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DIGITAL COMPETITIVENESS OF V4 COUNTRIES[1]

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Abstract: *Digital technologies are gradually becoming a part of the everyday life of the entire population. As a result, there is room for mutual competition in this area between individual countries, as the development of each country is not uniform. Through this contribution, we aim to highlight the differences as well as similarities in the area of digitization in the V4 countries, not only in comparison with each other but also with Denmark as a leading country in digital competitiveness. For analysis, we used the IMD index, which measures three main factors influencing a country's digital competitiveness (Knowledge, Technology, Future Readiness). The results of the analysis showed that each country has several areas that still need to be developed. Overall, the most problematic sub-factor in all analyzed countries was capital.*

Keywords: *V4 countries, competitiveness, digitization*

JEL Classification: O33, O38

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1 Introduction

Digital technologies are one of the driving forces of the future development of society as a whole. By utilizing them, the competitiveness of individual countries increases, thus also increasing their standard of living.

In recent years, the V4 countries, namely the Czech Republic, Hungary, Poland, and Slovakia, have become more significant players in the European and global markets. Digitization and new technologies play an increasingly important role in these countries.

In this paper, we will focus on defining the basic concepts related to digitization and digital competitiveness. We will also focus on the digital competitiveness of the aforementioned four countries. The basis of the analysis will be the IMD Digital Competitiveness Index for the last five years in order to identify the position of each country and subsequently specify the differences between them.

By joint efforts as well as individual initiatives, the V4 countries are striving to improve their digital competitiveness and become leaders in the field of digital technologies.

2 Digitalization of Society

Digitalization can be defined as an integral part of the modern global economy that contributes to more rational resource management (Antikainen, Uusitalo & Kivikytö-Reponen, 2018), optimization of business models (Rachinger et al., 2019), and structural changes (Heavin & Power, 2018).

According to several authors, digitalization leads to the individualization of modern production (Paritala, Manchikatla & Yarlagadda, 2017). Products are thus adapted to individual customer requirements. However, it is necessary to realize that over time, digitalization is becoming prevalent in all areas of economic and social life. Examples include the music industry (Bourreau, Moreau & Gensollen, 2008), education (Zolfaghari Mashhadi & Reza Kargozari, 2011), and healthcare (Chircu, Sultanow & Sözer, 2017).

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The Eurofound Foundation identified several indicators in its study that directly affect the digitalization of the public sector and the level of technological development of macro-systems (Fernández-Macías, 2018):

1. Utilization and implementation of digital technologies (ICT),
2. Availability of skilled personnel,
3. Access to equipment, technologies, and their distribution among citizens and businesses,
4. Sufficient domestic demand for technologies and successful stories in various spheres of life and economy,
5. Sufficient level of system integration of technological products and services (from design to implementation),
6. Building a creative culture and generating ideas.

The result of the digitalization of society is the creation of a so-called SMART society, which aims to build an intelligent environment for simpler and more efficient functioning of society. Every citizen should have equal access to information and knowledge provided through ICT. This process should ensure benefits in various areas of life, such as education, healthcare services, job creation, business environment development, as well as agriculture, among others (Okhrimenko et al., 2019).

2.1 Digitalization of a country as a basic for increasing competitiveness

In recent years, there has been a significant emphasis on finding tools to increase competitiveness in all areas of life. This is no exception when it comes to the functioning of individual countries. Porter argues that the only meaningful concept of competitiveness at the national level is a country's productivity (Porter, 2008). This means that the higher the level of productivity in a country, the higher the standard of living for its population. The ability of a country to work with and effectively utilize innovations is also directly related to its current level of productivity. In this context, the term "digital economy" has been increasingly used in recent years. Sendlhofer and Lernborg state that the digital economy describes the development of a technological society and assumes the widespread use of ICT in all areas of human activity (Sendlhofer & Lernborg, 2018). The result is the simplification and streamlining of

everyday tasks, with individual ICT emerging and taking root in people's lives as a response to societal needs.

The use of ICT affects not only individuals but also society as a whole, including individual business entities. Digitalization creates new business opportunities and facilitates global availability of products and services (Elia, Margherita & Petti, 2016). The process of digitalization brings several benefits to both the business and public sectors. For the business sector, we can mention, for example: increasing the efficiency and effectiveness of business processes, better understanding and subsequent response to customer requirements, better knowledge management, and development of the most modern employee skills (Rossato & Castellani, 2020). On the other hand, the process of digitalization has a positive impact on the public sector and the overall functioning of the country: GDP per capita growth, reducing unemployment, political decision-making (Sabbagh et al., 2013).

