesis, each article being equivalent to a case (Mays, Pope and Popay, 2005).

4 Results

4.1 Intensity of research

Through analysis, we found that there are 25 articles in the Scopus database that directly examine SL in industry, with an annual growth rate of 8.16%. There are currently 30 active authors in the field, while we record 36% international co-authorship. The most active researchers are Kantabutra, Avery, Iqbal, Suriyankietkaew. According to the analysis of literature in the field of SL, made by Hallinger and Suriyankietkaew (2018), they are representatives of Sustainable Leadership School, which is small but especially important because the authors located in this school, have made the headway in defining and examining SL as an independent construct. It is indicative that the above-mentioned group of researchers is focused on the study of SL without the admixture of different models (entrepreneurial, responsible, ethical, authentic, transformational, servant) of leadership in connection with sustainable development. In addition, they do not study sustainable leadership only in the context of a closed organizational system, but are always interested in the public social context as well. This consequently means that such refined and targeted SL could have great possibilities for practical application and further development.

Table 2: Rank order of the ten most highly cited authors on sustainable leadership in industry, 2009–2023

Rank	Author	h_index	g_index	m_index	Citations	Articles
1	Kantabutra, S.	7	9	0,5	201	9
2	Avery, G.C.	6	6	0,44	328	6
3	Iqbal, Q.	3	4	0,6	68	4
4	Suriyankietkaew, S.	3	3	0,273	64	3
5	Bergsteiner, H.	2	2	0,143	214	2
6	Piwowar-Sulej, K.	2	3	1	19	3
7	Ahmad, N.H.	1	1	0,2	49	1
8	Branco, M.C.	1	1	0,143	9	1
9	Chaves, C.	1	1	0,143	9	1
10	Cheng, C-F.	1	1	0,25	5	1
11	Chowdhury, F.	1	1	0,25	5	1

4.2 Geographical research presence

The largest contribution to scientific articles in the field of SL in industry was made by educational institutions and researchers on Thailand (12). This was certainly supported by the politics of King Bhumibol Adulyadej, who, following the financial crisis in 1997, laid the foundations for the Philosophy of Sufficiency Economy, which promotes self-sufficiency and sustainability in agriculture and industry. The basis of the subject philosophy are Buddhist values, whose three major components are wisdom, moderation, and caution, while morality and knowledge should be always applied. With this purpose, six Royal Development Study Centers have also been established to conduct research and development activities to ease problems faced by residents in each region of the country (Languepin, 2019). They are followed by researchers from Australia (7), who have great collaboration (4) with Thai colleagues. They are followed by Saudi Arabia and Poland (3), where researchers Iqbar and Piwowar-Sulej, who have been particularly active recently, participate together. This can certainly be attributed to the activity of Saudi Arabia, which, even more than other countries, advocates to achieve the Sustainable Development Goals of the United Nations 2030 Agenda. Credit goes to the Saudi king Salman bin Abdulaziz who in 2016 launched the Vision project, which aims,

based on the key component of sustainability in a broad spectrum, transforming their unique strategic location into a global hub connecting three continents, Asia, Europe and Africa.

4.3 The most explored country industries

By far the most research was done on companies located in Thailand (12). It concerns various areas of industry, namely: telecommunications, banking, construction, manufacturing, and the food industry. This makes Thailand the world's leading country in research of SL in the field of industry. It is followed by research in Pakistani industry (3), which was probably fostered in a broader perspective by the atmosphere in which the Pakistani government, due to social inequality, population growth and industrial pollution, promotes various sustainable projects, as "the current social and environmental indicators and other related figures are horrific and mind-boggling" (Mehdi, 2019). The research was directed particularly on the hospitality industry and other types of industries, which are not specifically mentioned in the research. In China, India, Germany, 2 surveys were done and 1 in Canada, Portugal, Romania and USA.

4.4 Prevalence by type of research

In terms of prevalence by type of research, a balance between quantitative and qualitative studies should be acknowledged. There are 12 quantitative surveys which samples consisted of employees from small- and medium-sized enterprises (SMEs) across diverse industries. They are followed by case study research (11), including those based on: a) multi-method case study approach, which includes in-depth interview sessions with top management team members and employees, multi-data collection methods included non-participant observations made during visits to the enterprise, and reference to internal and published documentation and information, b) including survey by questionnaire c) or ex-post facto research, d) analysis of managerial practices through companies' annual reports and financial overview. Among them, the first approach dominates, while the last two are quite rare. The last one was, for example, used in the initial phase of establishing the study of SL. The remaining two studies belong to the field of conceptual studies, as they are based on the authors' past research.

5 Discussion and conclusion

After analysis, the paper concludes that SL is a relatively young field that still offers much potential for future development and research. This is also confirmed by the small number of articles, authors and geographical absence in most parts of the world. Additional explanations are provided below.

To better understand all the nuances of the discussion, we must first take note of the fact that 193 countries in the UN General Assembly adopted the 2030 Development Agenda entitled "Transforming our world: the 2030 Agenda for Sustainable Development". It is necessary to start with this and in this context also address all the implications related to SL. Considering that implementation involves national governments and sub-national authorities, while non-state actors are businesses and civil society (Llanos et al., 2022), there are surprisingly few studies on SL. This is even more so considering that industry is the biggest factor in implementing sustainable solutions due to its scale and overall (social, environmental, and cultural) impact. It can therefore be concluded that current leaders are not up to the challenges of sustainable development, whose main characteristics are the satisfaction of all stakeholders and a long-term vision. A small number of authors dominate the geographical area of practical exploration of SL, so it is imperative that others join them in disseminating SL and its results in practice. Because sustainability is not the task of the chosen ones, but of every individual.

The main researchers working on SL as an independent construct come from the Indo-Pacific region; most research is also carried out in companies from this part of the world, while increased activity can be recognized in the Middle East. Examples of SL practices from other parts of the world are rare and/or do not have the scope to provide insight into the use of SL characteristics in practice. Therefore, there is a need for larger part of the world to become more actively involved in the implementation and research of SL. This is even more necessary because leadership, as a complex process by which one person influences others to accomplish a mission, task or goal and guide the organization to become more coherent and cohesive (Clark, 1997), is a fundamental role in implementing the concept of sustainable development. Given that a person conducts this process using their leadership attributes (beliefs, values, ethics, character, knowledge and skills), in light of the study's findings, a change in mindset and behavior is required if we want to

achieve the Sustainable Development Goals. It is necessary to move forward because current leadership models have been developed for the "typical American worker": a white male with a high school education working in manufacturing (Hogan, Curphy and Hogan, 1994), while transformational leadership, as the most studied leadership model, has no component of inclusion and sustainability.

In the long term, the authors assume that a global change in the perception of the importance and implementation of SL will require the constructive interaction of researchers from the fields of business and management with researchers from the field of education. The aim is to explore the extent to which sustainable development and SL are present in the formal education of young people in the educational system. Because it is precisely through a change of mindset and the high-quality implementation of sustainable mechanisms in the school system that we will create a better and fairer world.

