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## The Dilemmas of Open (Citizen) Science

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### 1. Introduction

The contribution is addressing the concepts of 'open science' and citizen science in a broader socio-political and socio-scientific context. It discusses the dilemmas, ambivalence and a (perhaps) ideologised perception of the importance and role of openness in science and participation of general public in scientific research. It is clear that this kind of participation and collaboration can be beneficial, however, limits exist and a radical form of openness can lead to a loss of identity of science as autonomous social subsystem (Weingart, Joubert, Connnoway, 2021).

The notion of open science refers to a number of aspects, from greater public accessibility of scientific publications and data to the openness of scientific research in terms of cooperation with the general public. In this sense, the concept of citizen science has become more popular in recent years, being heavily advertised „*as a recognized, promoted and funded approach, which fosters scientific literacy and democratization of science*“ (ECSA, 2023). It is promoted by several international organisations and associations, notably the European Citizen Science Association (ECSA) and the European Commission which emphasizes that the general public should be able to make significant contributions and be recognised as a valid European producer of scientific knowledge (European Commission, 2023).

Furthermore, these approaches are not only a part of an EU (or global) campaign, but are becoming the subject of legislative implementation in many EU countries. They go beyond recommendations and strategic directions and are becoming mandatory instruments despite uncertainties and controversial interpretations with

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both the definition of open science and in terms of public engagement or citizen science.

The initiatives for open science (OS), initially only in terms of open access to publications and data, have been ongoing since 1995, led by both policymakers and researchers. Many guidelines were adopted by the European Commission, and subsequently by the EU member states, between 2015 and 2020. In recent years, we are witnessing a new wave of campaign that goes beyond recommendations and further emphasizes the inclusion of general public in scientific research. In this context, this paper discusses the following questions:

Does the current campaign for OS, especially in terms of public engagement (citizen science) and particularly as concerns a radical change in the criteria for scientific performance, have support within the scientific community, or is it being in some way imposed and led by certain groups? Can we talk about the excessive intervention of scientific research and development (R&D) policy in the scientific sphere – a kind of dirigism? Could it be that these normative changes – seemingly diverging from the principles of the so-called discrete contextual intervention (Willke, 1989) – will challenge the autonomy and principle of functional differentiation in the relationship between the subsystems of policy, science, civil society and law?

Will the campaign lead to long-term solutions? Does this set/system of new rules and methods for scientific operation include built-in mechanisms for identifying and addressing negative consequences or side effects during the implementation process?

In which cases would it be valuable and productive to forge connections between certain natural sciences and social sciences, especially with disciplines that traditionally employ methods like participant observation, focus groups, action research, and other forms of collaboration with community members or organisations involved in research?

## 2. Theoretical background of the open science narrative

Open science and citizen science have their theoretical foundations in sociology, philosophy of science, and policy documents. These texts focus on epistemological issues and the development of a new paradigm that integrates science within the social framework. Concepts like the Mode 2 production of knowledge and context of application (Gibbons et al., 1994), socially robust science (Nowotny et al., 2021), post-normal science (Funtowicz and Ravetz, 2003), democratisation of expertise (Jasanoff, 2005), Triple and Quadruple Helix (Carayannis and Campbell, 2009), and post-academic science (Ziman, 2006) aim to address the impact of science on society and locate scientific research and expertise within a new cognitive-epistemic framework. This means that, in the sense of a feedback loop, it also takes account of the influence of social factors, their knowledge and their relevant information arising from the context of application. We are speaking about the process of the socialisation/ social contextualization of science, where civil society is not only a passive recipient of scientific knowledge and technological applications, but it has a more active role, namely, one where society “speaks back to science” (see also Weingart, 2008). With this, a new type of knowledge is emerging – contextualized knowledge.

In these theoretical approaches, we are dealing with the socialisation rather than the politicisation and commercialisation of science. The former is based on civil society/stakeholder engagement and should exhibit the characteristics of a bottom-up process. Our thesis is that this engagement or approach has been lacking, and the campaign we are discussing here suggests more of a top-down approach (as implied by the term „campaign“). This means that we are instead dealing with politicisation in the sense of the initiative being administered by science policy, while on the level of public participation and ‘citizen scientists’ the initiative lies in the hands by professional researchers.

Apart from the mentioned theoretical concepts, the campaign for open science is impacted by the experiences related to the relationships between science, politics and broader societies, especially in the latest years (during the COVID-19 pandemic, see Adam and Gorišek

2022). Additionally, a post-factual society with conspiracy theories and fake news is emerging (Fischer, 2017; Alaszewski, 2023). The campaign for open science is likely intended as a response to these for science questionable tendencies. At the same time, it seeks to demonstrate that science is not something distant and elitist but accessible to ordinary people.

