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Original Scientific Article

Digital Skills in the Context of the Economic Growth of Countries

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Abstract: *The digital environment has become an essential part of everyday life, work, and education. Digital skills are crucial for personal and professional success in today's technological age. OECD and EU statistics indicate that approximately 90% of job positions require digital skills at various levels. The more skilled and adept employees are in businesses, the more the company progresses, which subsequently influences the country's economic growth and development. Different indices have been created to compare the digital performance of countries. One of the most used is The Networked Readiness Index (NRI) and The Digital Economy and Society Index (DESI). The aim of the article is to describe the levels of digital skills of citizens and compare the level of digital skills in Slovakia and EU countries in the year 2022. The data will be obtained from the databases of the mentioned NRI and DESI indices.*

Keywords: *Digital skills, Digital competencies, Economic growth.*

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1. INTRODUCTION

In an increasingly complex and technology-driven world, the essence of humanocentricity lies in placing human needs, values, and potential at the center of technological and organizational development. This approach emphasizes the importance of designing systems and processes that enhance human well-being, foster creativity, and support meaningful interactions. It is essential to develop competencies across three pivotal areas: digital, social, and cognitive. Digital competence encompasses the skills and knowledge necessary to effectively navigate and leverage technology. Social competence involves the ability to communicate, collaborate, and build relationships within diverse and often virtual environments. Cognitive competence refers to the mental skills and strategies that enable individuals to think critically, solve problems, and make informed decisions. By focusing on these three areas, we can develop a well-rounded skill set that not only enhances individual capabilities but also contributes to a more resilient, innovative, and human-centered society.

Information technology (IT) has had a significant impact on economic growth over the past few decades. The diffusion of information and communication technologies (ICT) in different areas has accelerated the growth of the global economy (Rozite et al., 2019). One of the main ways in which IT has impacted economic growth is by increasing productivity. IT has allowed businesses to automate many tasks, reducing the time and cost required to perform them. This has led to increased efficiency and productivity, which in turn has boosted economic growth. The development of the global knowledge society and the rapid integration of ICT make it imperative to acquire digital skills necessary for employment and participation in society (Laar et al., 2017). The current labor market makes digital competencies obligatory for every person who wants to work professionally (Rogacka, 2022). The development level of digital skills depends on the digital transformation of the economy, which creates not only socio-economic conditions but also gives an impetus to mastering digital skills, essential both for career growth and for the performance of basic actions according to new digital requirements (Bondarenko, 2023). First, it is necessary to define what is meant by the term digital skills. According to Livingstone et al. (2023) digital skills are defined as the ability to use ICTs in ways that help individuals to achieve beneficial, high-quality outcomes in everyday life for themselves and others' and that 'reduce potential harm associated with more negative aspects of digital engagement. UNESCO (2018) defined digital skills as a range of abilities to use digital devices, communication applications, and networks to access and manage information. Today, with the development of the digital field, the world and Europe are offered a wide range of opportunities for business growth (Kiseľáková et al., 2022). Generally, the relationship between digital skills and economic growth is complex and multifaceted. Digital skills refer to the ability to effectively use digital technologies and tools to access, understand, create, and communicate information. Economic growth, on the other hand, typically refers to an increase in a country's production of goods and services.

2. LITERATURE REVIEW

In the rapidly evolving landscape of the 21st century, the acquisition and application of digital skills have emerged as essential factors influencing various facets of individuals' lives, industries, and societies. According to World Economic Forum (2022) every single job of the future will have a digital element. At the most basic level, digital skills refer to the essential skills needed to use computers and digital devices to access and manage information. However, digital skills go beyond basic knowledge and cover more complex sets of skills (DevSkiller, 2022). Usually to the basic digital skills belong computer literacy, data entry, social media, email, and chat or word processing. Increasing of digital skills is part of the European Union's action plan to year 2030. According to this

action plan, the EU will launch actions to increase the number of qualified and competent Information and communication technology (ICT) professionals and train more digital experts to reach 20 million ICT professionals in Europe (Misheva, 2021). According to Balacescu et al. (2019) digital skills have been identified as one of the pillars of economic development, both at the social and community level, as well as at the individual level. The influence of information and communication technologies, especially digital skills, is also confirmed by several other studies and publications. The results of Niebel (2017) confirm the positive contribution of ICT to economic growth. The results is study of Ishnazarov et al. (2021) shows that ICT is important predictor of economic growth. The study of Jayaprakash and Pillai (2022) indicates a positive significance of ICT on economic growth, but the intensity of the usage of ICT highly depends on the nature of the society.