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PRILAGAJANJE NA PODNEBNE SPREMEMBE S TROPSKIMI STROČNICAMI

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V zadnjem desetletju se je v Sloveniji izrazito povečalo število kaskadnih primerov izrednih vremenskih dogodkov. Prav tako velik del slovenskega ozemlja sodi na območje, kjer se je pridelek močno zmanjšal zaradi različnih oblik kmetijske suše. Podnebni krizi se najverjetneje ne moremo izogniti, lahko pa se nanjo pripravimo. Kmetijska pridelava je močno odvisna od vremenskih in podnebnih razmer, zaradi česar spada kmetijstvo po eni strani med najbolj ranljive gospodarske sektorje, po drugi strani pa igra pomembno vlogo pri blažitvi podnebnih sprememb, zato je eden od ciljev skupne kmetijske politike tudi uvajanje dobrih kmetijskih praks za zavarovanje pridelka. Ena od možnosti je tako kolobarjenje z vrtninami, ki jih je mogoče gojiti na posameznem območju in ki dobro prenašajo toplotni in sušni stres. Med te rastline spadajo nekatere stročnice, ki pa jih pri nas skorajda ne gojimo. Z namenom, da bi bolje spoznali to obsežno skupino kmetijskih rastlin, želimo v prispevku predstaviti nekatere manj znane stročnice, ki bi lahko bile primerne za gojenje v naših podnebnih razmerah, hkrati pa bi lahko obogatile ponudbo na lokalnih tržnicah. Med te tropske stročnice sodijo: limski fižol ali masleni fižol (*Phaseolus lunatus* L.), guar (*Cyamopsis tetragonoloba* [L.] Taub.), kitajski fižol (*Dolichos lablab* L.), golobji grah ali kajan (*Cajanus cajan* [L.] Millsp.) in krilati fižol (*Psophocarpus tetragonolobus* [L.] D.C.).

Ključne besede:

trajnostno
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tropske
stročnice

ADAPTING TO CLIMATE CHANGES WITH TROPICAL LEGUMES

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In the past decade, Slovenia has experienced a significant increase in cascading extreme weather events. A large part of the Slovenian territory is also within an area where agricultural droughts have severely reduced crop yields. While we may not be able to avoid the climate crisis, we can prepare for it. Agricultural production is highly dependent on weather and climate conditions, making it one of the most vulnerable economic sectors. On the other hand, agriculture also plays a crucial role in mitigating climate change, which is why one of the goals of the Common Agricultural Policy is to promote the adoption of good agricultural practices to safeguard crop production. One possible approach is crop rotation with vegetables that can be grown in a specific area and are resilient to heat and drought stress. Among these plants are some legumes that are not commonly cultivated in Slovenia. In order to better understand this extensive group of agricultural crops that tolerate heat and drought stress well, we aim to introduce some lesser-known legumes that could be suitable for cultivation in our climate conditions while also enriching the offerings at local markets. These include lima bean or butter bean (*Phaseolus lunatus* L.), guar (*Cyamopsis tetragonoloba* [L.] Taub.), *hyacinth bean* (*Dolichos lablab* L.), pigeon pea or cayan (*Cajanus cajan* [L.] Millsp.), and winged bean (*Psophocarpus tetragonolobus* [L.] D.C.).

Keywords:

Sustainable
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climat
changes,
tropical
legumes

1 Uvod

Podnebne spremembe povzročajo vidne spremembe v okolju, vplivajo na zdravje ljudi ter spreminjajo možnosti za pridelavo hrane in rejo živali. Po statističnih podatkih zahtevajo celo več življenj kot trenutne vojne, potresi in migracije, ki so prav tako povezani s spreminjanjem podnebja (Kapun, 2020).

Posledice klimatskih sprememb ogrožajo številne vidike našega življenja, ko vplivajo na:

- družbo (povečanje umrljivosti zaradi poletne vročine, tveganja, povezana s spremembo kakovosti zraka, razseljevanje in migracije, državljanski nemiri, razširjenje virusov, škodljivi organizmi in bolezni ...),
- podjetja (infrastruktura je ranljiva zaradi svoje zasnove, močno se povečuje povpraševanje po energiji za hlajenje, zvišanje zavarovalnih premij, negativen vpliv na zimski turizem ...),
- naravo (spreminjajo se fenologija rastlinskih in živalskih vrst, njihova številčnost in razširjenost vrst, struktura habitatov in ekosistemskih procesov, pojav škodljivcev, dviga se morska gladina, spreminja se slanost oceanov, pogostnost poplav se povečuje, pogostejši so vročinski valovi ...).

Ozračje v Sloveniji se je v zadnjih 50 letih v povprečju segrelo za 1,7 °C, kar je hitreje od evropskega povprečja (Kajfež - Bogataj, 2015). V primerjavi z večjim delom sveta, kjer so se temperature najbolj zviševale pozimi, so pri nas vse toplejša poletja. Presoje posledic podnebnih sprememb so kljub sedanjim splošnim trendom precej negotove. Scenariji bodočega podnebja, ki so bili pripravljene v okviru ocene podnebnih sprememb v Sloveniji do konca 21. stoletja, nakazujejo, da se bo ob predvidenem povečanju vsebnosti sulfatnih aerosolov in toplogrednih plinov (Bergant in sod., 2004) temperatura zraka še dvignila, v poletnih mesecih pa se bo zmanjšala tudi količina padavin. Tako naj bi se do leta 2030 temperature dvignile za 0,5 do 2,5 °C, od leta 2031 do 2060 za 1 do 3,5 °C in od leta 2061 do 2090 za 1,5 do 6,5 °C (Bertalinič in sod., 2018).

Med glavne ukrepe za zmanjševanje ranljivosti in povečevanje odpornosti proti pričakovanim vplivom podnebnih sprememb sodi tudi prilagajanje, tako na ravni države, regij in lokalnih skupnosti kot gospodarskih subjektov in posameznikov.

Namen prilagajanja pa je zmanjšati tveganja in škodo za okolje in zdravje ljudi na stroškovno učinkovit način (Sektor za trajnostno kmetijstvo, 2023). V predlagani novi skupni kmetijski politiki EU za obdobje od 2021 do 2027 sodi prilagajanje med prednostne naloge, a bodo za to potrebne velike javne in zasebne naložbe.

Med najpogostejšimi prilagoditvenimi ukrepi na nacionalni ali regionalni ravni so ozaveščanje, praktični ukrepi za zmanjšanje vpliva in tveganja ekstremnih vremenskih pojavov, strategije za porazdelitev tveganja ter razvoj in gradnja infrastrukture za namakanje in protipoplavno zaščito (Kurnik, 2019).

V zadnjem času je bilo preizkušenih več ukrepov za prilagajanje ekstremnim sušnim razmeram. Priporočila kažejo na to, da bo treba v prihodnosti (Bergant in Kajfež - Bogataj, 2004; Oberstar, 2015):

- ustanavljati centre za sušo,
- spremljati razmere in svetovati na terenu prek kmetijske svetovalne službe,
- razvijati sodobne tehnologije pridelave oziroma razviti ustrezno setveno sestavo,
- ohranjati avtohtone in tradicionalne sorte kmetijskih rastlin,
- prilagoditi kolobar, za kar bodo potrebni sortno-ekološki poskusi z vrstami in sortami poljščin in vrtnin, odpornih proti suši,
- izboljšati kakovost in rodovitnost tal (povečanje humusa v tleh) z zmanjšano obdelavo, setvijo metuljnic, uporabo dosevkov in sosevkov, z zaoravanjem žetvenih ostankov ...,
- izboljšati trajnostno rabo vode in uvajati pametno namakanje,
- zavarovati kmetijsko pridelavo ...