### 3. Evolution of the open science campaigns: from strategic documents to legislative implementation and new criteria for evaluating scientific performance

Essentially, the movement for open science is aimed at a more transparent, inclusive, and democratic scientific process by ensuring openness and accessibility to scientific knowledge, promoting scientific collaboration, and opening up the process of scientific knowledge creation beyond the traditional scientific community (UNESCO Recommendation on Open Science, 2023). The beginnings of the open science movement were largely focused on open access to scientific publications, data, and software, which encouraged investments in the development of data-sharing platforms such as the European Open Science Cloud and triggered the first wave of development of national (and supranational) guidelines for open access and open science around 2015.<sup>19</sup>

However, today we can observe a new wave of revisions to guidelines and strategies for open access. In the first half of 2023 alone, national strategies were adopted or revised in Spain, Slovenia and Romania (Science Europe, 2023). More recent strategies increasingly include the aspect of public engagement in science.<sup>20</sup> A considerable portion of the drive towards open science comes from universities, research

<sup>19</sup> For instance, Estonia developed principles and recommendations for the establishment of a national open science policy in 2016 (Estonian Research Council, 2024), while the Czech Republic implemented national strategy for open access to scientific information (EOSC 2024). Similarly, in 2015 Slovenia adopted the National Strategy for Open Access to Scientific Publications and Research Data in Slovenia 2015–2020.

<sup>20</sup> One example is Sweden, which is presently in the process of formulating guidelines for the “transition to open science”. Among the proposed goals is the promotion of research practices involving the public where relevant for the quality and advancement of research (National Library of Sweden, 2023).

institutions, and agencies (see for example organizations EOSC and OpenAire). Open science is expanding beyond national strategies and is gaining traction in national research policies. It encompasses advocating for open access to research findings and data, as well as more radical ideas that anyone can create scientific knowledge. Here, we observe the cases of France, the Netherlands and Slovenia, where the concept of open science is deeply ingrained in the national policies.

France adopted The Second French Plan for Open Science under the *Loi de programmation de la recherche*. The plan includes mandatory open access publication of books and articles, data and software access, and even the revision of the evaluation criteria for projects and researchers in order to prioritise the integration of open science principles, recognise the diversity of scientific production, and also reduce the importance of the impact factor (Ministere de l'enseignement duperieur et de la recherche, 2024).

The French plan mentions public involvement in the scientific research process only indirectly, whereas in the Netherlands it is more prominently highlighted. There, the coalition agreement even includes a vow to make open access the standard within ten years. One of the guiding concepts of the *National Programme Open Science NL* is to promote collaboration in the creation, assessment, and dissemination of scientific knowledge where collaboration includes actors beyond the conventional academic community, such as NGOs, government agencies, and citizens. The National Programma Open Science program posits that “*the scientific community itself needs to be representative of the society it aims to serve*” (p. 2022).<sup>21</sup>

In Slovenia, the idea of open science is incorporated into national sectoral legislation, where Article 2 of the Act on Scientific Research and Innovation Activity states among its principles that scientific research activity is grounded in the principles of “*open science, including open*

<sup>21</sup> „*Stakeholders from across all sectors of society and all components of the Quadruple Helix have clear pathways to participate in open and collaborative processes of scientific knowledge creation, evaluation, and communication to the benefit of society and its members, in all domains of research*“ (National Programma Open Science, 2022) is the stated objective of the Dutch approach by 2030.

access (following the principle of being open as much as possible, closed as much as necessary) /.../ and the inclusion of communities and citizen science" (Official Gazette of the Republic of Slovenia, Nos. 186/21 and 40/23).<sup>22</sup> Slovenia also recently adopted a decree<sup>23</sup> which, in addition to mandating publication in open access for publicly funded research and involving the interested public in scientific research, addresses the evaluation and assessment of researchers, organisations, and projects in accordance with the principles of open science.

The idea of open science has developed in the last few years from simply advocating for open and accessible data to calls for greater (or total) inclusivity in science and even a complete overhaul of scientific evaluation criteria. In 2022, 350 organisations from 40 countries signed the Agreement on Reforming Research Assessment, which calls for a broader understanding and evaluation of research contributions beyond just scientific publications. It proposes basing scientific evaluation primarily on qualitative assessments, abandoning metrics such as the h-index and the impact factor, and overall reforming assessment systems.<sup>24</sup> This agreement was also endorsed by the European Commission (CoARA, 2022).