The digital economy has a direct impact on a country's economic and social outcomes. It is important to understand this concept correctly. We will proceed from the following assumption: the digital economy is based on the digitization of information through the appropriate information and communication infrastructure (Zimmermann, 2000). The digital transformation of the economy is understood as the manifestation of qualitative, revolutionary changes, which consist not only in digital transformations of individual processes but also in fundamental changes in the structure of the economy, in the transfer of value-added centers to the sphere of building digital resources and end-trend digital processes (Harafonova, Zhosan & Akimova, 2017).

Another relatively significant characteristic feature of the digital economy is the creation of network effects. This is due to the reduction of transaction costs, as digital technologies facilitate authentication of the other party in the transaction and gain knowledge about reputation, meaning that it is easier to build trust between parties who do not know each other (Dyer & Chu, 2003).

The International Labour Organization (2018) states that crowd-work is also a key feature of the digital economy. This trend could bring several benefits, one of which is reducing gender discrimination by employers (Graham, Hjorth & Lehdonvirta, 2017). On the other hand, the digital economy may also bring several disadvantages for employees, primarily the polarization of employee groups. We can speak of polarization in terms of age, qualifications, and territory.

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3 Aim and methodology

The main goal of this paper is to identify the position of V4 countries within the IMD Digital Competitiveness Index, to compare their position in individual indicators with each other and subsequently to the leading country Denmark. The result will be the identification of problematic areas of digital development of individual countries as well as the entire Visegrad Group.

3.1 Object of research

In this article, we focused on analyzing the digital competitiveness of V4 countries compared to the leader in this field - Denmark. Table 1 summarizes the basic characteristics of V4 countries and Denmark.

Table 1: Information about object of research

	Poland	Hungary	Czech Republic	Slovakia	Denmark
Population	38.2 mil.	9.7 mil.	10.5 mil.	5.4 mil.	5.9 mil.
GDP per capita	43 455	42 665	49 957	36 704	74 793
Household debt (% of disposable income)	59.1%	45.2%	77.3%	86.9%	254.6%
Government debt (% of GDP)	68.3%	88.6%	48.4%	79.8%	50.3%
World Digital Competitiveness Index IMD 2022	46.	42.	33.	47.	1.

Source: OECD (2023)

From Table 1, it is clear that there are some differences emerging between the countries, however, in most of the indicators, the V4 countries do not differ significantly.

3.2 Methodology of research

In processing this paper, we used the World Digital Competitiveness Index IMD (hereafter referred to as the IMD index) and analyzed the years 2018-2022. By means of comparison, we compared the positions achieved by the V4 countries and the leader in this index, Denmark, and analyzed the year-on-year changes in the individual indicators of this index.

The World Digital Competitiveness Index focuses on measuring the capacity and readiness of economies to adopt digital technologies for economic and social transformation. Overall, this index analyzes 63 countries worldwide. Through this index, we identify the level of transformation of government practices, business models, and society as a whole. The index is divided into 3 main factors, each comprising several sub-factors. The construction of the IMD index is presented in Table 2.

Table 2: Structure of World Digital Competitiveness Index IMD

Knowledge	**Technology**	**Future Readiness**
Talent	Regulatory Framework	Adaptive Attitudes
Training and Education	Capital	Business Agility
Scientific Concentration	Technological Framework	IT Integration

Source: IMD (2023)

Based on the obtained data for individual sub-factors of the IMD index, we identified the development in each country between the years 2017 and 2022. To calculate the pace of change, we used a simple difference between two analyzed years: tn - tn-1.

Before writing the paper, we established the following research questions:

RQ1: What is the level of digital competitiveness of the V4 countries based on the IMD index?

RQ2: How does the digital competitiveness of the V4 countries develop compared to the leader in this area (Denmark)?

RQ3: What is the predisposition for the development of the positions of the

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V4 countries in the individual factors of the IMD index based on the average development in the last 5 years?