Eden od možnih prilagoditvenih ukrepov v povezavi s spreminjajočimi se klimatskimi razmerami je tudi gojenje rastlin, ki dobro prenašajo toplotni oziroma sušni stres. V to skupino spadajo tudi nekatere poljščine oziroma vrtnine iz skupine stročnic, ki bi lahko bile ključ za povečanje odpornosti kmetijskih ekosistemov, saj so zelo odporne proti izrednim klimatskim razmeram. V primerjavi z večino tradicionalnih kmetijskih rastlin imajo manjši ogljični in vodni odtis (npr. za vzgojo 1 kg leče je potrebnih 1.250 l, za 1 kg govedine pa 13.000 l vode).

Žal danes v EU in Sloveniji tradicionalne zrnate stročnice (soja, fižol, bob in grah) gojimo le na približno 3 % obdelovalnih površin (Cigić in sod., 2022). Ker imajo stročnice široko genetsko raznolikost, lahko iz te družine izberemo nekatere klimatsko odporne vrste, ki jih predstavljamo v nadaljevanju.

2 Stročnice

Stročnice pripadajo družini Fabaceae (metuljnice), ki obsega več kot 700 rodov in okoli 20.000 vrst. Prepoznamo jih po obliki cvetov (v obliki metulja) in značilnih plodovih (strokih). Ker stročnice na koreninah razvijejo simbiotske bakterije, imajo sposobnost vezave atmosferskega dušika, to pa ima za posledico manjšo porabo mineralnih gnojil in povečanje razvoja trajnostnih beljakovinskih izdelkov (Cigić in sod., 2022). Stročnice so odličen vir beljakovin in so prepoznaven znak vegetarijanske prehrane. Setev stročnic pa vpliva tudi na biotsko pestrost, ker rastline s svojimi pisanimi cvetovi privlačijo opraševalce (Žnidarčič, 2013).

2.1 Limski fižol (*Phaseolus lunatus* L.)

Pradomovina limskega fižola naj bi bili tropski deli Južne in Srednje Amerike, kjer fižol uspeva na območjih do 2500 metrov visoko. Prvotni evropski naseljenci so ta fižol našli v Peruju, zato so ga poimenovali po glavnem mestu Peruja Limi (Bonita in sod., 2020). Zdaj je pridelovanje fižola razširjeno v južnem delu Severne Amerike, Južni Ameriki, Afriki in Aziji. Divji tipi tega fižola vsebujejo glikozid – fazeolunatin, zato jih je treba pred uporabo kuhati (Salunkhe in sod., 1989). Po debelini zrnja razlikujemo debelozrnati (trajnica) in drobnozrnati limski fižol (enoletnica). Oba tipa fižola imata plezajočo grmičasto ali pritlikavo rast (Černe, 1997).

Limski fižol ne prenese zmrzali in kali pri temperaturah od 15 do 30 °C, za rast pa je najugodnejša temperatura med 22 in 30 °C. Drobnozrnat sorte dobro prenašajo sušo in vročino, zato so bolj razširjene kot debelozrnat sorte. Limski fižol oskrbujemo podobno kot navadni fižol (Adebo, 2023).

Okužbe, ki jih povzroča gramnegativna bakterija *Pseudomonas syringae* in so vidne kot ožig na listih in lise na strokih, so največja nevarnost za to vrsto fižola. Veliko škode rastlinam povzroča tudi pepelasta plesen (*Phytophthora phaseoli* Thaxt) (Sikora, 2023).

Zeleni (mladi) fižol pobiramo ročno, ko so semena skoraj povsem razvita, vendar preden začnejo stroki rumeneti. Barva semen se spreminja od temne proti zeleni in je na koncu bela. Tehnološko zrelost ocenimo tako, da je v stroku od 3 do 5 % belih semen, preostala semena pa so blede zelena. Pridelek zrnja pa se giblje od 6 do 15 t/ha.

Limski fižol je hitro pokvarljiv in občutljiv za poškodbe zaradi mraza, zato ga takoj po žetvi najprej ohlajajo in tudi kasneje ohranjajo pri nizki temperaturi. Stroki so bolj občutljivi za poškodbe zaradi mraza, kot so pri navadnem fižolu. Zato neoluščena semena hranijo pri temperaturi od 5 do 6 °C, oluščena pa pri temperaturi od 3 do 4 °C. Pri teh pogojih lahko neoluščena semena hranimo do največ 5 dni, oluščena semena pa približno en teden (Lešić in sod., 2002).

Svež limski fižol lahko tudi konzerviramo, in sicer tako, da zrna najprej operemo, nato sortiramo po velikosti in blanširamo z vročo vodo (88–95 °C). Še vroč fižol prelijemo z 2-odstotno slanico in konzerve segrejemo na 115 °C (Salunkhe in sod., 1989). Drug način konzerviranja pa poteka tako, da se blanširana zrna tretirajo z 1,5-% raztopino sulfita pri pH 7,2, da ohranijo barvo. Nato zrnje za približno 12 ur dehidrirajo skozi pretočni atmosferski sušilnik. Dehidrirani fižol kasneje vakuumsko pakirajo v navadne konzerve (Esquivel in sod., 2005). Najpreprosteje pa je, če stroke posušimo na soncu in semena šele kasneje ločimo od stroka. Taka semena lahko nekaj mesecev shranjujemo pri sobni temperaturi (Mani in Thirumalai Natesan, 2021).

2.2 Guar (*Cyamopsis tetragonoloba* [L.] Taub.)

Guar je avtohtona rastlina z indijske podceline in ga večinoma pridelujejo na siromašnih in manj rodovitnih tleh v sušnih in pol sušnih razmerah tropskega in subtropskega pasu. Rastlina je samooprašna, cveti v kratkem dnevu, občutljiva je za mraz in vznikne šele pri 22 °C (Lešić in sod., 2002). Mladi stroki so sladkastega okusa in se pripravljajo podobno kot stročji fižol.

Semena guara vsebujejo galatkomanan, ki ima v primerjavi z drugimi vodotopnimi polisaharidi veliko molekulsko maso. Endosperm namreč vsebuje od 68 do 70 % galaktomananske smole, poznane tudi kot »guar gum«, rastlinska smola. Smola je sestavljena iz delov D-galaktopiranose in D-manopiranoze. Pri kalitvi semen je za

biološko razgradnjo galatkomana potrebna prisotnost vsaj treh encimov: α -D-galaktozidaze, β -D-manaze in β D-manozidaze. Guar je tudi dober vir vitamina A in železa (Khan in sod., 1998). Galaktomanansko smolo najpogosteje uporabljajo kot zgoščevalec v prehranski, tekstilni, kozmetični in papirni industriji (Pathak in sod., 2010).

Guar lahko gojimo na skoraj vseh tipih prsti, najboljša zanj pa so odcedna lahka tla. Ker je rastlina zelo odporna proti suši, jo lahko gojimo na območjih z malo dežja in visokimi temperaturami, tako da je guar primeren tudi za pridelovanje brez namakanja. Po navadi ga gojijo v mešanih posevkih z bučami, bombažem ali sladkornim trstom, obirajo pa zrele stroke, od spodaj navzgor, in si s tem zagotovijo podaljšano obdobje obiranja (Gunjal in Kadam, 1989).