Economic and digital indexes provide possibilities for comparing individual countries from different points of view. One of the most important indexes for European Union countries is the Digital Economy and Society Index (DESI). The Networked Readiness Index (NRI) serves best for the global comparison of countries. The aim of the paper is to describe the levels of digital skills of citizens and compare the level of digital skills in Slovakia and EU countries in a year 2022 – year with the actual data. The data will be obtained from the databases of the mentioned NRI and DESI indices.

3. DATA AND METHODOLOGY

The Digital Economy and Society Index (DESI) summarises indicators of Europe's digital performance and tracks the progress of EU countries. The European Commission has been monitoring Member States' digital progress through the Digital Economy and Society Index reports since 2014. Each year, DESI includes country profiles which support Member States in identifying areas requiring priority action as well as thematic chapters offering a European-level analysis across key digital areas (European Commission, 2023). DESI has four main dimensions:

Dimension 1: Human capital
Dimension 2: Connectivity
Dimension 3: Integration of digital technology
Dimension 4: Digital public services

For the purposes of this article, data from the first dimension (Human capital) was used. This dimension has the latest structure from year 2022 shown in Table 1.

Table 1. Structure of the dimension Human capital

Internet user skills	Advanced skills and development
• At least basic digital skills • Above basic digital skills • At least basic digital content creation skills	• ICT specialists • Female ICT specialists • Enterprises providing ICT training • ICT graduates

Source: Digital Economy and Society Index (DESI) 2022 – Methodological Note, Own processing

The Network Readiness Index (NRI) report maps the network readiness landscape of 131 economies based on their performance in four areas (Portulans Institute, 2023):

Area 1: Technology
Area 2: People
Area 3: Governance
Area 4: Impact

For the analysis data from the second area were used – People. This area has three sub-dimensions and 15 indicators. In this article one indicator - ICT skills in the education system that is similar to DESI indicators was used.

The dataset for DESI was obtained from European Commission pages and includes the year 2022. The dataset for NRI was obtained from the Portulans Institute page and includes the year 2022. Basic descriptive statistics and forms of logarithmic data transformation were used for data evaluation.

4. RESULTS

The subject of this paper are digital skills of EU citizens. It is important to find out how EU countries are grouped according to selected DESI indicators. For this we use clusters. The clusters are groups of countries with similar values of the indicators. In the research, Ward's method of minimum gloss dispersion was used in accordance with DESI 2022 data. Analyzes were performed in Statgraphics Centurion 18. Based on the following 6 DESI indicators, we grouped the countries of the European Union into 6 different groups:

Indicator 1: At least Basic Digital Skills
Indicator 2: Above basic digital skills
Indicator 3: ICT Specialists
Indicator 4: Female ICT specialists
Indicator 5: Enterprises providing ICT training
Indicator 6: ICT graduates

The outputs of the cluster analysis are presented by the cluster dendrogram, the values of the centroids of the DESI indicators, and the list of countries included in the clusters. Countries are grouped in the following clusters:

Cluster 1: Finland, Netherlands, Sweden
Cluster 2: Denmark, Estonia, Ireland, Luxembourg, Malta
Cluster 3: Austria, Greece, Spain, France, Croatia, Lithuania, Latvia
Cluster 4: Belgium, Cyprus, Germany, Portugal, Slovenia
Cluster 5: Czech, Hungary, Italy, Poland, *Slovakia*
Cluster 6: Bulgaria, Romania

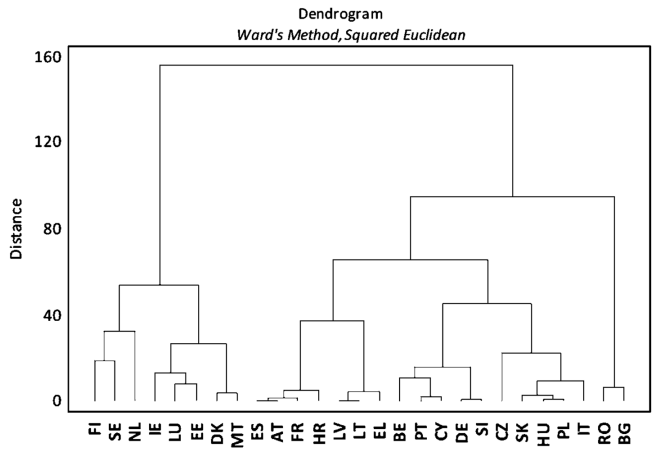

Figure 1. Cluster dendrogram EU countries based on selected DESI indicators
Source: European Commission, 2023, Own calculations

Countries with similar levels of skills are in clusters 2, 3, 4, and 5. Slovakia belongs to cluster 5 along with the countries Czechia, Hungary, Italy, and Poland. Countries with the best digital skills are in Cluster 1 (Finland, the Netherlands, Sweden). These countries hold top positions in the DESI rank. Romania and Bulgaria belong to countries with the worst digital skills. The dendrogram below shows the hierarchical clustering of six observations – Figure 1.