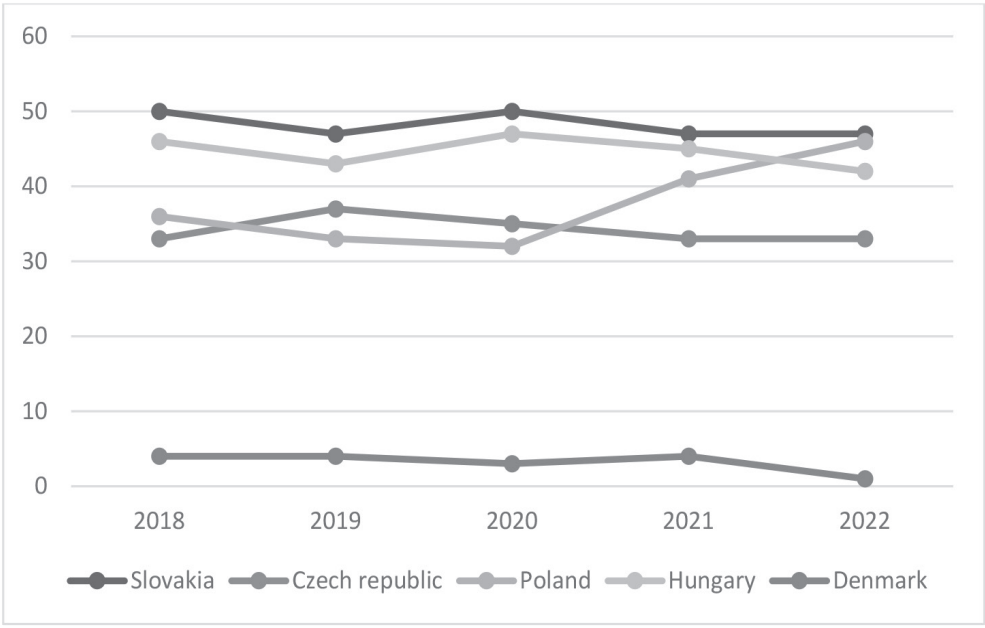
Answering the stated research questions will ensure the fulfillment of the set goal of the article.

4 Results

In the analytical part of the paper, we focused on analyzing the level of digital competitiveness of the V4 countries in mutual comparison and in comparison with Denmark, which is one of the leaders in this field in recent years.

Regarding the overall results of the IMD Index, it is clear that the V4 countries have been ranked between 30th and 50th out of a total of 63 evaluated countries over the past 5 years. As a result, all four Visegrad countries have below-average positions. On the other hand, Denmark has maintained its position in the range of 1st to 4th place over the past 5 years. The overall ranking of the analyzed countries over the past 5 years is shown in Figure 1.

Fig. 1: Overall rank in IMD index 2018 – 2022 in V4 countries and Denmark



Source: own processing according to IMD (2023)

As we see a certain difference emerging between the countries, in the next part of the article we focused on individual factors and sub-factors of the IND index in order to identify the strengths and weaknesses of each country.

4.1 Analysis of the development of the main factors of the IMD Index for V4 countries and Denmark

When analyzing the individual factors of the IMD index, it became clear that Poland has the biggest problems with the digitalization process. It has recorded worse positions in all three factors in the last 2 years, and in all factors, it has deteriorated its position by 1.5 to 2.25 places on average over the past 5 years.

For Slovakia and the Czech Republic, the most problematic factor seems to be technology, where both countries have recorded an average drop of 1 and 1.5 positions, respectively, in the last 5 years. The situation with this factor in Slovakia is very unstable, as there was a drop of 8 positions between 2022/2021, but an improvement of 6 positions between 2021/2020. We will analyze the reasons for this fluctuation in more detail in the following subsection of this article, where we will focus on the individual sub-factors of the IMD index.

In terms of long-term development, Hungary has the best situation, with none of its factors showing a decline on average over the past 5 years. The shift in individual index factors is on average at the level of 1 position.

As for Denmark, the situation is currently the best among all the evaluated countries in the IMD index. However, the most problematic factor for this country is also the technology factor, but it records an average annual shift of 0.75 positions. In the case of the future readiness factor, the average annual change is 0, but in this factor, Denmark has been consistently ranked 1st or 2nd in the IMD index over the past 5 years.

The summarized index of changes within the individual factors of the IMD index is presented in Table 3. Negative numbers indicate an improvement in position, while positive numbers indicate a worsening position in that factor.