Certainly, the quantitative criteria currently in place exhibit many shortcomings that have to be addressed. The current trends, however, lean towards completely abandoning them and basing evaluation

<sup>22</sup> More precisely, the domain of public involvement in science is addressed by the *Resolution on the Slovenian Scientific Research and Innovation Strategy 2030*. This resolution underscores open science as a goal to enhance the quality, efficiency, and responsiveness of research. In addition, it advocates the advancement of citizen science and the engagement of the public in scientific research activities as key measures to attain this objective. In line with this strategy, over the last few years the government has invested significant resources in promoting the idea of open science and citizen science. For example, EUR 4 million was allocated for the adaptation of public research organisations and the Central Technical Library at the University of Ljubljana to align their practices with the principles of open science (source: <https://www.gov.si/novice/2023-04-24-rezultati-razpisa-prilagoditev-javnih-raziskovalnih-organizacij-in-centralne-tehniske-knjiznice-univerze-v-ljubljani-za-delo-po-nacelih-odprt-znanosti/>).

<sup>23</sup> Decree on the Implementation of Scientific Research Work in Accordance with the Principles of Open Science (Official Gazette of the Republic of Slovenia, No. 59/2023).

<sup>24</sup> The aforementioned Slovenian decree foresees the evaluation of the content of the work rather than the place of publication, the evaluation of open access results, and the consideration of other research outputs (such as data and software, early and open sharing of research results, participation in open peer review processes, and involving citizens and civil society in research).

processes solely on qualitative assessments, which include openness and a wider spectrum of research outputs. However, it is not clear how these processes should be structured. Is the open access aspect of research output more important than its quality? Moreover, there is a lack of consideration of the feasibility of such a qualitative system and the potential shortcomings of qualitative evaluation. The idea of open review goes a step further by involving individuals from outside academia in the review process and enabling public commentary on scientific publications (Foster Open Science, 2024). This approach fails to consider the complexity of the relationship between science and the broader public.

For example, conspiracy theories emerged from manipulative or inaccurate interpretations of published studies, or methodologically flawed studies already in current, 'closed' system with peer review before publication. This raises questions whether just *passive* opening is sufficient to bridge the gap between science and the general public, or is it also necessary to address the issue of active openness, i.e., the explanation and interpretation of scientific results to the general public? Who takes on this role in the case of total inclusivity? Such a lack of critical reflection on some aspects of the open science movement could trigger doubts concerning the feasibility and meaningfulness of approaches this type, which could overshadow the positive aspects of citizens being involved in scientific research.

#### 4. Lack of critical approach and historical perspective

In general, two aspects of the open science movement are clearly missing. First, there is a lack of consideration for the historical context. Many principles established by the concept of open science have long been part of the scientific community. In the social sciences and humanities, several principles of involving non-scientists in the research process have been well established for decades (for example – Participatory Action Research, see Adam 2012). In addition, many organisations are already making their research findings publicly available. The question arises: who is truly *closed* and how are current trends leaning towards open science addressing this? Furthermore,

documents outlining guidelines and programmes for open science are often very general and give the impression of an ideological campaign rather than a professional consideration of solutions to the problem grounded in the scientific method.<sup>25</sup>

Second, there is a lack of critical reflection and consideration of the possible unintended negative implications of such calls. The assumption that anyone can create scientific knowledge, even without any prior knowledge, is quite naive. To communicate effectively with a scientist, a certain level of background knowledge is already required, but this becomes even more pertinent when engaging in the scientific process. There is also insufficient consideration of the relationship between different actors when discussing full inclusivity. How to proceed if there is a conflict between actors? Who prevails and how does this affect the quality of science?

The open science movement is undoubtedly positive in terms of facilitating easier access to scientific findings and data openness. Such passive openness promotes the creation of scientific knowledge and innovations and can potentially enhance quality and efficiency (OECD, 2015). Nonetheless, some problematic aspects of this approach are emerging. Reichmann and Wieser (2022) warn that open science in its present form exacerbates inequalities within the academic community. Scientific journals have adapted to the new guidelines, often requiring a substantial fee for publishing an article in open access, which for many may be unaffordable. This means that those with greater access to resources tend to benefit more from the open science movement (Cole et al., 2023).

