

Kaj trenutno vemo o prihodnjem razvoju livarske industrije v Evropi?

What do we currently know about the future development of the foundry industry in Europe?

Povzetek

Zaradi trenutnih razmer v svetu se moramo vprašati, kako zanesljive so dejansko izjave o prihodnjem gospodarskem in družbenem razvoju. To vprašanje si je treba vedno znova zastavljati, pri tem pa upoštevati, za razliko od znanstvenih problemov, kjer so dejstva neodvisna od z njimi povezanih izjav, da gospodarski razvoj temelji na odločitvah ljudi, podjetij, političnih in številnih drugih institucij, ki oblikujejo mnenja in s svojimi idejami spreminjajo družbene sisteme. Pri tem gre lahko za nezavedne spremembe, ki pa jih je treba obravnavati zavestno in načrtno, npr. z ustrezno intenzivno oglaševalsko kampanjo. Ta povezava med razmišljanjem in dejanskim stanjem v gospodarstvu vodi do dejstva, da so »trgi po svoji naravi nestabilni« [1], zato je treba izjave jemati z določeno stopnjo negotovosti. Posebej aktualen primer razvoja trgov, ki se odvija drugače, kot so si zamislili odgovorni ljudje v politiki in gospodarstvu, je razvoj elektromobilnosti v Nemčiji, ki ima katastrofalne posledice za avtomobilsko industrijo in pomembne dobaviteljske panoge. Čeprav se zavedamo, da so trgi nestabilni in da se lahko včasih razvijajo zelo hitro in na skoraj nepredvidljiv način, je zanimivo razmisliti, ali je mogoče opredeliti dejstva, ki kljub negotovosti dajejo določen vpogled v možni prihodnji razvoj.

Abstract

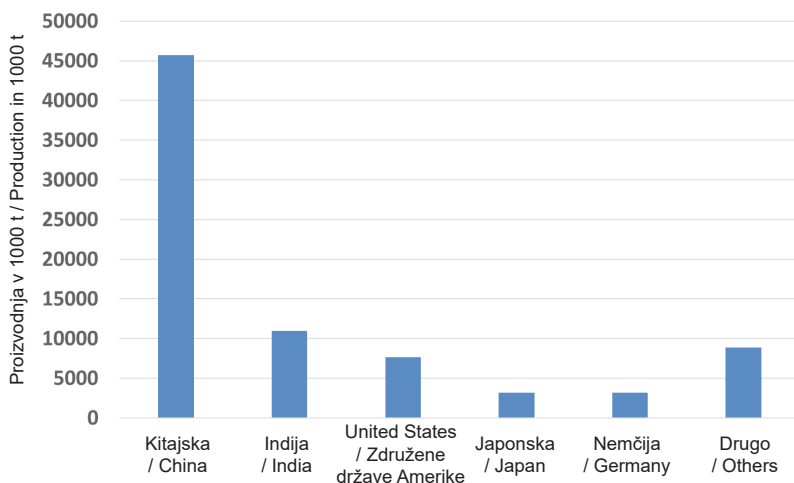
The current situation in the world forces us to ask ourselves how reliable statements about future economic and social developments are possible. This question must be asked time and again, similarly as they are at scientific problems, where the facts are independent of other opinions. The statements about economic future and social developments should not be characterized by the fact that they are shaped by people, companies, political and a multitude of other opinion-forming institutions that change social systems through their ideas. These may be unconscious changes, but as a rule, they are changes to be initiated consciously and purposefully, e.g., through a correspondingly intensive advertising campaign. This connection between thinking and reality in the economy leads to the fact that 'markets are inherently unstable' [1], and therefore, statements are only possible with a certain degree of uncertainty. A particularly topical example of markets developing differently than intended by those in positions of responsibility in politics and business is the development of electromobility in Germany, with catastrophic consequences for the automotive industry and important supplier industries. Even if we recognize that markets are unstable and can sometimes develop very quickly and in an almost unforeseeable way, it is interesting to consider whether facts can be identified that, despite the uncertainty, provide a certain sense of future possible developments.

1 Trenutni položaj svetovne livarske industrije

Izhodišče za takšno analizo je opis trenutnega stanja svetovne livarske industrije. **Sliki 1** in **2** prikazujeta obseg svetovne proizvodnje ulitkov iz železa in jekla (ISC) ter ulitkov iz barvnih kovin (NFC) leta 2021 [2], iz katerega je razvidno, da proizvodnja ulitkov iz železa in jekla s približno 88,9 milijona ton letno presega proizvodnjo ulitkov iz barvnih kovin, ki znaša 18,5 milijona ton letno. Porazdeljenost po državah kaže, da je najpomembnejša proizvajalka Kitajska, zato bo nadaljnji razvoj odvisen od razvoja kitajskega gospodarstva v naslednjih 20 letih. Čeprav se statistični podatki glede na vir lahko precej razlikujejo, je mogoče domnevati, da je trenutna proizvodnja ulitkov iz železa in jekla približno 90 milijonov ton na leto, ulitkov iz barvnih kovin pa približno 20 milijonov ton na leto, pri čemer je zanjo značilna težnja po stagnaciji. Leta 2012 je storitveni sektor na Kitajskem prvič prispeval k bruto domačemu proizvodu več kot predelovalna industrija, kar kaže, da kitajsko gospodarstvo doživlja strukturne spremembe [3], podobne tistim v Evropi in na Japonskem v sedemdesetih letih prejšnjega stoletja. Malo verjetno je pričakovati večje povečanje proizvodnje ulitkov na Kitajskem. Indija bo v prihodnosti verjetno dosegla največjo rast proizvodnje ulitkov med vsemi gospodarstvi. Leta 2008 je Indija proizvedla 6,8 milijona ton ulitkov iz železa in jekla ter 0,6 milijona ton ulitkov iz barvnih kovin [4]. Po podatkih Odbora združenj evropskih livarn CAEF se bo ta obseg proizvodnje do leta 2021 povečal za 62 % na 11 milijonov ton ulitkov iz železa in jekla ter za 150 % na 1,5 milijona ton ulitkov iz barvnih kovin [2]. V naslednjih nekaj letih pa se bo pokazala dejanska stopnja rasti absolutnega obsega proizvodnje.