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Table 3: Year-on-year changes in positions in individual factors of the IMD index for V4 countries and Denmark

		2019-2018	2020-2019	2021-2020	2022-2021	average
Knowledge	Slovakia	-3	+3	-3	0	-0,75
	Czech	-1	0	-2	-3	-1,5
	Poland	0	-3	+8	+4	+2,25
	Hungary	-4	0	-1	0	-1,25
	Denmark	-2	0	2	-2	-0,5
Technology	Slovakia	-3	+7	-6	+8	+1,5
	Czech	+3	+2	+1	-2	+1
	Poland	0	0	+4	+5	+2,25
	Hungary	-4	+3	-3	-5	-2,25
	Denmark	+1	-2	0	-2	-0,75
Future Readiness	Slovakia	-6	+4	-5	-1	-2
	Czech	+5	-3	+1	-8	-1,25
	Poland	-4	+2	+4	+4	+1,5
	Hungary	-1	+3	+1	-4	-0,25
	Denmark	+1	-1	+1	-1	0
Overall Rank	Slovakia	-3	+3	-3	0	-0,75
	Czech	+4	-2	-2	0	0
	Poland	-3	-1	+9	+5	+2,5
	Hungary	-3	4	-2	-3	-1
	Denmark	0	-1	+1	-3	-0,75

Source: own processing according to IMD (2023)

The overall development of the positions of the V4 countries is particularly interesting for Hungary, which has managed to move up 5 positions in the last 2 years, indicating a positive outlook for further progress. On the other hand, there is a negative outlook in this regard for Poland, which has dropped 14 positions in the last 2 years. Slovakia and the Czech Republic have not been able to move up even one position in the last year, which is not entirely positive news in terms of future progress.

4.2 Analysis of the development of IMD index sub-factors in the V4 countries and Denmark

During the analysis of the sub-factors of the IMD index, we identified several problematic areas in individual countries. Each country has its own specific

problematic areas on which it should work to improve in the coming years. Technological framework appears to be the most problematic for the majority of the analyzed countries, where, except for Hungary, all analyzed countries experienced a deterioration on average. In the following sections, we will discuss the development of sub-factors of the IMD index in each country separately.

Slovakia

Regarding Slovakia's digital competitiveness, the most problematic area in the last 5 years appears to be the lack of capital for technology and the sub-factor of technological framework. Slovakia has seen improvement in other sub-factors and with an expected maintenance of the average pace of development, the other sub-factors should have positive growth.
The development in the last 5 years is presented in Table 4.

Table 4: Year-on-year changes in positions in individual sub-factors of the IMD index for Slovakia

Factors	Sub-factors	2019-2018	2020-2019	2021-2020	2022-2021	average
Knowledge	Talent	-2	-1	-1	-8	**-3**
	Training & Education	+5	0	-3	-6	**-1**
	Scientific concentration	-6	+2	+2	-1	**-0,75**
Technology	Regulatory framework	-2	+3	-1	-2	**-0,5**
	Capital	-3	+4	-5	+16	**+3**
	Technological framework	+3	+1	+1	+1	**+1,5**
Future Readiness	Adaptive attitudes	-9	+8	-1	+1	**-0,25**
	Business agility	+3	+1	-2	-10	**-2**
	IT integration	-5	+4	-4	-1	**-1,5**

Source: own processing according to IMD (2023)

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Based on the table presented, we can state that the situation in Slovakia was the worst between the years 2019 and 2020, with improvement in only one sub-factor (Talent). The situation was also significantly bad between the years 2021 and 2022, with a major decline particularly in two sub-factors: Capital (+16 positions) and Business agility (+10 positions). Overall, the situation can be summarized as unstable from a time perspective. It is necessary for the situation in the area of digitalization to stabilize and for the development to gradually become constant.

Czech Republic

Regarding the Czech Republic, the most problematic sub-factors are also, like in Slovakia, part of the technological factors group. Specifically, it is the Technological framework sub-factor, which has declined by an average of 3 positions in the last 5 years, followed by the sub-factor of lack of capital for digital technologies. A positive aspect compared to Slovakia is that the Czech Republic improved in both of these sub-factors between 2021 and 2022. The question is whether the Czech Republic will be able to maintain this positive trend in the coming years.

The development of individual sub-factors in the last 5 years is shown in Table 5.