2.3 Kitajski fižol (*Dolichos lablab* L.)

Kitajski fižol izvira iz podsaharske Afrike in s tropskih območij, kjer raste na območjih do 2000 m nadmorske višine. Poznan je tudi kot egipčanski, indijski, hiacintni in lablab fižol. To je grmičasta (zraste do enega metra) ali vzpenjava (zraste od 4 do 6 metrov) trajnica, ki jo gojimo kot enoletnico. V do 20 cm dolgem stroku najdemo od 4 do 6 semen, ki so okrogla, belo, rdeče, rjavo, črno ali pisano obarvana, na semenu je do 1 cm dolg bel popek. Rastline cvetijo v kratkem in dolgem dnevu, nekatere pa so glede dolžine dneva tudi nevtralne. Večinoma so to samooprašne rastline, samo 5 % je tujeprašnih, križanje pa opravijo žuželke (Letting in sod., 2021).

Kitajski fižol pridelujemo podobno kot navadni fižol. Od setve do obiranja mine od 90 do 150 dni, za uspešen razvoj pa potrebujejo rastline od 18 do 30 °C, ob pogoju, da rastejo na dobro osončeni in zavetni legi ob vsaj 70-% zračni vlagi. Za hektar površine je potrebnega okoli 30 kg semena. Visoke sorte potrebujejo oporo, na katero rastline privezujemo med rastjo. Pri nizkih sortah pa je priporočljivo odstraniti rastne vršičke, da se rastline močneje razraščajo (Černe, 1997).

Pomembnejše bolezni kitajskega fižola so (Schaaffhausen, 1983): *Cercospora dolichii* E. & E 134, *Leveillula taurica* var. *macrospora* Uppal, Kamat & Patel. in rumeni mozaik (BYMV). Kitajski fižol napadajo isti škodljivci kot navadni fižol.

Mlade stroke obiramo od 42 do 63 dni, zrna pa od 70 do 100 dni po setvi. Zelo močne rastline po obiranju skrajšamo za polovico, kar pospeši razvoj poganjkov, tako da v ugodnih razmerah lahko oberemo še en pridelek z iste rastline. Povprečen pridelek je 5–8 ton zelenih strokov na hektar (Kay, 1979).

Kitajski fižol je hrana z visoko hranljivo vrednostjo. V Aziji ga uporabljajo kot zelenjavo in ga pripravijo na različne načine. Nezrela zelena semena ločijo od strokov in jih jedo kuhana ali pečena. V Egiptu so kitajski fižol včasih uživali namesto bob, v Aziji pa zrele stroke pogosto uporabijo v jedi dhal. Seme včasih namočijo čez noč, ko začne kaliti, ga posušijo na soncu in shranijo za poznejšo uporabo. Luščine pa pogosto uporabijo kot hrano za govedo (Kadam in sod., 1998). Zadnje raziskave so pokazale, da bi ekstrakt iz semen kitajskega fižola lahko preprečeval obolenje zaradi hudega akutnega respiratornega sindroma koronavirusa-2 (SARS-CoV-2) (Liu in sod., 2020).

2.4 Golobji grah (*Cajanus cajan* [L.] Millsp)

Golobji grah so v Egiptu gojili že 2000 let pred našim štetjem. Izvira iz tropske Afrike in Indije, kjer je še zdaj pomembna stročnica. Ker ima globok koreninski sistem, je primeren za sušna območja. Večje pridelke dosega v suhem obdobju leta, medtem ko v vlažnih letih semena in stroke ogrožajo škodljivci. Kot vrtnino uporabljamo nezrela zrna in stroke, največ pa dozorela semena. Rastline so primerne tudi za zeleno gnojenje in prehrano živali (Odeny, 2007).

Golobji grah je pokončna, do 250 cm visoka lesnata trajnica, ki jo gojimo kot enoletnico. Ima tanke koničaste tridelne liste in rumene ali rdeče cvetove. Stroki spominjajo na grah, so koničasti in zeleni, v grozdih jih je po več skupaj. Pri golobjem grahu razlikujemo dve podvrsti (Morton, 1976), in sicer tur (*Cajanus cajan* var. *Flavus*), ki je dolgodnevica, zori bolj zgodaj, ima zelenkaste stroke, v katerih so po tri semena, in arhar (*Cajanus cajan* var. *bicolor*), ki dozoreva pozno, ima rdeče ali rjavo marmorirane stroke, v katerih je po 4 do 5 semen in je kratkodnevica.

Rastline zahtevajo zelo prepustna tla z lahko teksturo. Zaradi globokih korenin je pred setvijo nujno globoko oranje. Grah je predvsem občutljiv za pomanjkanje fosforja, zato je priporočljivo vsakoletno gnojenje s 50 kg P₂O₅/ha (Ae in sod., 1990). Rastline razmnožujemo s semeni, ki jih posejemo v vrste od 90 do 120 cm

narazen, med vrstami pa je razmik od 30 do 40 cm, tako da potrebujemo od 8 do 10 kg semena/ha. Izjemoma pa rastline lahko razmnožujemo tudi s stebelnimi potaknjenci. Začetek razvoja strokov se začne od 3 do 4 mesece po setvi; v 5 do 6 mesecih dozorijo zgodnje sorte, medtem ko pozne rastejo eno leto (Černe, 1997). Najpomembnejša bolezen golobjega graha je venenje, ki ga povzroča gliva *Fusarium oxysporum* Schltdl, 1824 (Hillock in sod., 2000).

Konzerviranje zelenih semen golobjega graha je najpogostejši način shranjevanja golobjega graha (Mainsfield, 1980).

2.5 Krilati fižol (*Psophocarpus tetragonolobus* [L.] D.C.)

Gojenje krilatega fižola se je razširilo najprej v jugovzhodnem delu tropske Azije. Rastlina spada med zelne trajnice, ki jo sicer gojijo kot enoletnico, za katero je značilno žilavo steblo, ki je nagnjeno k ovijanju ob opori. Fižol ima gomolje z visoko sposobnostjo vezave dušika, modre ali vijoličasto obarvane cvetove in do 35 cm dolge stroke, za katere je značilno, da so po vsej dolžini obraščeni z nazobčanimi krilci (Kadam in Salunkhe, 1984).

Odlika krilatega fižola je, da je kakovostno beljakovinsko rastlinsko hranilo. Gomolji, ki so prijetnega in nekoliko sladkastega okusa, slonokoščenega leska in čvrste teksture, imajo visoko prehransko vrednost, saj vsebujejo približno petkrat toliko beljakovin kot sladki krompir in desetkrat toliko kot korenine kasave. Poleg tega imajo v primerjavi z drugimi tropskimi gomoljnicami manj žveplovih aminokislin (Parthasarathy, 1986).

Fižol za pravi razvoj potrebuje zelo veliko vode, zato ga gojijo na vlažnih tropskih območjih, to je tam, kjer soja ne uspeva. Cveti v kratkem dnevu, zato ga ni mogoče gojiti v zmernem podnebju, saj začne cveteti v času, ko razmere za pridelovanje te toplotno zahtevne rastline niso ugodne. Idealna temperatura za rast se giblje pri okoli 25 °C.