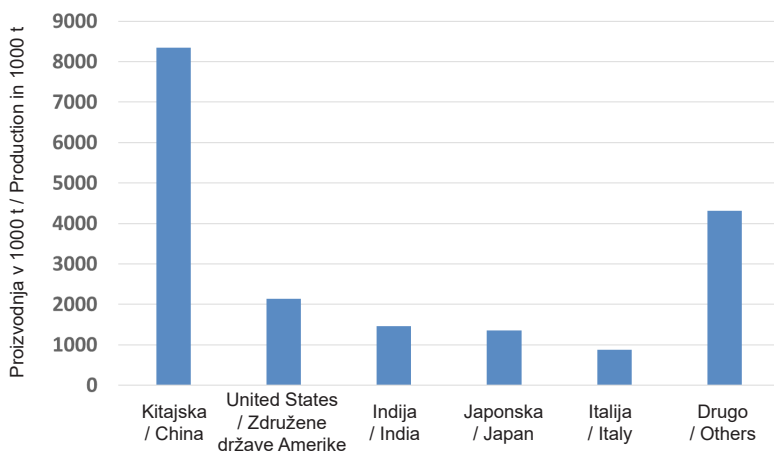
1 The current situation of the global foundry industry

The starting point for such an analysis is a description of the current situation of the global foundry industry. **Figures 1** and **2** show the global production volumes of iron and steel castings (ISC) and non-ferrous metal castings (NFC) in 2021 [2]. It can be seen that, at around 88.9 Mt per year, iron and steel casting production of 88.9 Mt per year, exceeds the production of non-ferrous metal castings at 18.5 Mt per year. The distribution by country shows that China is the most crucial nation here, so further development will depend on how China's economy develops over the next 20 years. Even though the statistical data might vary considerably depending on the source, it can be assumed that the current casting production for iron and steel castings is around 90 Mt per year and for non-ferrous metal castings, around 20 Mt per year, and that tendency towards stagnation characterizes it. In 2012, the service sector in China contributed more to the gross domestic product than the manufacturing industry for the first time, which indicates that the Chinese economy is undergoing a structural change [3] similar to that seen in Europe and Japan in the 1970s. It is doubtful that a major increase in casting production in China will occur. In the future, India will likely have the most considerable growth in casting production of any economy. In 2008, India produced 6.8 Mt of iron and steel castings and 0.6 Mt of non-ferrous metal castings [4]. These production volumes will have increased by 2021, according to CAEF data, by 62% to 11 Mt of iron and steel castings and by 150% to 1.5 Mt of non-ferrous metal castings [2]. However, the next few years will show the actual rate at which growth in absolute production volumes will continue.



Slika 1. Globalna proizvodnja ulitkov iz železa in jekla 88,9 milijona ton v letu 2021 [2].

Figure 1. Global iron and steel casting production of 88.9 mio t in 2021 acc.[2].



Slika 2. Globalna proizvodnja ulitkov iz barvnih kovin 18,6 milijona ton v letu 2021 [2].

Figure 2. Global non-ferrous casting of 18.6 mio t in 2021 acc.[2].

2 Trenutni položaj evropske livarske industrije

Po koncu druge svetovne vojne je bilo za gospodarski razvoj v Evropi in drugih delih tržno usmerjenega zahodnega sveta [3] značilno, da je zaradi potrebe po obnovi

2 The current situation of the European foundry industry

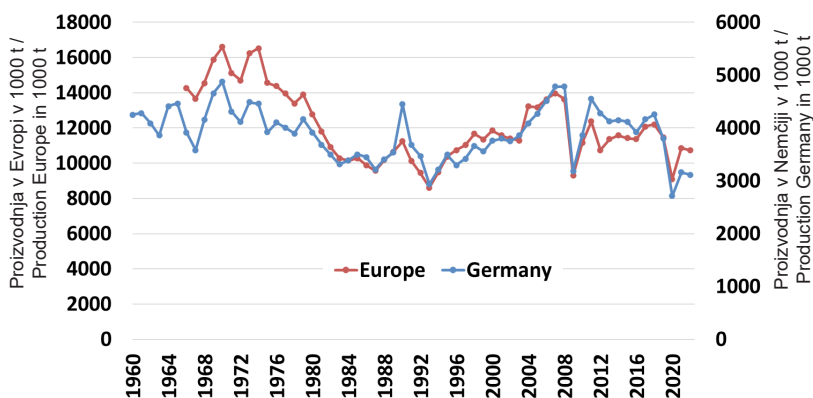
After the end of the Second World War, economic development in Europe and other parts of the market-oriented Western world [3] was characterized by a dominance of

prevladovala industrijska proizvodnja, tj. sekundarni sektor. V začetku sedemdesetih let prejšnjega stoletja so tradicionalne industrijske države v Evropi in na Japonskem začele strukturno prehajati iz sekundarnega sektorja (industrijska družba) v terciarni sektor (storitvena družba).

Tradicionalne industrijske države v Evropi, Japonska in ZDA so zdaj storitvena gospodarstva. Leta 2015 je bil delež sekundarnega sektorja (vključno z gradbeništvom) še vedno 30,4 % v Nemčiji, 19,8 % v Franciji, 20 % v Angliji, 20 % v ZDA, 29,1 % na Japonskem in 41 % na Kitajskem [5]. Zaradi strukturnih sprememb se je od začetka sedemdesetih let prejšnjega stoletja evropska in nemška livarska industrija železa, jekla in tempranega železa razvijala podobno (**slika 3**) kot jeklarska industrija [3]. Iz slike 3 je razvidno, da se je proizvodnja ulitkov iz železa, jekla in tempranega železa v Evropi zmanjšala s približno 16 milijonov ton na leto leta 1970 na 9 milijonov ton na leto leta 1993, nato pa se je zaradi svetovne rasti, ki je bila posledica industrijskega razvoja na Kitajskem, ponovno povečala na 14 milijonov ton leta 2007. Po gospodarski krizi leta 2008 se je obseg proizvodnje ponovno povečal, in sicer na 12 milijonov ton leta 2011, nato pa se je začel bolj ali manj stalno zmanjševati do leta 2020 z izbruhom koronavirusne krize. V tem času se je proizvodnja ulitkov iz železa, jekla in tempranega železa (ISC) v Evropi zmanjšala na 9 milijonov ton. Trenutno proizvodnja znaša 10–11 milijonov ton na leto. V Nemčiji je opazen enak trend, saj se je proizvodnja ulitkov iz železa, jekla in tempranega železa (ISC) zmanjšala s skoraj 5 milijonov ton na leto leta 1970 na 3 milijone ton na leto leta 1993, nato pa se je do leta 2008 skoraj povzpela nazaj na 5 milijonov ton na leto. Proizvodnja ulitkov iz železa, jekla in tempranega železa (ISC) v Nemčiji trenutno znaša približno 3 milijone

industrial production, i.e., the secondary sector, due to the need for reconstruction. In the early 1970s, the traditional industrial nations in Europe and Japan began to undergo a structural change from the secondary sector (industrial society) to the tertiary sector (service society).