Table 5: Year-on-year changes in positions in individual sub-factors of the IMD index for Czech Republic

Factors	Sub-factors	2019-2018	2020-2019	2021-2020	2022-2021	average
Knowledge	Talent	+6	-9	+2	-6	**-1,75**
	Training & Education	-11	+2	-1	-7	**-4,25**
	Scientific concentration	-6	+1	-1	-1	**-1,75**
Technology	Regulatory framework	-1	+2	-1	-7	**-1,75**
	Capital	+9	-1	+2	-3	**+1,75**
	Technological framework	+10	0	+4	-2	**+3**
Future Readiness	Adaptive attitudes	+12	-12	+1	-4	**-0,75**
	Business agility	+12	-10	+5	-8	**-0,25**
	IT integration	+1	+1	0	0	**+0,5**

Source: own processing according to IMD (2023)

In terms of temporal development, the situation is relatively better than in Slovakia. The worst development was between 2018 and 2019, when there were significant declines in positions from the previous year in almost all sub-factors. On the contrary, over time, the situation in the Czech Republic has been improving and in the last monitored period between 2021 and 2022, it achieved a stable value or improvement in all sub-factors. The assumption is that the trend of development in the Czech Republic will be positive or stable in the coming years as well.

Poland

In terms of development over the years, the situation in Poland is by far the worst among the V4 countries. The negative aspect is that Poland is experiencing the opposite trend compared to the Czech Republic, meaning that the situation is worsening from year to year. If this trend continues in the coming years, it will lead to a significant lag of Poland in terms of digital competitiveness, not only within the Visegrad Four group but also within Europe as a whole.

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Once again, one of the most problematic areas is the lack of capital for digital technologies, where there has been an average deterioration of 4.25 positions over the past 5 years. In addition, only 2 sub-factors have shown improvement on average over the past 5 years (Scientific concentration and Technological framework).

The year-on-year changes in the positions of individual sub-factors for Poland are presented in Table 6.

Table 6: Year-on-year changes in positions in individual sub-factors of the IMD index for Poland

Factors	Sub-factors	2019-2018	2020-2019	2021-2020	2022-2021	average
Knowledge	Talent	-2	+1	+12	+7	**+4,5**
	Training & Education	0	-3	+12	-2	**+1,75**
	Scientific concentration	-7	-3	0	+2	**-2**
Technology	Regulatory framework	-1	+1	+7	+4	**+2,75**
	Capital	+6	-2	+11	+2	**+4,25**
	Technological framework	-7	-7	+8	+2	**-1**
Future Readiness	Adaptive attitudes	+4	-8	-1	+9	**+1**
	Business agility	-12	+5	+11	+3	**+1,75**
	IT integration	-4	+2	+7	+6	**+2,75**

Source: own processing according to IMD (2023)

As we have already mentioned, the most problematic area in Poland is the timing of the declines in individual sub-factors. As we can see in Table X, the situation is worsening year by year. Between 2018 and 2019, there was a decline in only two of the analyzed sub-factors, while between 2021 and 2022, only one sub-factor improved. As a result, we believe that the concept of developing a digital society in Poland is currently insufficient or incorrectly conceived, which is causing a greater lag behind European countries every year.

Hungary

Hungary is a country that, based on the shift in individual sub-factors, is the best developing country among the V4 countries. The country recorded a positive change on average in all sub-factors.

In Table 7, we present the development of individual sub-factors in Hungary over the last 5 years.

Table 7: Year-on-year changes in positions in individual sub-factors of the IMD index for Hungary

Factors	Sub-factors	2019-2018	2020-2019	2021-2020	2022-2021	average
Knowledge	Talent	+1	-3	-1	-3	**-1,5**
	Training & Education	-5	+2	+2	-3	**-1**
	Scientific concentration	-6	-1	-2	-4	**-3,25**
Technology	Regulatory framework	0	+4	-3	-10	**-2,25**
	Capital	-5	0	-1	-3	**-2,25**
	Technological framework	-27	+5	-3	-2	**-6,75**
Future Readiness	Adaptive attitudes	0	0	0	0	**0**
	Business agility	0	+3	+3	-14	**-2**
	IT integration	0	+5	+1	-7	**-0,25**

Source: own processing according to IMD (2023)

Based on the table presented, it is clear that the most problematic period in Hungary was the transition from 2019 to 2020. On the other hand, the best period in the country is between 2021 and 2022. The most significant improvements were achieved in the sub-factors of Regulatory framework and Business agility. If the established trend is maintained, it is expected that Hungary will build a country ready for the process of digitalization in the near future and become competitive not only within the V4 countries, but also across Europe.

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Denmark

Denmark, as a leading country in digital competitiveness, has relatively volatile development of individual sub-factors, but this fluctuation is always only at the highest levels. This means that the country maintains a relatively stable level of competitiveness and can serve as an example for V4 countries.