Trda povrhnjica semen ovira vznik, zato vznik pospešimo, če semena narežemo ali pred sajenjem namočimo. Priporočena razdalja setve je 60 cm v vrsti, medvrstna razdalja pa naj bi se gibala med 60 in 120 cm. Na rastlinah redko srečamo boleznin in škodljivce. Na listih se občasno pokažejo rja vrst *Synchytrium psophocarpi* (Rac.)

Gäumann in *Cercospora psophocarpi* J. M. Yen ter črna fižolova uš (*Aphis craccivora* Koch), na koreninah pa nematode (*Meloidogyne* spp.) (Kadam in Chavan, 1998).

Seme, ki je okroglo in zeleno, podobno kot pri soji, se razvije približno 60 dni po opraitvi. Na hektar pa se pričakovani pridelek suhega semena giblje med 5 in 20 tonami (Parthasarathy, 1986).

Za prehrano je mogoče uporabljati suho seme, nežne poganjke in liste. Liste in cvetove krilatega fižola lahko uživamo surove ali kuhane ali pa jih dodajamo v solate, k ribjim jedem ali juham (Kadam in Salunkhe, 1984).

4 Zaključek

Pridelava hrane postaja vse večja grožnja za naravo, saj se s povečevanjem prebivalstva povečuje potreba po hrani, z ekonomskim razvojem pa tudi potreba po vedno bolj raznovrstni prehrani. Intenzivno kmetijstvo je tako med drugim krivo za krčenje gozdov in izgubo biotske raznovrstnosti, prav tako močno spodbuja tudi podnebne spremembe zaradi izpusta plinov, kot so ogljikov dioksid, metan in drugi plini, zaradi katerih se segreva planet. Približno tretjina vseh svetovnih izpustov toplogrednih plinov nastane zaradi proizvodnje hrane na svetu, čedalje večji izpusti toplogrednih plinov pa bi lahko otežili doseganje ciljev, sprejetih v pariškem podnebnem sporazumu, celo, če bi se zaradi izgorevanja fosilnih goriv takoj ustavili.

Ker je kmetijstvo postavljeno pred izziv, kako zagotoviti zadovoljive in kakovostne pridelke ter stabilne prihodke pridelovalcev ob spremenljivih vremenskih razmerah, je dobro vedeti, da obstajajo rastline, kot so tropske stročnice. Od njih bi lahko imeli večkratne koristi, in sicer tako z vidika prehranske kakovosti kot zaradi njihovega prispevka k trajnostnim prehranskim sistemom.

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UVAJANJE TRAJNOSTNIH METOD HLAJENJA IN MAZANJA PRI TEHNOLOŠKIH PROCESIH ODREZAVANJA

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Proizvodni sektor odrezavanja kovin močno vpliva na svetovno gospodarstvo in s tem tudi na svetovne naravne vire in ekosisteme. Naraščajoče povpraševanje po blagu in storitvah je povzročilo paradigmo linearne proizvodnje in potrošnje, ki je ni mogoče vzdrževati na dolgi rok. Potreba po prehodu v trajnostno proizvodnjo vključuje tudi zagotavljanje varnosti in zdravja pri delu, upoštevanje zakonodaje, zagotavljanje primernih delovnih okolij za zaposlene ter ustrezno ravnanje z odpadki (prekomerna uporaba hladilno mazalnih sredstev v procesu odrezavanja kovin). Konvencionalna raba hladilno mazalnih sredstev (HMS) v procesih odrezavanja je netrajnostna z vidika vpliva na okolje in zdravje zaposlenih. Za ovrednotenje učinkovitosti različnih načinov hlajenja in mazanja v procesu odrezavanja vrednotimo pet kazalcev trajnostne proizvodnje: poraba energije, varnost in zdravje zaposlenih, ravnanje z odpadki, stroški obdelave in vpliv na okolje. Za določitev ogljičnega odtisa (ali ekoloških sledi) izdelkov je bistvena poraba energije in snovi, učinkovitost strojne obdelave (življenjska doba orodja), ter ocena življenjskega cikla snovnih tokov. Analiziramo tudi organizacijske pristope in morebitne ovire pri uvajanju trajnostne proizvodnje (trajnostne strategije hlajenja in mazanja).

Ključne besede:

trajnostna proizvodnja, tehnološki procesi odrezavanja, hlajenje in mazanje, življenjski cikel izdelka, varnost in zdravje zaposlenih

INTRODUCTION OF SUSTAINABLE METHODS OF COOLING AND LUBRICATION IN TECHNOLOGICAL CUTTING PROCESSES

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The metal cutting manufacturing sector has a strong impact on the global economy and thus also on the world's natural resources and ecosystems. The increasing demand for goods and services has resulted in a paradigm of linear production and consumption that cannot be sustained in the long term. The need to transition to sustainable production also includes ensuring safety and health at work, complying with legislation, ensuring suitable working environments for employees and proper waste management (excessive use of coolants and lubricants in the metal cutting process). Conventional use of cooling lubricants (HMS) in cutting processes is unsustainable from the point of view of impact on the environment and the health of employees.

In order to evaluate the efficiency of different methods of cooling and lubrication in the cutting process, we evaluate five indicators of sustainable production: energy consumption, employee safety and health, waste management, processing costs and environmental impact. In order to determine the carbon footprint (or ecological footprint) of products, the consumption of energy and materials, the efficiency of machining (tool life), and the assessment of the life cycle of material flows are essential. Also analyzed were organizational approaches and possible obstacles in the introduction of sustainable production (sustainable cooling and lubrication strategies).

Keywords:

sustainable
production,
technological
processes of
cutting,
cooling and
lubrication,
product
life
cycle,
safety and
health of
employees

1 Uvod

Razvoj vsakega ekonomskega sistema temelji na njegovi proizvodni uspešnosti. Koncept trajnostne proizvodnje, ki je usmerjena k integraciji sistemov upravljanja dobavne verige z ekonomskimi, okoljskimi in družbenimi dejavniki pomembno vpliva razvoj opazovanega ekonomskega sistema (Hegab H, 219).

Koncept trajnostne proizvodnje je mogoče interaktivno analizirati na treh glavnih ravneh: izdelek, proces in sistem (Korkmaz 2023). Na ravni izdelka, se osredotočamo na pristop 6R (zmanjšanje porabe, ponovna uporaba, popravilo, ponovno oblikovanje izdelka, predelava, recikliranje, angleško: reduce, reuse, recover, redesign, remanufacture, recycle), tak pristop predstavlja zaključen življenjski krog (Hegab, 219). Na procesni ravni aktivnosti usmerjamo v zmanjšanje porabe energije, obvladovanje nevarnosti in odpadkov. Sistem dobavne verige naj upošteva vse faze življenjskega kroga.

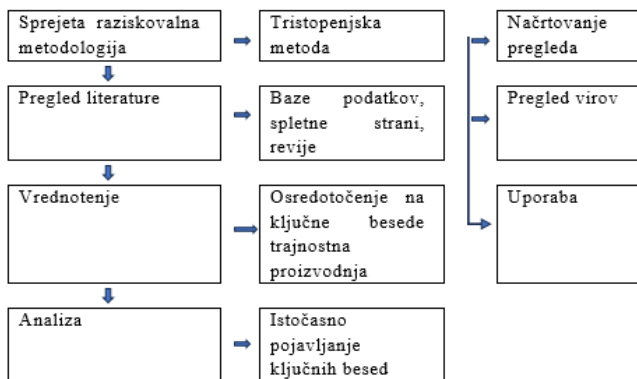
Poglavitni vir negativnih vplivov na okolje in zdravje zaposlenih pri obdelovalnih procesih odrezavanja je povezan z uporabo HMS. V literaturi (Klocke, 1997, Byrne 1993, Pušavec, 2010 Simpson, 2003, Hallock, 1994) je mogoče zaslediti, da uporaba HMS povzroča tveganje za različna zdravstvena tveganja, zato aktivnosti usmerjamo v zmanjševanje porabe HMS.