The traditional industrial nations in Europe, Japan, and the USA are now service economies. In 2015, the share of the secondary sector (including construction) was still 30.4% in Germany, 19.8% in France, 20% in England, 20% in the USA, 29.1% in Japan, and 41% in China [5]. Due to structural change, Europe's and Germany's iron, steel, and malleable iron foundry industries have developed similarly (**Figure 3**) to the steel industry since the beginning of the 1970s [3]. From Figure 3, it can be seen that iron, steel, and malleable iron casting production in Europe fell from around 16 Mt per year in 1970 to 9 Mt per year in 1993, but then rose again to 14 Mt in 2007 due to global growth as a consequence of industrial development in China. After the economic crisis in 2008, the production volume increased again, up to 12 Mt in 2011, but started to constantly decrease until 2020, the beginning of the coronavirus crisis. During that time, iron, steel, and malleable iron casting production (ISC) in Europe dropped to 9 Mt. Currently, the production is 10-11 Mt per year. In Germany, the same trend can be seen, with output of ISC falling from almost 5 Mt per year in 1970 to 3 Mt per year in 1993, but then nearly returning to 5 Mt per year by 2008. Currently, ISC production in Germany is in the region of 3 Mt per year. The decline in casting production during the coronavirus crisis was particularly drastic, and although it has recovered since then, it has not yet returned to its pre-crisis level.



Slika 3. Razvoj livarske proizvodnje litega železa in jekla v Evropi in Nemčiji od leta 1960 do 2022 [2]

Figure 3. Development of cast iron and steel foundry production in Europe and Germany from 1960 – 2022 acc.[2]

ton na leto. Upad proizvodnje ulitkov je bil med koronavirusno krizo še posebej izrazit, in čeprav se je od takrat okrepil, še ni dosegel ravni pred krizo.

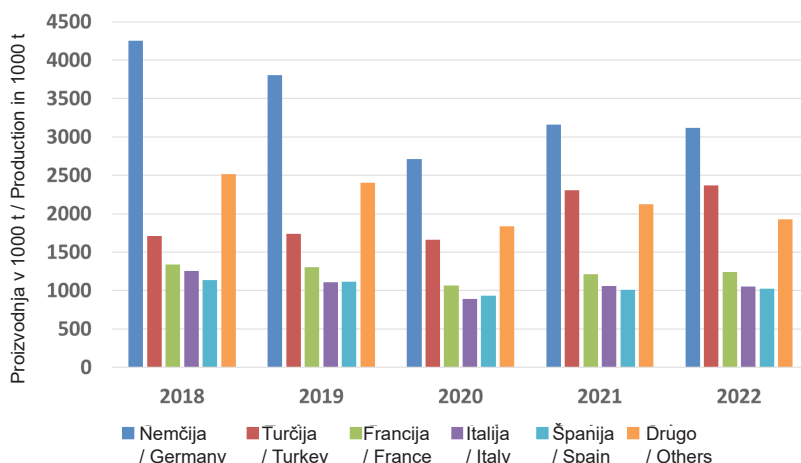
Razvoj evropske proizvodnje ulitkov iz železa in jekla med letoma 1993 in 2008 jasno kaže, kako zelo je ta v Evropi odvisna od svetovne gospodarske rasti, torej prihodnjega gospodarskega razvoja v Aziji.

Sliki 4 in 5 prikazujeta gibanje obsega proizvodnje železa, jekla in tempranega litega železa, ki je zaradi nizkega obsega proizvodnje tempranega litega železa in ulitkov iz barvnih kovin v Evropi od leta 2018 do leta 2022 skoraj enak proizvodnji ulitkov iz železa in jekla (ISC). Leta 2022 bo proizvodnja ulitkov iz železa in jekla z 10,7 milijona ton letno preseгла proizvodnjo ulitkov iz barvnih kovin s 3,8 milijona ton letno. Podatki kažejo, da se je v tem obdobju proizvodnja ISC v Nemčiji zmanjšala za 1,14 milijona ton ali 27 %, medtem ko se je v Turčiji povečala za 0,662 milijona ton ali 39 %. V drugih državah se obseg proizvodnje v tem obdobju ni bistveno spremenil, čeprav so beležile rahel padec.

The development of European iron and steel casting production between 1993 and 2008 clearly shows how dependent casting production in Europe is on global economic growth, which means future economic development in Asia.

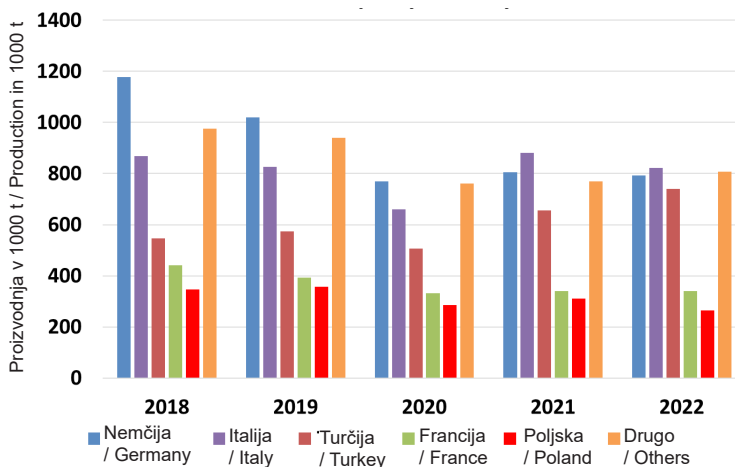
Figures 4 and 5 illustrate the developments in the production volumes of iron, steel, and malleable cast iron, nearly equal to iron and steel casting (ISC) due to low production volumes of malleable cast iron and non-ferrous metal castings in Europe from 2018 to 2022. In 2022, iron and steel casting production, at 10.7 Mt per year, exceeded the volume of non-ferrous metal casting production at 3.8 Mt per year. The data show that in this period, the output of ISC in Germany decreased by 1.14 Mt, or 27%, while in Turkey, it increased by 0.662 Mt, or 39%. In the other countries, production volumes have not changed significantly during this period, although there has been a slight downward trend.

The production of non-ferrous metal castings in Germany has decreased by 0.39 Mt, or 33%, while in Turkey, it has increased by 0.19 Mt, or 35%. In Italy, the



Slika 4. Proizvodnja ulitkov iz železa, jekla in tempranega železa v Evropi po državah med letoma 2018 in 2022 [2]

Figure 4. Iron, steel, and malleable casting production in Europe by countries between 2018 -2022 acc.[2]



Slika 5. Proizvodnja ulitkov iz barvnih kovin v Evropi po državah med letoma 2018 in 2022 [2]

Figure 5. Non-ferrous metal casting production in Europe by countries between 2018 -2022 acc.[2]

Proizvodnja ulitkov iz neželeznih kovin v Nemčiji se je zmanjšala za 0,39 milijona ton oziroma 33 %, medtem ko se je v Turčiji povečala za 0,19 milijona ton oziroma 35 %. V Italiji, državi z drugo največjo

country with the second-largest production of non-ferrous metal castings, production volumes have remained almost constant at approximately 0.8 Mt per year from 2018 to 2022. Slightly decreasing declines

proizvodnjo ulitkov iz barvnih kovin, je obseg proizvodnje od leta 2018 do leta 2022 ostal skoraj nespremenjen in znašal približno 0,8 milijona ton na leto. V drugih državah je opaziti rahlo upadanje obsega proizvodnje.