In the following Table 8, we present the development of individual sub-factors of the IMD index in Denmark over the last 5 years.

Table 8: Year-on-year changes in positions in individual sub-factors of the IMD index for Denmark

Factors	Sub-factors	2019-2018	2020-2019	2021-2020	2022-2021	average
Knowledge	Talent	0	-2	+1	0	**-0,25**
	Training & Education	+3	+3	-5	+3	**+1**
	Scientific concentration	+3	-2	+2	0	**+0,75**
Technology	Regulatory framework	+2	-6	0	+2	**-0,5**
	Capital	+5	-4	-10	+1	**-2**
	Technological framework	+3	-2	0	0	**+0,25**
Future Readiness	Adaptive attitudes	-4	+1	+2	+1	**0**
	Business agility	+4	-5	2	-6	**-1,25**
	IT integration	-4	0	0	0	**-1**

Source: own processing according to IMD (2023)

From a time perspective, the most problematic period in Denmark was between 2018 and 2019, when there was a decrease in almost all sub-factors of the index. Conversely, a year later, between 2019 and 2020, Denmark's position improved in almost all sub-factors.

The established trend in Denmark is at a relatively good level, and the level of digitization in the country is among the highest in almost every area. The area of knowledge and related sub-factors appears to be problematic.

5 Conclusion

In recent years, the process of digitalization has significantly spread across all developed countries in the world. The Visegrad Four countries are no exception, and we have focused on analyzing them through the IMD index in this article. According to this index, Denmark is one of the leaders in digital competitiveness, which we compared with the Visegrad Four countries. In terms of overall positions in this index, the Czech Republic has been at the highest level among the Visegrad Four countries in recent years, while Slovakia has been in the worst position.

The most problematic area for both the V4 countries and Denmark appears to be Technology and the associated necessary capital. On the other hand, all analyzed countries are relatively well prepared in terms of their ability to adapt technologies to the business environment.

In terms of temporal development, the situation is worst in Poland, where the position in all analyzed factors has worsened in recent years. The opposite situation is observed in Hungary, where positions in the analyzed indicators have improved in recent years. If the established trend in the development of individual factors does not change, the differences between the V4 countries may deepen significantly. It is therefore necessary for each of the analyzed countries to focus on their weakest areas in order to support overall development of digital competitiveness.

Recommendations for improving the situation of the most problematic sub-factors in Slovakia:

- the creation of a specialized budget to support the country´s digital environment in order to ensure a regular supply of sufficient capital to this sector,

- draw up a several-year investment plan in individual digital technologies to correctly locate the spent funds,

- through compiled plans and budgets, to ensure stable development of the digital environment without significant fluctuations over time.

Recommendations for improving the situation of the most problematic sub-factors in Czech Republic: (the situation is very similar to Slovakia, technological factors are the most problematic therefore the recommendations

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for the country are very similar):

- the creation of a specialized budget to support the country´s digital environment in order to ensure a regular supply of sufficient capital to this sector,

- draw up a several-year investment plan in individual digital technologies in order to correctly locate the spent funds,

-through the already existing system and newly created plans, there is room to stabilize the situation based on the improving level in recent year.

Recommendations for improving the situation of the most problematic sub-factors in Poland:

- to create a constructive system with the aim of setting the individual steps of creating the country´s digital environment, as in recent years there have been significant declines in several sub-factors,

- in the current situation in the country, not to focus attention on specific sub-factors separately, but to focus on the possibilities of building a digital environment globally with the aim of gradually working towards individual sub-factors.

Recommendations for improving the situation of the most problematic sub-factors in Hungary:

- due to the positive trend of development within the individual sub-factors, we recommend the country to stay on the currently set system of introducing and working with digital technologies – the existing concept is beneficial for the development of the country in the field of digitization.