2 Raziskovalna metodologija

Za vrednotenje uporabljenih načinov hlajenja in mazanja uporabljamo v tabeli 1 prikazane kazalce. Za vsak način, vrednotimo kazalce s točkami 1 do 5 (1 zelo slabo, 5 odlično), nato točke seštejemo in razvrstimo posamezne načine hlajenja in mazanja (več točk - boljše).

Pri uvajanju trajnostne proizvodnje se osredotočamo na učinkovito rabo energije, zmanjševanje količine odpadkov in učinkovitejša masna tokova ter vrednotenje življenjskega kroga izdelka (Korkmaz, 2023), ob upoštevanju ogljičnega odtisa ali ekoloških sledi. Za vrednotenje trajnostnega izdelka je potrebno upoštevati: čas izdelave in priprave izdelka, porabo energije, stroške in porabo energije za transport. Vitka proizvodnja in trajnost sta povezani, saj z zmanjšanje porabe energije na enoto časa vodi do zmanjšanja časa proizvodnje na enoto izdelka.

Pri vrednotenju trajnostnih postopkov uporabe HMS upoštevamo parametre odrezavanja in učinkovitost obdelave. Podatke analiziramo s pomočjo literature kot prikazuje slika 1. Za trajnostno analizo upoštevamo tudi analizo življenjskega kroga.



Slika 1: Prikaz raziskovalne metodologije

Vir. lasten

3 Trajnostni dejavniki pri odrezavanju

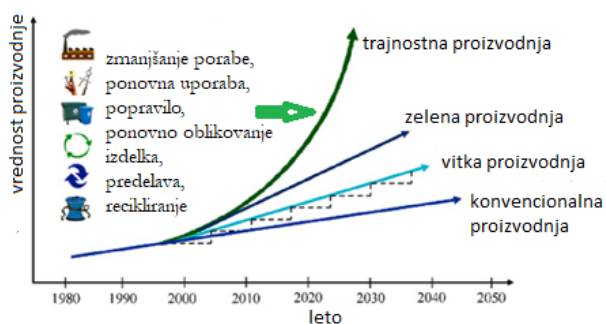
Proizvodni sektor odrezavanja kovin je v središču gospodarstev industrijskih držav, zato je zagotavljanje trajnostne proizvodnje ključno za ohranjanje visokega standarda življenja, ki ga je vzpostavila industrializirana družba, ključne elemente trajnostne proizvodnje so predstavljamo na sliki 2.

Na sliki 3 je prikazan razvoj od konvencionalne do vitke, zelene in končno trajnostne proizvodnje v več generacijah. Nova strategija, imenovana pristop 6R, nadomešča tradicionalni pristop 3R (recycling, reuse, remanufacturing).

Ob upoštevanju rezultatov raziskav (Yilmaz, 2020, Zhou, 2016, Zhao, 2017) najmanjšo **porabo energije** dosegamo ob povečanju odstranjenega materiala na enoto časa, z uporabo ustreznih rezilnih orodij in optimalnimi rezalnimi parametri.



Slika 2: Ključni dejavniki trajnostne proizvodnje
(Korkmaz, 2023)



Slika 3: Prehod na trajnostno proizvodnjo
(prirejeno po Korkmaz, 2023)

Izpostavljenost aerosolom, škodljivim plinom in kovinskim delcem pri odrezavanju predstavlja tveganje za **zdravje zaposlenih** (Shokoohi, 2015). Uporaba konvencionalnih HMS in HMS na osnovi vode (razvoj bakterij in plesni) negativno vpliva na zdravje zaposlenih.

Optimiziranje HMS, rezalnih orodij in parametrov odrezavanja omogoča ustrežnejše **upravljanje z odpadki** (Biron, 2020). Pri postopku odrezavanja nastajajo odrezki, izrabljena HMS in izrabljeno rezilno orodje. Odrezke lahko ponovno uporabimo (3-D tisk kovin, prašnata metalurgija), recikliranje odrezkov, ponovna uporaba ali recikliranje HMS in v nekaterih primerih tudi ostrenje rezalnega orodja (Günan, 2020). Recikliranje HMS je mogoče izvesti s fizikalnimi, kemičnimi in biološkimi postopki (Wu, 2021).

4 Vrednotenje postopkov hlajenja in mazanja pri procesih odrezavanja

4.1 Odrezavanje brez uporabe HMS

Odrezavanje brez uporabe HMS zmanjšuje okoljska tveganja. Povečuje se obraba orodja in slabša kakovost površine, povečuje se poraba energije in temperatura v rezalni coni. Kljub temu tak način odrezavanja glede porabe energije in stroškov strojne obdelave ocenjeno kot učinkovito (Hegab, 2018). Odrezavanje brez uporabe HMS opredeljujemo kot okolju prijazen način obdelave z odrezavanjem.

4.2 Kriogeni način

Kriogeno odrezavanje je postopek, ki znižuje temperaturo rezalne cone z uporabo utekočinjenih plinov (CO_2 , N_2), zmanjša se obraba orodja in ni kemičnih reakcij, ki so posledica povišanja temperature (Pušavec, 210). Boljša je učinkovitost rezalnih procesov in manjša poraba energije. Oprema je zahtevnejša in dražja, zaradi česar ta način ocenjujemo kot srednje učinkovit glede porabe energije. Stroški rezalnega orodja so nižji. Uporaba okolju in zaposlenim nenevarnih plinov prispeva k trajnostnemu načinu odrezavanja, nizke temperature pa predstavljajo nevarnost omrzlin. Kriogeno odrezavanje vrednotimo kot srednje učinkovito glede varnosti in zdravja zaposlenih, ravnanja z odpadki ter vplivov na okolje.

4.3 Minimalna količina uporabe HMS (MQL)

Pri MQL načinu se optimalna količina HMS v meglici razprši v cono rezanja, pri tem načinu dosegamo boljšo učinkovitost postopka odrezavanja (manjše rezalne sile v primerjavi brez uporabe HMS). MQL ima slabše hladilne sposobnosti, saj se bolj

osredotoča na mazalne zahteve (Günan, 2020). Način odrezavanja MQL glede porabe ocenjujemo kot srednje učinkovit, potrebno je dodatno vlaganje za reševanje težav, ki so posledica odvajanja nastale toplote. MQL način je okoljsko prijazen in zmanjšuje negativne vplive na zdravje zaposlenih, kljub temu meglica HML slabo vpliva na okolje. Srednjo stopnjo učinkovitosti upoštevamo pri vplivu na varnost in zdravje zaposlenih, visoko stopnjo pa pri ravnanju z odpadki.