3 Glavna področja uporabe lamelnega in nodularnega litega železa

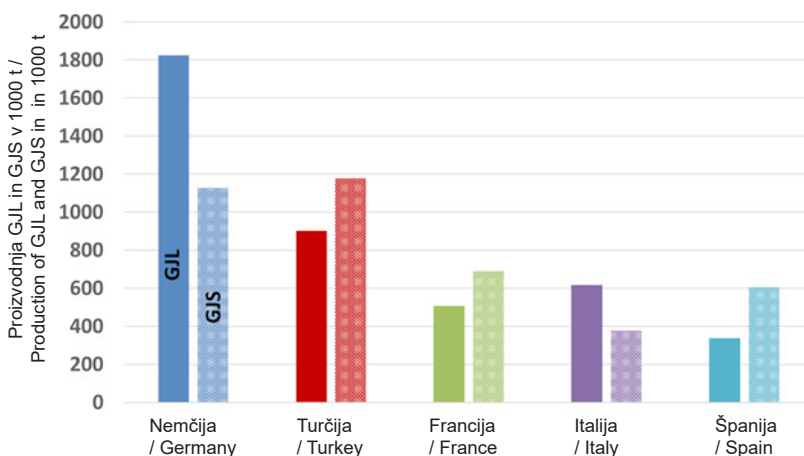
Slika 6 prikazuje obseg proizvodnje lamelnega grafitnega litega železa (GJL) in nodularnega litega železa (GJS) v petih največjih državah proizvajalkah v Evropi. Nemčija in Italija proizvedeta več grafitnega litega železa (GJL) kot nodularnega litega železa (GJS). Po drugi strani pa Turčija, Francija in Španija proizvedejo več nodularnega litega železa kot grafitnega litega železa. Poleg tega je na sliki 6 razvidno, da ima Turčija največjo proizvodnjo nodularnega litega železa v Evropi.

in production volumes can be seen in the other countries.

3 The main areas of application for lamellar and ductile cast iron

Figure 6 shows the production volumes of lamellar graphite cast iron (GJL) and ductile cast iron (GJS) in Europe's five largest producing countries. Germany and Italy produce more GJL than GJS. On the other hand, Turkey, France, and Spain produce more GJS than GJL. Furthermore, Figure 6 shows that Turkey has Europe's most significant GJS production.

The shares of GJL and GJS for applications in the automotive industry and plant and mechanical engineering are illustrated in **Figures 7** and **8**. For Germany and Spain, it can be seen that GJL is used in the automotive industry for approx. 70% and 80%, respectively. In other countries, the share of GJL production for the



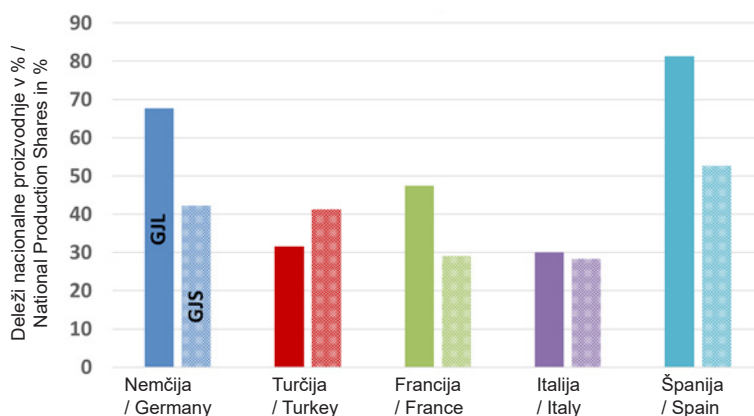
Slika 6. Proizvodnja GJL in GJS v petih največjih evropskih državah proizvajalkah v obdobju 2018–2022 [2]

Figure 6. Production of GJL and GJS in Europe's five largest producing countries in the period 2018–2022 acc.[2]

Deleži GJL in GJS za aplikacije v avtomobilski industriji ter strojogradnji in strojništvu so prikazani na slikah 7 in 8. Za Nemčijo in Španijo je razvidno, da se GJL v avtomobilski industriji uporablja približno v 70 % oziroma 80 %. V drugih državah delež proizvodnje GJL za avtomobilsko industrijo znaša 30–50 %. Delež uporabe GJS v

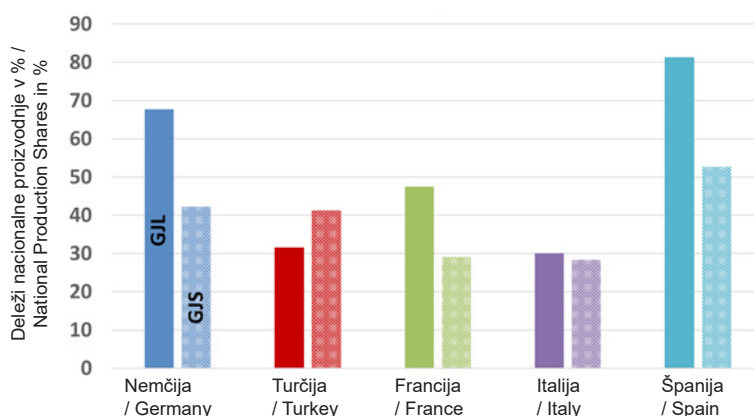
automotive industry is 30-50%. The share of applications of GJS for the automotive industry in the five countries is between 30-50%, with an average of 39%.

Figure 8 shows that in four of the five countries, the share of GJL for plant and machinery construction is between 10% and 30%, and only in Italy is the share around



Slika 7. Deleži uporabe GJL in GJS v petih največjih evropskih državah proizvajalkah na področju avtomobilске tehnologije v letu 2022 [2]

Figure 7. Shares of applications of GJL and GJS in Europe's five largest producing countries in automotive engineering in 2022 acc [2]



Slika 8. Deleži uporabe GJL in GJS v petih največjih evropskih državah proizvajalkah na področju postrojenj in strojništva v letu 2022 [2]

Figure 8. Shares of applications of GJL and GJS in Europe's five largest producing countries in plant and mechanical engineering in 2022 acc [2].

avtomobilski industriji v petih državah znaša od 30 do 50 %, v povprečju pa 39 %.