At the same time, the idea of openness chiefly focuses on outward openness, with less emphasis given to internal openness, that is, within the scientific community, particularly as concerns interdisciplinary collaboration. A more critical approach to the ideas of open science is needed, moving beyond the oversimplified understanding

<sup>25</sup> The first principle of the afore-mentioned Dutch programme is that scientific knowledge is a public good, and access to it is a universal right. In this context, it is stated that academia must “provide equal opportunities for everyone to access, participate in, benefit and learn from, and contribute to scientific process and its outputs” (National Programma Open Science, 2022).

of open science. As Rafols, Meijer, and Gallart (2023) emphasise, „we shouldn’t monitor whether there is more or less open science, but what types of OS are developed and adopted, by whom, and with what consequences“.

## 5. Dilemmas of Citizen Science and total inclusivity in science

In general, the term „citizen science“ can be described as the involvement of volunteers (the public) in the process of research and expert advice. The literature contains a whole range of definitions and translations that often are already interpretations. Definitions oscillate between a minimalist and a maximalist version of citizen science, and between the proclaimed image and the actual implementation of projects. On the one hand, authors such as Lewenstein (2016) describe citizen science as the involvement of non-scientists in different steps of scientific process, including interpretation of data. On the other hand, documents, such as ECSA (Haklay et al. 2020) see citizen science as many different types of involvement of non-scientists’ in scientific project, even if their participation in the project is minimal (for example, sharing computing resources or downloading an app on their phone).<sup>26</sup>

In general, some authors see citizen science as a new doctrine, even a paradigm that leads to a new era in the democratisation of science. In their view, the data collected by ‘citizen scientists’ is of the same quality as if it had been collected by professional researchers and that their participation can be realised as project management and decision-making on all aspects of research, even methodological.

<sup>26</sup> The problems of the wide definitions and the importance of terminology were already raised by Eitzel et al. (2017). The authors noted that there are different dimensions of understanding citizen science as a tool (a method, research collaboration that improves scientific outcomes and educates participants), a movement (democratising the scientific process, restoring public trust in science), or a knowledge-producing capacity (empowering communities through scientific research – rooted in participatory action research). They found more than 15 different terms were being used to describe scientists (e.g., citizen scientist, civic educator, academic, professional, researcher, paid professional etc.) and 15 different terms to describe participants in citizen science projects (e.g., amateur, hobbyist, citizen researcher, collaborator, citizen, lay knowledge holder, layman etc.).

Others are more cautious, pointing to the issue of ethical and financial responsibility and the division of labour in conducting research. Even professional scientists struggle with many of these challenges, especially if they work in a disconnected or over-specialised way. Nevertheless, the participation of interested and cognitively active citizens is certainly beneficial for both themselves<sup>27</sup> and the research field they are engaged in, but only in certain conditions and without ideological bias. Thus far, however, we have been dealing with quite an undefined openness. But what we do know is that breaking down all boundaries and limits leads to a loss of identity for both science and public engagement. Weingart and his colleagues state: „... *the vagueness amongst science communication scholars and science policymakers regarding the most appropriate formats, features and objectives of public engagement with science is striking*“ (Weingart et al., 2021: 22).

Other analysts also note the unbearable ease with which the aims and mission of citizen science are defined. Most publications on the subject are normative, descriptive and value-oriented and a clear disconnect is visible between the propagated role of citizen science and the reality of the project's implementation and course. In practice, most of citizen science projects are from the natural science fields, include non-scientists (or, according to EU terminology, citizen scientists) as data collectors, and could be categorised as crowdsourcing projects (see for example Kullenberg and Kasperowski, 2016; Hexker, Garbe and Bonn 2018; Davis et al. 2023; Vohland et al. 2021). 'Citizen scientists' are essentially a kind of volunteers who participate or are involved in research work with professional researchers. In this sense, it is not a relationship between scientists and lay people so much as citizens and "well-informed citizens". Schutz (1976) noted that while these (cognitively active) citizens are under no illusion that they can replace experts, they simultaneously do not agree with the vagueness and ignorance of lay people regarding issues of importance. Well-informed citizens are those who look for explanations, verify their sources of information and are interested in research-supported explanations and 'second opinions'.

<sup>27</sup> Raddick, Prather and Wallace (2019) also warn about the limitations of the educational role of citizen science. The study conducted among participants in the Galaxy Zoo citizen science project failed to establish that their involvement with the project led to increased knowledge in the field of astrophysics.