4.4 Nano rezalne tekočine

Pri uporabi nano rezalnih tekočin v tehnoloških procesih odrezavanja dosegamo dobre rezultate pri toplotnih in triboloških lastnostih, zmanjšajo se rezalne sile, zmanjša se obraba orodja ter temperatura v coni rezanja (Sharma, 2015). Pojavljajo se težave zaradi turbulentnega toka, stabilnosti disperzije nano tekočine in visokih stroškov nano tekočine. Poraba energije se zmanjša, vendar je priprava nano tekočine energijsko intenzivna, zaradi tega tek način vrednotimo kot srednje učinkovito. Zaradi visokih stroškov priprave in predelave nano tekočin je takšen način odrezavanja stroškovno nizko učinkovit. Uporaba nano tekočin pri konvencionalnem načinu hlajenja predstavlja negativne vplive na okolje. Tak način postopka odrezavanja na področju ravnanja z odpadki, vlivov na okolje in varnosti in zdravja zaposlenih, ocenjujemo kot nizko učinkovito.

4.5 MQL nano rezalne tekočine

Uporaba nano rezalnih tekočin po načinu MQL v tehnoloških procesih odrezavanja je učinkovita na področju toplotne prevodnosti in zmanjšanju okoljskih vplivov. Porabo energije vrednotimo kot srednje učinkovito, ker ostanejo potrebe po energiji za pripravo nano tekočin enake kot pri konvencionalnem postopku uporabe nano rezalnih tekočin. MQL metoda uporabe nano rezalnih na področju ravnanja z odpadki, vlivov na okolje in varnosti in zdravja zaposlenih, ocenjujemo kot srednje učinkovito. Skupni stroški obdelave so zaradi manjše porabe nano rezalnih tekočin ocenjeni kot srednje učinkoviti.

5 Rezultati trajnostnih postopkov hlajenja in mazanja pri tehnoloških postopkih odrezavanja

Na podlagi vrednotenja za vsak način hlajenja in mazanja pri tehnoloških procesih odrezavanja izračunamo skupno število točk. Postopke vrednotimo na podlagi učinkovitosti, upoštevamo teoretične izračune in praktične izkušnje, rezultate prikazujemo v tabeli 2. Hlajenje in mazanje brez uporabe HMS in kriogeni način izkazujeta najboljše trajnostne načine hlajenja in mazanja pri odrezavanju, najslabša pa je metoda z uporabo nano tekočin. V naslednjem koraku smo pri oceni upoštevali učinkovitost obdelave pri izračunanih parametrih rezanja v laboratorijskih pogojih. Najdaljšo obstojnost orodja je bila dosežena pri hlajenju in mazanju z MQL načinom. Optimalne pogoje rezanja smo določili na podlagi teoretičnih izračunov in praktičnih izkušenj. Učinkovitost merimo z kvocientom med časom rezanja in celotnim časom. Najboljšo učinkovitost smo ugotovili in zasledili v literaturi (Hssan, 2022) pri tehnologiji MQL.

Tabela 1: Vrednotena matrika vrednotenja kazalcev trajnostnega hlajenja in mazanja pri postopkih odrezavanja ob upoštevanju učinkovitosti obdelave (Hegab 219, lastni izračuni)

		Načini hlajenja in mazanja pri postopkih odrezavanja				
		Odrezavanje brez HMS	Kriogeno odrezavanje	MQL	Nano-tekočine	MQL-nano-tekočina
Kazalci trajnostnega odrezavanja	Poraba energije	1	2	2	3	3
	Stroški obdelave	1	2	3	2	3
	Varnost in zdravje zaposlenih	4	3	3	2	3
	Ravnanje z odpadki	5	5	3	2	3
	Vpliv na okolje	5	5	4	2	3
Učinkovitost obdelave		1	5	3	4	4
Skupaj		17	23	18	15	19

Največja poraba energije je pri postopku brez HMS, najučinkovitejša je tehnologija MQL (Hassan,, 2022). Poraba energije povečuje CO₂ odtis (Pavar, 2021), vendar samo kazalec porabe energije ne moremo sprejeti za osnovni kazalec trajnostne proizvodnje. Kot dopolnilo je lahko analiza življenjskega kroga izdelka (LCA) v naslednjih korakih:

- določitev namena in obsega presoje, opis obravnavanega izdelka in vire za izvedbo LCA,
- določitev in analiza snovnih tokov za izdelek, ki vključuje tudi vodo, transport in energijske tokove
- analiza LCA, ki vključuje tudi vpliv na zdravje zaposlenih.

Kot dopolnilo lahko uporabimo metodo ekoloških sledi prikazano v tabeli 3. Pri metodi ekoloških sledi vrednotimo energijske in snovne tokove ter transport. Za vrednotenje ogljičnega odtisa upoštevamo energijske površine (Global Footprint Network, 2024).

Tabela 3: Parametri za določitev ekoloških (Žun, 2004, Global Footprint Network,, 2024)

vrste bioproduktivne površine	energijske	kmetijske	pašniki	gozdovi	vodne	pozidane
	Utežni faktorji za določitev ekoloških sledi različnih tehnologij za proizvodnjo električne energije iz fosilnih goriv in jedrske energije					
	(gha / GWh) opomba: gha = globalni hektari					
termoelektrarne na premog	161					
termoelektrarne na tekoča fosilna goriva	150					
termoelektrarne na plinasta fosilna goriva	94					
jedrske termoelektrarne	161					
	Utežni faktorji za določitev ekoloških sledi , ki nastanejo pri proizvodnji električne energije iz obnovljivih virov energije					
hidroelektrarne						18

vrste bioproduktivne površine	energijske	kmetijske	pašniki	gozdovi	vodne	pozidane
toplotne elektrarne na biomaso				30		
vetrne elektrarne	4					1
geotermalna energija	20					
PV elektrarne						24
	Utežni faktorji za določitev ekoloških stopinj, ki so posledica transportnih sredstev					
	(gha/t km)					
železniški tovorni transport	$0,01 \cdot 10^{-3} \cdot 0,98$					$0,01 \cdot 10^{-3} \cdot 0,02$
cestni tovorni transport	$0,07 \cdot 10^{-3} \cdot 0,99$					$0,07 \cdot 10^{-3} \cdot 0,01$
letalski tovorni transport	$0,07 \cdot 10^{-3}$					
ladijski tovorni transport	$0,01 \cdot 10^{-3}$					
Utežni faktorji za transport so izračunani glede na povprečno porabo goriva, povprečno zasedenost transportnih sredstev, izdelave in vzdrževanja ter potrebno površino cest. Pri letalskem prometu so upoštevane le emisije v troposferi.						
	Pretvorbeni faktorji za določitev ekoloških sledi materiala (uporabe, odpadki, recikliranje)					
	(gha/t)					
surovine						
jeklo in jeklene zlitine	0,8*0,81					0,8*0,19
aluminij in ostale barvne kovine	9,8*0,81					9,8*0,19
odpadki						
aluminij in ostale barvne kovine						9,4*0,19
ostale kovine						5*0,09
ponovna uporaba snovi						
jeklo	0,8*0,81*0,15					-0,8*0,19
surovina za aluminij in ostale barvne kovine	9,8*0,81*0,95					-9,8*0,19
voda	Vodo obravnavamo kot lokalni vir, vso vodo iz hladilno mazalnega sistema je potrebno prečistiti in kot tako vrniti v vodotoke					

Pri tej metodi izračunamo porabo posamezne dobrine (energenti in snovi), to porabo nato pomnožimo z utežnim faktorjem. Ekološke sledi porazdelimo na šest različnih tipov bioproduktivnih površin prostora.

$$ES = \sum_{l=1}^n \sum_{j=1}^6 k_{j,l} r_{j,l} \quad (1)$$

- l , vrsta energenta ali snovi (),
- j , vrsta bioproduktivne površine (),
- r , raba posamezne dobrine (GWh/leto ali t/leto),
- kl_j , pretvorbeni faktor za posamezno dobrino, razdeljeno po tipih bioproduktivne površine

Ugotovimo, da sta metodi MQL uporabe nano tekočine in kriogeni način hlajenja in mazanja pri postopkih obdelave z odrezavanjem najbolj trajnostna načina obdelave, pri teh metodah dosežemo najboljše razmerje trajnostne proizvodnje in učinkovitosti obdelave. Metodi MQL in obdelava brez uporabe HML sta trajnostni proizvodnji, kar je potrebno upoštevati pri spremenjenih pogojih proizvodnje (delavniška proizvodnja, malo število kosov).