Slika 8 prikazuje, da je v štirih od petih držav delež GJL za gradnjo postrojenj in strojev med 10 % in 30 %, le v Italiji je ta delež okoli 50 %. Deleži uporabe GJS za gradnjo postrojenj in strojev se gibljejo med 20 % in 40 %, z izjemo Francije, kjer je ta delež precej nižji.

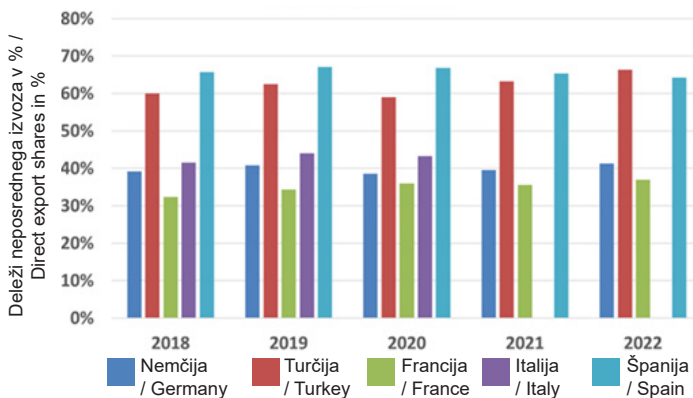
Če deleže uporabe GJL in GJS v avtomobilski industriji ter industriji naprav in strojništvu obravnavamo skupaj, lahko ugotovimo, da se v teh dveh sektorjih uporablja 64–94 % (povprečno 80 %) GJL in 33–78 % (povprečno 64 %) GJS. Slika 9 kaže, da bodo v Nemčiji, Franciji in Italiji deleži neposrednega izvoza železa, jekla in tempranega litega železa v obdobju 2018–2022 ostali razmeroma nespremenjeni in bodo znašali 30–40 %. Nasprotno pa bosta deleža neposrednega izvoza v Turčiji in Španiji prav tako ostala razmeroma nespremenjena in znašala približno 60–70 %.

50%. The shares of applications of GJS for plant and machinery construction are between 20% and 40%, with one exception in France, where the share is significantly lower.

If the shares of applications for GJL and GJS in the automotive, plant and mechanical engineering sectors are considered together, it can be seen that 64-94% (mean 80%) of GJL and 33-78% (mean 64%) of GJS are used in these two sectors. **Figure 9** shows that in Germany, France, and Italy, direct export shares of iron, steel, and malleable cast iron will remain relatively constant at 30-40% in 2018-2022. By contrast, the direct export shares in Turkey and Spain will also remain relatively constant at around 60-70%.

4 The future development of automotive engineering

As described in the previous chapter, the automotive industry (64–94%), is Europe's most crucial customer for iron and steel casting products, besides plant



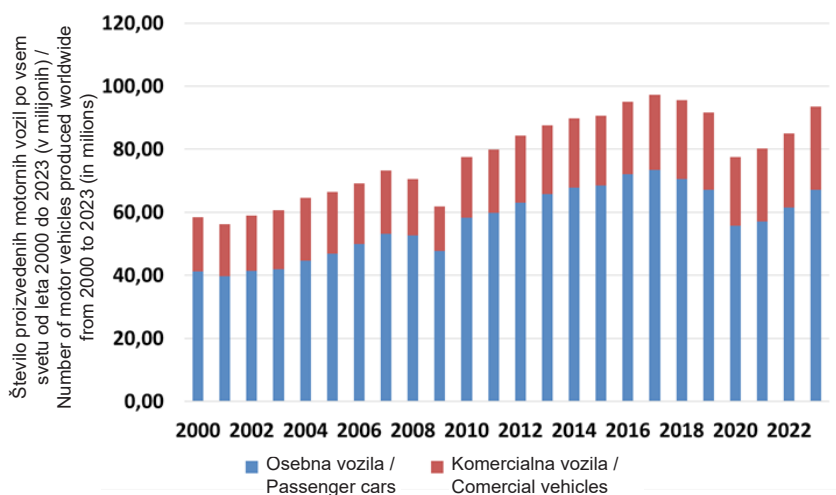
Slika 9. Deleži neposrednega izvoza železa, jekla in tempranega litega železa iz petih največjih evropskih držav proizvajalk v obdobju 2018–2022

Figure 9. Direct export shares of iron, steel, and malleable cast iron from Europe's five largest producing countries in 2018–2022.

4 Prihodnji razvoj avtomobilske tehnologije

Kot je opisano v prejšnjem poglavju, je avtomobilska industrija (64–94 %) poleg strojništva (33–78 %) najpomembnejši kupec izdelkov iz železa in jekla v Evropi. Zato bo prihodnji razvoj avtomobilske industrije po vsem svetu bistvenega pomena za prihodnji razvoj livarske industrije. Slika 10 prikazuje svetovno rast proizvodnje avtomobilov od leta 2000 do leta 2023. Proizvodnja je upadla med svetovno gospodarsko krizo leta 2009 in zaradi koronavirusne krize leta 2020, kar je jasno razvidno iz tega diagrama. Proizvodnja avtomobilov si je po svetovni gospodarski krizi zelo hitro opomogla in še naprej naraščala. To je verjetno posledica svežnjev gospodarskih spodbud, ki so se takrat začeli izvajati po vsem svetu, pri čemer so bili nekateri od njih izrecno namenjeni spodbujanju avtomobilske proizvodnje. Nasprotno pa je povečanje avtomobilske proizvodnje po koronavirusni krizi veliko počasnejše. Po trenutnih podatkih naj bi

and mechanical engineering (33–78%). Therefore, the future development of the automotive industry will be essential worldwide for future developments in the foundry industry. Figure 10 shows the global growth of automobile production from 2000 to 2023. Production slumped during the global economic crisis in 2009 and due to the coronavirus crisis in 2020, which can be seen clearly in this diagram. Automobile production recovered very quickly after the global economic crisis and continued to rise. This is probably due to the economic stimulus packages initiated worldwide at the time, some of which were explicitly designed to promote automobile production. By contrast, the increase in automobile production after the coronavirus crisis is much slower. According to current figures, the global automobile market in 2024, with 78.5 million new registrations, is expected to have exceeded the 2019 figure again. According to [2], an increase in new registrations worldwide of 2% to 80.4 million passenger cars is expected for 2025. With respective growth rates of approx. 2% new



Slika 10. Svetovna proizvodnja motornih vozil v obdobju 2000–2023 [8]

Figure 10. Global motor vehicle production from 2000 - 2023 acc. [8]

svetovni avtomobilski trg leta 2024 z 78,5 milijona novih registracij ponovno presegele rezultate iz leta 2019. Po podatkih iz [2] se pričakuje, da se bo do leta 2025 število novih registracij na globalni ravni povečalo za 2 % na 80,4 milijona osebnih avtomobilov. Leta 2025 se pričakujejo nove registracije na Kitajskem (23,2 milijona), v ZDA (16,2 milijona) in v Evropi (10,8 milijona) s približno 2-odstotno stopnjo rasti. Skladno s [7] bo leta 2024 po vsem svetu prodanih približno 11 milijonov osebnih avtomobilov na izključno akumulatorski pogon (BEV).