## 6. Discussion and conclusions

There are several ways in which approaches in the sense of open science and citizen science can be beneficial for researchers as well as for cognitively active citizens. We can mention the possibility of an enrichment of knowledge and a potential opportunity for (social) innovation. Two approaches in particular have proven useful in this respect. The first is the transmission of tacit (implicit) knowledge, acquired through experience, self-learning, and long-term professional practice. Such knowledge is not codified and can therefore only be transferred through contacts and interpersonal interactions (Polanyi, 1969). The second approach refers to the ability of interested and cognitively active citizens to participate in the verification and interpretation of obtained data, either by commenting or through group feedback analysis, which is closer to the social sciences (see Adam, 2018).

However, there are also risks and negative side effects that could erode the importance and status of scientific research. It is especially dangerous to create illusions about the capabilities of ad hoc citizen science projects and their exceptional, immediate outcomes. In this sense the campaign for open science may be used as an excuse to cover up certain problems and anomalies in the scientific sphere, such as the oversaturation and expansion of science, and especially the issues regarding the introduction of greater interdisciplinarity, dialogue between disciplines, and ways of resolving conflicts and differences of opinion and interpretation. This also includes making greater use of knowledge and optimising research findings. In this setting, a more methodologically demanding critical treatment of the concept of citizen science is required.

Furthermore, social sciences and humanities should have a greater, if not a decisive, role in this context. As we identified, most citizen science projects are carried out in the field of natural sciences where non-scientists are mostly (or solely) involved in the data collection process. It is legitimate to question the high expectations of the role of non-scientists in such projects. Moreover, public involvement in the research process is not novel as it has been present in the social sciences for several decades – and also in the natural sciences, albeit less methodologically developed – in various forms and under various names.

We can note that it is very likely that the ongoing campaign of recent years will not yield stable regulations that will attract the needed consensus, as it seems that the current campaign is all about immediate effects and does not proceed incrementally. On one hand, it could be defined as some kind of 'social engineering' or at least in the ad experimentum sense, and, on the other, as an attempt to establish a 'cultural hegemony' in the sphere of research policy. If this trend of politicisation is to continue, it may reduce scientific autonomy. In addition, within the scientific community, it may lead to the emergence of in-breeding clientelism, especially if it becomes evident that the old criteria of scientific performance no longer apply, and new ones have not yet been established, are unclear, or lack recognition among a broader group of researchers. This leads to an anomic state that certainly does not support innovation or the exchange of ideas between research groups and disciplines.

We noticed that the current campaign is very 'self-referential' and pays little attention to those with critical views who perceive it as the politicisation of science. Current observations suggest that the discourse on open science tends to be normative, the campaign lacks an incremental approach, and in some cases, it is not the product of a broader debate within national contexts (at least in the case of Slovenia). This means there is little likelihood that it will entail a higher degree of self-reflection or self-correction. More (meta)analyses and cross-national comparisons on this matter are needed.

Establishing connections between natural sciences disciplines that extensively rely on public participation or volunteer approaches and the social sciences is essential for fostering interdisciplinarity and promoting increased reflexivity. Disciplines in the social sciences and humanities have accumulated knowledge of more sophisticated methodological approaches and soft-skills knowledge such as communication with involved subjects (who act as respondents, interviewees, informants, or members of action research groups), organisation of the research process, and group dynamics. In contrast, the natural sciences have more experience with teamwork.

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## A Commentary on the article: The Dilemmas of Open (Citizen) Science

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I first wish to point out that EU projects of both open and citizen science can be considered in the context of past, ideologically and politically supported EU actions. In this context, which is too often ignored, one would expect that experiences from the past would be able to help improve the efficiency of new ventures like open and citizen science, reduce their costs and bureaucratisation, and yield tangible results in the field of RDI.

Second, in response to the question asked in the title of the article being commented on, I agree with the authors that the Open and Citizen sciences are political and, of course, PR campaigns. They have very little connection or none at all to existing and past scientific paradigms, like participatory or field research in sociology, anthropology and other social and humanities disciplines. They are even not built on any paradigm of their own, but are instead the result of political circumstances, negotiations and compromises regarding technological progress and innovation, which should place Europe on the top steps of the global R&D ladder. Although they do not take scientific achievements into account, they introduce changes in this very field with the Commission's decrees, financing (scientific) projects and actions, using political propaganda and PR techniques.

Third, I attempt to briefly shed light on the implementation and results of two previous EU actions – Active citizenship and the Bologna reform – from which the designers of new ones, such as open and citizen science, could learn quite a lot, especially from the mismatch between the initial goals and visions with the achieved results.

Active citizenship was based on the EU action „Improving the socio-economic knowledge base“ with the Fifth Framework Programme (1998–2002). It held broad and ambitious objectives like to

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