6 Sklepi

Pričakuje se, da bodo proizvodna podjetja prevzela trende uvajanja zelene trajnostne proizvodnje tudi pri tehnoloških procesih odrezavanja. Uvajanje trajnostnega pristopa v tehnoloških procesih odrezavanja ponuja usmeritve za določitev rezalnih parametrov za vsako specifično tehnološko operacijo odrezavanja posebej. Uporaba umetne inteligence omogoča kreiranje podatkovnih zbirk ustreznih podatkov, ki bi bile dostopne brez dodatnih stroškov in na ta način pripomogle k uvajanju trajnostne proizvodnje.

V raziskavi primerjalne študije je predstavljen pregled ocene trajnosti in učinkovitosti različnih strategij hlajenja in mazanja pri tehnoloških postopkih odrezavanja: odrezavanje brez HMS, kriogeno odrezavanje, MQL, nano-tekočine, MQL-nano-tekočina. Za merjenje učinkovitosti teh strategij so uporabljeni kazalci trajnosti proizvodnje: poraba energije, stroški obdelave, varnost in zdravje zaposlenih, ravnanje z odpadki, vpliv na okolje ter učinkovitost obdelave. Rezultati raziskav so

pokazali, da sta rezanje brez HMS in MQL najustreznejša načina hlajenja in mazanja v smislu trajnosti. Kriogeni način in MQL-nano-tekočine pa sta izkazali enakovredno trajnostno učinkovitost glede na preučevane trajnostne vidike. Najslabši rezultati so bili opaženi pri uporabi nano-rezalnih tekočin. Ob upoštevanju učinkovitosti obdelave sta se MQL-nano tekočine in kriogena obdelava izkazali kot najbolj trajnostna načina hlajenja in mazanja pri odrezavanju, ki združujeta ravnovesje interesov glede trajnosti proizvodnje in učinkovitosti obdelave.

Za nadaljnje delo se je potrebno osredotočiti na podrobnejšo razpravo glede vsakega trajnostnega kazalca in na možnost uporabe prilagojene metode ekoloških sledi, predvsem zaradi njene razširjenosti

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KAKŠNE SPREMEMBE LAHKO GENERATIVNA UMETNA INTELIGENCA PRINESE V ZDRAVSTVO?

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Ta vprašanja si zastavljamo ob osupljivih rezultatih umetne inteligence (UI). Generativna sistemi UI, kot je npr. GPT, ki poganja Chat GPT, preseneča tudi vrhunske strokovnjake. Prepletata se strah in velika pričakovanja. So segmenti človekove dejavnost, tudi v zdravstvu, kjer nas računalnik prekaša. Vendar ne gre za to, kdo je boljši, ampak zato, da z uporabo sodobnih orodij dela človek bolje. V prispevku bomo obravnavali nekatere spremembe, ki jih UI prinaša zdravstvenim delavcem in pacientom. Gre za uporabo UI kot kopilota v procesih diagnosticiranja, zdravljenja, rehabilitacije in ne nazadnje preventive. Končne odločitve pa ostajajo v rokah človeka pacienta in zdravstvenega delavca.

Ključne besede:

zdravstvo,
umetna
inteligenca,
generativna
umetna
inteligenca,
chat gpt,
računalnik

WHAT CHANGES CAN GENERATIVE ARTIFICIAL INTELLIGENCE BRING TO HEALTHCARE?

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These questions we ask ourselves in the face of the astonishing results of artificial intelligence (AI). Generative AI systems, such as GPT powered Chat GPT surprises even top professionals. Fear and great expectations are intertwined. They are segments of human activity, even in healthcare, where the computer surpasses us. However, it is not about who is better, but because using modern tools, a person works better. In this article, we will discuss some of the changes that UI brings to healthcare professionals and patients. It is about the use of UI as a co-pilot in the processes of diagnosis, treatment, rehabilitation and, last but not least, prevention. The final decisions, however, remain in the hands of the patient and the healthcare professional.

Keywords:

healthcare,
artificial
intelligence,
generative
artificial
intelligence,
chat gpt,
computer

43RD INTERNATIONAL CONFERENCE ON ORGANIZATIONAL SCIENCE DEVELOPMENT: GREEN AND DIGITAL TRANSITION – CHALLENGE OF OPPORTUNITY?

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The 43rd International Scientific Conference on the Development of Organisational Science was held in Portorož from 20 to 22 March 2024. This year's conference was held under the umbrella of the field, which is one of the key companions of development in modern organisations. The question we addressed - Challenge or Opportunity? was primarily aimed at reflecting on where change is taking us, in academic, economic and non-economic environments. In the context of scientific contributions promoting the development of knowledge and competences in both national and international contexts, we have reconnected the experience, theory and research findings of representatives of the academic and applied environments. The development of organisational science opens the door to the development strategies of organisations at the level of people, information systems and business systems engineering. The main three pillars of organisations are thus at the forefront of development, driven by environmental factors and guiding performance and growth from the perspective of social, economic, natural and other elements.

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43. MEDNARODNA KONFERENCA O RAZVOJU ORGANIZACIJSKIH ZNANOSTI: ZELENI IN DIGITALNI PREHOD – IZZIV ALI PRILOŽNOST?

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43. mednarodna znanstvena konferenca o razvoju organizacijskih znanosti je potekala med 20. in 22. marcem 2024 v Portorožu. Letošnja konferenca je potekala pod okriljem področja, ki je v sodobnih organizacijah eden ključnih sopotnikov razvoja. Vprašanje, ki smo ga naslovili – izziv ali priložnost? je bilo namenjeno predvsem razmisleku, kam nas vodijo spremembe, tako v akademskem, gospodarskem in negospodarskem okolju. V okviru znanstvenih prispevkov, ki spodbujajo razvoj znanja in kompetenc tako nacionalnega kot mednarodnega okolja, smo ponovno povezali izkušnje, teorijo in raziskovalne izsledke predstavnikov akademskega in aplikativnega okolja. Razvoj organizacijskih znanosti odpira vrata v razvojne strategije organizacij na nivoju ljudi, informacijskih sistemov in inženiringa poslovnih sistemov. V ospredju razvoja so tako omenjeni glavni trije stebri organizacij, ki jih vodijo dejavniki okolja ter usmerjajo delovanje ter rast s perspektive družbenih, gospodarskih, naravnih in drugih elementov.



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