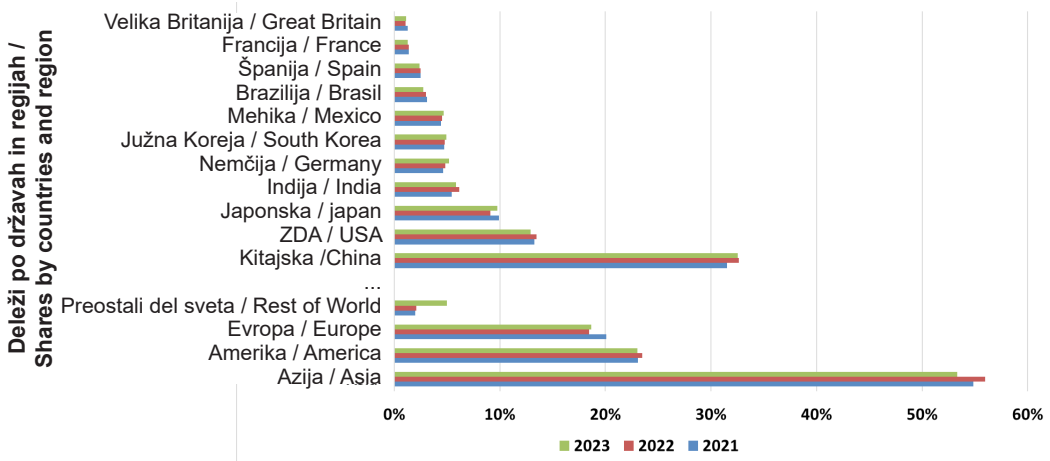
Struktura svetovne proizvodnje avtomobilov na sliki 11 jasno kaže prevlado Azije nad ZDA, Evropo in preostalim svetom. Ob upoštevanju te strukture in predvidenih prihodnjih registracij za leto 2025 se postavlja vprašanje, kakšno vlogo bi Evropa želela imeti v mednarodni avtomobilski industriji v luči prepovedi motorjev z notranjim izgorevanjem, ki jo je Evropska komisija določila za leto 2035.

Hartung [9] meni, da se ob tem postavlja tudi vprašanje, ali je dopustno, da država razglasi za sprejemljivo samo eno vrsto pogona, ne da bi pri tem dovolila

registrations in China (23.2 million), the US (16.2 million), and Europe (10.8 million) are expected in 2025. According to [7], approx. 11 million purely battery-powered passenger cars (BEV) were sold worldwide in 2024.

The structure of global automobile production in Figure 11 clearly shows Asia's dominance over the US, Europe, and the rest of the world. Considering this structure and the predicted future registration figures for 2025, the question arises about what role Europe would like to play in the international automotive industry, given the European Commission's ban on combustion engines in 2035.

According to Hartung [9], the question is whether it is permissible for the state to declare only one type of drive acceptable without allowing all technologies for reducing CO₂ emissions to compete against each other so that they can be evaluated based on their success. In the mobility transition, Germany relied entirely on electric mobility technology through battery electric vehicles (BEV) as the energy source that was in harmony between politics and industry.



Slika 11. Deleži držav in regij v svetovni proizvodnji osebnih avtomobilov leta 2023 [8].

Figure 11. Shares of countries and regions in global passenger car production 2023 acc.[8].

konkurenco vseh tehnologij za zmanjšanje emisij CO₂, tako da jih je mogoče oceniti na podlagi njihove uspešnosti. Pri prehodu na področju mobilnosti se je Nemčija ob podpori politike in industrije v celoti oprla na tehnologijo električne mobilnosti na podlagi baterijskih električnih vozil (BEV) kot vira energije. Po mnenju Schlogla [10] je njihova korist za zmanjšanje emisij CO₂ opredeljena z regulativnimi ukrepi in ne z dejanskim zmanjšanjem emisij CO₂ v celotnem sistemu. Poudarja, da so se drugi veliki onesnaževalci s CO₂, kot je Kitajska, odločili za tehnološko nevtralno strategijo, pri kateri vsi pogonski sistemi tekmujejo med seboj na podlagi dejanskih emisijskih faktorjev v točkovnem sistemu. Iz tega je mogoče sklepati, da je dejanske prihranke verjetno mogoče doseči hitreje in z minimalnimi stroški kot v nemškem in evropskem sistemu toge ideologije idealiziranih mejnih vrednosti voznega parka.

Srednjeročno in dolgoročno bodo električni pogoni najverjetneje prihodnost, vendar bo tovrstna mobilnost uspešna le, če bodo kupci prepričani, da jim takšna vožnja prinaša koristi. Pri tem je ena od nespornih prednosti ta, da ne bo več škodljivih izpušnih plinov posameznih vozil, kar je najpomembnejši doprinos elektrifikacije voznega parka. Zato si je treba prizadevati za povečanje števila tovrstnih pogonskih sistemov. V trenutnih razmerah pa bodo kupci svojo odločitev o nakupu sprejeli na podlagi odgovorov na naslednja vprašanja:

- Ali je na voljo dovolj polnilnih postaj ter kako in kje lahko napolnim avtomobil v stanovanjskih zgradbah v velikem mestu?
- Kako se bodo gibalni stroški električne energije zaradi naraščajočih stroškov pospešene širitve omrežja?
- Kakšne bodo cene avtomobilov, če se bodo stroški baterij znatno povečali

According to Schlögl [10], their benefit for CO₂ reduction is defined by regulatory measures and not by the actual system-wide CO₂ reduction. He points out that other major CO₂ emitters, such as China, have opted for a technology-neutral strategy in which all drive systems compete with each other based on their actual emission factors in a points system. Thus, actual savings can probably be achieved more quickly and at a minimal cost than in the German and European systems of the rigid ideology of idealized fleet limit values.

In the medium to long term, electric driving will most likely be the future, but it will only be a real success if buyers are convinced that this type of driving will benefit them. One undeniable advantage is that there will no longer be any harmful exhaust fumes from individual vehicles, which is the most important advantage of electric driving. An increase in electric driving should be achieved. In the current situation, however, buyers will base their actual purchase decision on the answers to the following questions:

- Are there enough charging stations, and how and where can I charge my car in an apartment building in a big city?
- How will electricity costs develop due to increasing accelerated grid expansion costs?
- How will the costs for a car develop if battery costs increase significantly due to the increasing consumption of important raw materials like lithium, nickel, cobalt, and so on?
- Can I afford an electric car in the current economic situation, and what will its resale value be?
- Will CO₂ emissions be reduced if there is not enough green electricity?