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REFERENCES

[1] Antikainen, M., Uusitalo, T., & Kivikytö-Reponen, P. (2018). Digitalisation as an enabler of circular economy. *Procedia Cirp*, 73, 45 ─ 49. https://doi.org/10.1016/j.procir.2018.04.027

[2] Bourreau, M., Moreau, F., & Gensollen, M. (2008). The Digitization of the Recorded Music Industry: Impact on Business Models and Scenarios of Evolution. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.1092138

[3] Chircu, A. M., Sultanow, E., & Sözer, L. D. (2017). A Reference Architecture for Digitalization in the Pharmaceutical Industry. Informatik 2017. Gesellschaft fur Informatik, Bonn, pp. 2043 – 2057. https://doi.org/10.18420/in2017_205

[4] Dyer, J. H., & Chu, W. (2003). The Role of Trustworthiness in Reducing Transaction Costs and Improving Performance: Empirical Evidence from the United States, Japan, and Korea. *Organization Science*, 14(1), 57 – 68. https://doi.org/10.1287/orsc.14.1.57.12806

[5] Elia, G., Margherita, A., & Petti, C. (2016). An Operational Model to Develop Technology Entrepreneurship "EGO-System." *International Journal of Innovation and Technology Management,* 13(05), 1640008. https://doi.org/10.1142/s0219877016400083

[6] Fernández-Macías, E. (2018). Automation, Digitisation and Platforms: Implications for Work and Employment. Eurofound. Publications Office of the European Union, Luxembourg. https://doi.org/10.2806/090974

[7] Graham, M., Hjorth, I., & Lehdonvirta, V. (2017). Digital labour and development: impacts of global digital labour platforms and the gig economy on worker livelihoods. *Transfer: European Review of Labour and Research,* 23(2), 135 – 162. https://doi.org/10.1177/1024258916687250

[8] Harafonova, O., Zhosan, G., & Akimova, L. (2017). The substantiation of the strategy of social responsibility of the enterprise with the aim of providing efficiency of its activities. *Marketing and Management of Innovations,* 3, 267 – 279. https://doi.org/10.21272/mmi.2017.3-25

[9] Heavin, C., & Power, D. J. (2018). Challenges for digital transformation – towards a conceptual decision support guide for managers. *Journal of Decision Systems,* 27(sup1), 38 – 45. https://doi.org/10.1080/12460125.2018.1468697

[10] IMD. (2023). World Competitiveness Index Center. Database. Available at: https://www.imd.org/centers/wcc/world-competitiveness-center/rankings/world-digital-competitiveness-ranking/

[11] International Labour Organisation. (2018). *Digital Labour Platforms and the Future of Work.* Report. Available at: https://www.ilo.org/global/publications/books/WCMS_645337/lang–en/index.htm

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https://doi.org/10.53465/ER.2644-7185.2024.1.32-50

[12] OECD. (2023). OECD Statistics. database. Available at: https://stats.oecd.org/

[13] Okhrimenko, I., Sovik, I., Pyankova, S., & Lukyanova, A. (2019). Digital transformation of the socio-economic system: prospects for digitalization in society. *Revista Espacios,* 40(38).

[14] Paritala, P. K., Manchikatla, S., & Yarlagadda, P. K. D. V. (2017). Digital Manufacturing-Applications Past, Current, and Future Trends. *Procedia Engineering,* 174, 982 – 991. https://doi.org/10.1016/j.proeng.2017.01.250

[15] Porter, M. E. (2008). On competition. Boston: Harvard Business Press.

[16] Rachinger, M., Rauter, R., Müller, C., Vorraber, W., & Schirgi, E. (2019). Digitalization and its influence on business model innovation. *Journal of Manufacturing Technology Management,* 30(8), 1143 – 1160. https://doi.org/10.1108/JMTM-01-2018-0020

[17] Rossato, C., & Castellani, P. (2020). The contribution of digitalisation to business longevity from a competitiveness perspective. *The TQM Journal,* 32(4), 617 – 645. https://doi.org/10.1108/TQM-02-2020-0032

[18] Sabbagh, K., Friedrich, R., El-Darwiche, B., Singh, M., & Koster, A. (2013). Digitization for economic growth and job creation: Regional and industry perspectives. The global information technology report, 2013, 35-42.

[19] Sendlhofer, T., & Lernborg, C. M. (2018). Labour rights training 2.0: The digitalisation of knowledge for workers in global supply chains. *Journal of Cleaner Production,* 179, 616 – 630. https://doi.org/10.1016/j.jclepro.2017.12.173

[20] Zimmermann, H. (2000). *Understanding the digital economy: Challengers for new business models.* AMCIS 2000 Proceedings. Paper. https://doi.org/10.2139/ssrn.2566095

[21] Zolfaghari Mashhadi, V., & Reza Kargozari, M. (2011). Influences of digital classrooms on education. *Procedia Computer Science*, 3, 1178 – 1183. https://doi.org/10.1016/j.procs.2010.12.190