In this context, explanations can probably be found for the fact that in Germany, the development of purely

zaradi vse večje porabe pomembnih surovin, kot so litij, nikelj, kobalt itd.?

- Ali si lahko v trenutnih gospodarskih razmerah privoščim električni avtomobil in kakšna bo njegova vrednost pri nadaljnji prodaji?

Ali se bodo emisije CO₂ zmanjšale, če ne bo dovolj zelene električne energije?

V zvezi s tem je verjetno mogoče pojasniti dejstvo, da v Nemčiji razvoj izključno baterijskih električnih vozil (BEV), kot je prikazano na sliki 12, močno zaostaja za cilji, ki jih je določila nemška vlada v koalicijskem sporazumu za leto 2021.

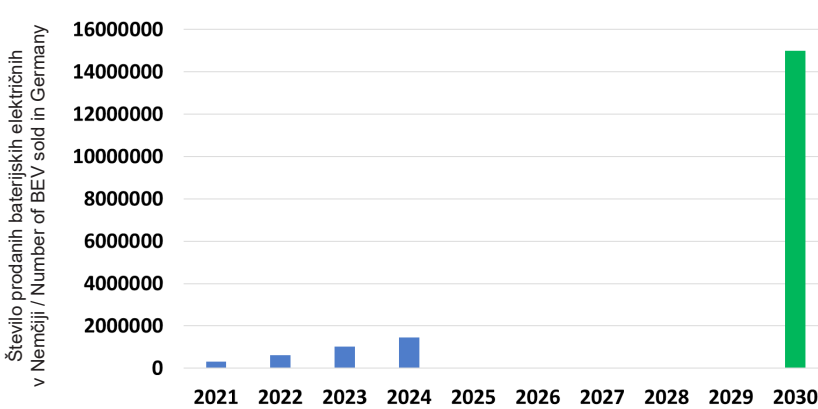
To pomeni, da so bile zgrajene proizvodne zmogljivosti za vozila, po katerih med kupci trenutno ni zadostnega povpraševanja. Zaradi zgoraj navedenih odprtih vprašanj tudi ni mogoče predvideti, kdaj se bo zanimanje povečalo. Glede na to, da je avtomobilska industrija s približno 770.000 zaposlenimi v Nemčiji ena najpomembnejših industrijskih panog [6] in da je njen izvoz leta 2024 znašal približno 289 milijard EUR in je predstavljal približno 18,5 % celotne nemške zunanje trgovine, je

battery-electric vehicles (BEV), as shown in **Figure 12**, lags well behind the targets set by the German government in the 2021 coalition agreement.

This fact means that production capacities have been built up for vehicles that buyers are not currently demanding to the desired extent. Due to the above open questions, it is also unpredictable when demand will change. Given that the automotive industry, with around 770,000 employees in Germany, is one of the most essential industries [6] and that its exports in 2024, at around €289 billion, accounted for around 18.5% of Germany's total foreign trade, it is clear how significant the current difficulties in the automotive industry in Germany are for society.

5 Vision and Reality

Today, the critical rationalism of Karl Popper is more crucial than ever [11]. According to Popper, we shape our current and future reality by trying to solve problems by using



Slika 12. Gibanje števila registracij izključno baterijskih električnih vozil (modra barva) v primerjavi s cilji, ki jih je določila nemška vlada za leto 2021 [8].

Figure 12. Development of registrations of purely battery-electric vehicles (blue) compared to the targets set by the German government in 2021 acc.[8].

jasno, kako pomembne so trenutne težave v avtomobilski industriji v Nemčiji za družbo.

5 Vizija in današnje stanje

Danes je kritični racionalizem Karla Popperja pomembnejši kot kadar koli prej [11]. Po Popperjevem mnenju svojo sedanjo in prihodnjo resničnost oblikujemo tako, da poskušamo reševati probleme s pomočjo znanja, s katerim iščemo »objektivno resnične razlagalne teorije« [12], kar naj bi bil – na podlagi dejstev – sam namen znanosti. V tem kontekstu lahko domnevamo, da je »teorija ali trditev resnična, če dejstva, ki jih opisuje teorija, ustrezajo resničnosti«. Po Popperjevem mnenju je znanje iskanje resnice, čeprav je treba sprejeti dejstvo, da je »človeško znanje zmotno in zato negotovo«. Zato po njegovem mnenju dejstvo, da so vsi labodi, ki smo jih doslej videli, beli, ne pomeni, da so vsi labodi beli. Če se strinjamo, da se lahko motimo, potem moramo biti pri iskanju resnice pozorni na napake v svojih teorijah, kar je še posebej pomembno pri iskanju rešitev za probleme prihodnosti (npr. oskrba z energijo, trajnostna zelena preobrazba, digitalizacija, mobilnost prihodnosti itd.), saj je to iskanje eksistenčnega pomena za življenje in razvojne možnosti prihodnjih generacij v naši družbi. Ne moremo potrditi pravilnost naših teorij, ker ne poznamo resnice. Dokler v svojih teorijah ne najdemo napak, lahko domnevamo, da so pravilne, čeprav dobro vemo, da je to le »predpostavlanje«.

Recimo, da na današnjo družbeno razpravo o trenutno bistvenih temah gledamo z nekoliko distance. V tem primeru se zdi, da je kar nekaj ljudi, skupin in institucij, ki verjamejo, da poznajo absolutno resnico, in za katere je skoraj nepredstavljivo, da bi se lahko motili. To pomeni, da smo v nevarnosti, ki jo še

knowledge to search for 'objectively true, explanatory theories' [12], which - based on facts - should be the very purpose of science. In this context, it can be assumed that 'a theory or proposition is true if the facts described by the theory correspond to reality.' According to Popper, knowledge is the search for truth, although it must be accepted that 'human knowledge is fallible and therefore uncertain.' Thus, in his opinion, the fact that all swans we have seen so far are white does not allow us to conclude that all swans are white. If we accept that we can err, then we must look for errors in our theories in the search for truth, which is particularly important for the solutions to future problems (e.g. energy supply, sustainable green transformation, digitization, mobility of the future, etc.), since this search is of existential importance for the life and development opportunities of future generations in our society. We cannot decide whether our theories are correct because we do not know the truth. However, as long as we do not find any errors in our theories, we can assume that they are correct, knowing full well that it is only 'assumed knowledge.'

Suppose today's social discussion on the currently essential topics is viewed with a little distance. In that case, it seems that there are quite a few people, groups, and institutions who believe that they own absolute truth and for whom the fact that one can be wrong is almost inconceivable. This means that we are in danger, highly intensified by the comprehensive and rapid communication and audiovisual reporting in the modern media, which is not new to humanity and was already described by Seneca [13] 2000 years ago as follows: 'And yet nothing involves us in greater harm than to follow the talk of the crowd, in the delusion that this is the best that enjoys general approval.'

povečuje obsežno in hitro komuniciranje ter avdiovizualno poročanje v sodobnih medijih, kar za človeštvo ni novost in jo je že Seneka [13] pred 2000 leti opisal takole: »A nič nam ne škodi bolj, kot če sledimo množici v zablodi, da je to najboljše, kar je deležno splošnega odobravanja.«

Denimo, da se pretežno usmerjamo k tistemu, kar uživa splošno odobravanje. V tem primeru nismo pripravljene iskati napak v svojih teorijah, da bi jih lahko popravili, to pa ima lahko katastrofalne posledice za družbe, kot kaže zgodovina zadnjih petdesetih let v Evropi ali trenutni zelo različni načini odzivanja na pandemije v svetu. Ne razumemo pa, da je iskanje napak pozitivna stvar, saj se na ta način nekoliko približamo resnici in dejanskim rešitvam problemov.

6 Povzetek

Povezava med razmišljanjem in resničnostjo v gospodarstvu vodi do spoznanja, da so »trgi po svoji naravi nestabilni«. [1] Čeprav se zavedamo, da so trgi nestabilni in da se lahko včasih razvijajo zelo hitro in na skoraj nepredvidljiv način, je zanimivo razmisliti, ali je mogoče opredeliti dejstva, ki kljub negotovosti dajejo določen občutek o možnem prihodnjem razvoju. Čeprav se statistični podatki glede na vir lahko precej razlikujejo, je mogoče domnevati, da je trenutna proizvodnja ulitkov iz železa in jekla približno 90 milijonov ton na leto, ulitkov iz barvnih kovin pa približno 20 milijonov ton na leto, in da je zanjo značilna težnja k stagnaciji. Kitajska je najpomembnejša država v svetovnem livarstvu, vendar je malo verjetno pričakovati znatno povečanje proizvodnje ulitkov na Kitajskem. Indija bo v prihodnosti verjetno dosegla največjo rast proizvodnje ulitkov med vsemi gospodarstvi. V naslednjih nekaj letih pa se bo pokazala

Suppose we predominantly orient ourselves towards what enjoys general approval. In that case, we are not willing to look for errors in our theories to be able to correct them, and this can have catastrophic consequences for societies, as the history of the last fifty years in Europe or currently the very different ways of dealing with the pandemic in the world show. What is not understood is that finding mistakes is a positive thing here because, in this way, we come a little closer to the truth and real solutions to problems.

6 Summary

The connection between thinking and reality in the economy leads to the fact that 'markets are inherently unstable.' [1] Even if we recognize that markets are unstable and can sometimes develop very quickly and in an almost unforeseeable way, it is interesting to consider whether facts can be identified that, despite the uncertainty, provide a certain sense of future possible developments. Even though the statistical data can vary considerably depending on the source, it can be assumed that the current casting production for iron and steel castings is around 90 Mt per year and for non-ferrous metal castings, around 20 Mt per year, and that a tendency towards stagnation characterizes it. China is the most crucial nation in the global foundry business, but it is doubtful that a significant increase in casting production in China can be assumed. In the future, India will likely have the most considerable growth in casting production of any economy. However, the next few years will show the actual rate at which growth in absolute production volumes will continue.

Due to structural change, Europe's and Germany's iron, steel, and malleable iron

dejanska stopnja rasti absolutnega obsega proizvodnje.

Zaradi strukturnih sprememb se je evropska in nemška livarska industrija železa, jekla in tempranega železa v zadnjih 65 letih razvijala podobno kot jeklarska industrija od začetka sedemdesetih let prejšnjega stoletja, ko so se tradicionalne industrijske države v Evropi in Japonska preoblikovale v storitvena gospodarstva. Razvoj evropske proizvodnje ulitkov iz železa in jekla od devetdesetih let prejšnjega stoletja jasno kaže, kako zelo je proizvodnja ulitkov v Evropi odvisna od svetovne gospodarske rasti, torej prihodnjega gospodarskega razvoja v Aziji.

V zadnjih letih se je livarska proizvodnja barvnih in nebarvnih kovin v Nemčiji zmanjšala, v Turčiji pa povečala. Avtomobilska industrija (64–94 %) je poleg strojništva (33–78 %) najpomembnejši kupec izdelkov iz železa in jekla v Evropi. Zato bo prihodnji razvoj avtomobilske industrije po vsem svetu bistvenega pomena za prihodnji razvoj livarske industrije. Struktura svetovne proizvodnje avtomobilov jasno kaže prevlado Azije nad ZDA, Evropo in preostalim svetom. Pri prehodu na področju mobilnosti se je Nemčija ob podpori politike in industrije v celoti oprla na tehnologijo električne mobilnosti na podlagi baterijskih električnih vozil (BEV) kot vira energije. Koristi zmanjšanja emisij CO₂ so opredeljene z regulativnimi ukrepi in ne z dejanskim zmanjšanjem emisij CO₂ v celotnem sistemu. Iz tega je mogoče sklepati, da je dejanske prihranke s tehnološko nevtralnno strategijo, kjer konkurirajo vsi pogonski sistemi in se jih ocenjuje na podlagi dejanskih emisij, verjetno mogoče doseči hitreje in z minimalnimi stroški kot v nemškem in evropskem sistemu toge ideologije idealiziranih mejnih vrednosti voznega parka.

foundry industries have developed in the last 65 years, similar to the steel industry since the beginning of the 1970s, when the traditional industrial nations in Europe and Japan turned into service economies. The development of European iron and steel casting production since the 1990s clearly shows how dependent casting production in Europe is on global economic growth, which means future economic development in Asia.

Over the last few years, foundry production, ferrous and non-ferrous, has decreased in Germany while increasing in Turkey. The automotive industry (64–94%), besides plant and mechanical engineering (33–78%), is Europe's most crucial customer for iron and steel casting products. Therefore, the future development of the automotive industry worldwide will be essential for future developments in the foundry industry. The structure of global automobile production clearly shows Asia's dominance over the US, Europe, and the rest of the world. In the mobility transition, Germany relied entirely on electric mobility technology through battery electric vehicles (BEV) as the energy source in harmony between politics and industry. The benefit of CO₂ reduction is defined by regulatory measures, not by the actual system-wide CO₂ reduction. It can be assumed that actual savings might be achieved more quickly and at a minimal cost with a technology-neutral strategy in which all drive systems compete and are evaluated based on their actual emission than in the German and European systems of rigid ideology of idealized fleet limit values.

Today, the critical rationalism of Karl Popper is more crucial than ever. According to Popper, knowledge is the search for truth, although it must be accepted that '*human knowledge is fallible and therefore uncertain.*' If we assume that we can err,

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