Basic statistical measures were used for calculating the cluster centroids and DESI indicators. Complete results are shown in Table 2.

Table 2. Values of the cluster's centroids and DESI indicator's basic statistical measures

Cluster's Centroids			**At least Basic Digital Skills**	**Above basic digital skills**	**ICT Specialists**	**Female ICT specialists**	**Enterprises providing ICT training**	**ICT graduates**
Cluster	**Members**	**Clusters proportion**	% individuals	% individuals	% individuals in employment	% ICT specialists	% enterprises	% graduates
1	**Finland, Netherlands, Sweden**	11%	75	45	7	21	31	5
2	**Denmark, Estonia, Ireland, Luxembourg, Malta**	19%	64	34	6	22	25	7
3	**Austria, Greece, Spain, France, Croatia, Lithuania, Latvia**	26%	58	29	4	21	17	4
4	**Belgium, Cyprus, Germany, Portugal, Slovenia**	19%	52	23	5	19	26	3
5	**Czech, Hungary, Italy, Poland, Slovakia**	19%	50	22	4	14	18	4
6	**Bulgaria, Romania**	7%	30	8	3	27	6	6
DESI indicators basic statistical measures		**max**	79	52	8	28	38	9
		min	28	8	3	10	6	1
		range	51	44	5	18	32	7
		average	56,3	27,8	4,8	20,1	21,1	4,6
		standard deviation	12,1	10,3	1,4	4,0	7,7	1,8
		standard error	0,4	0,4	0,1	0,1	0,3	0,1

Source: European Commission, 2023, Own calculations

Countries in Cluster 1 have the highest values in indicators like At least Basic Digital Skills, Above basic digital skills, ICT Specialists, and Enterprises providing ICT training. However, the

countries in Cluster 2 are better in the indicator of Female ICT specialists and ICT graduates. These countries also belong to the countries with the high DESI rank. The cluster's centroids valued by the DESI indicators are shown in Figure 2.

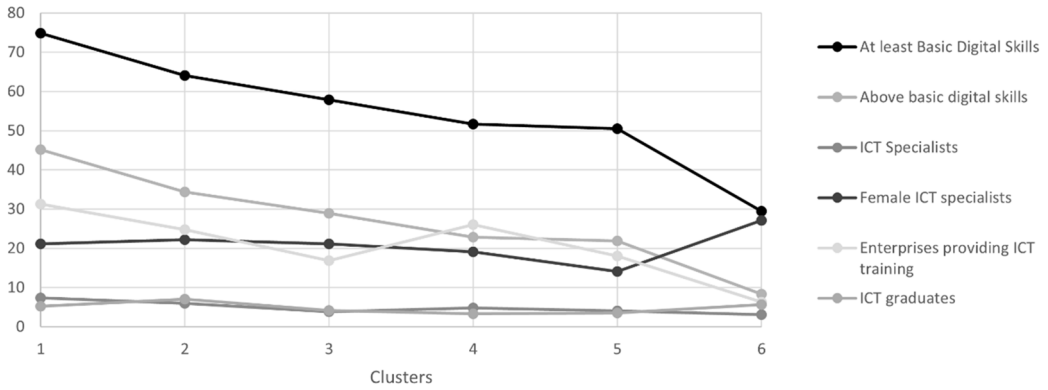

Figure 2. Cluster's centroids value by the DESI indicators
Source: European Commission, 2023, Own calculations

Countries in first five clusters have really high values in the indicator At least Basic Digital Skills. According to these values, more than 50% of individuals have some digital skills. In order to calculate the NRI, it was necessary to extract countries from the European Union, as the NRI measures and compare countries from around the world. Similar indicator to the DESI indicator At least Basic Digital Skills is the indicator ICT skills in the education system. This indicator measures the extent to which the active population possesses sufficient digital skills. According to this indicator, the countries with the highest scores are the countries in the first cluster – Finland and Sweden. If we rank the countries based on these indicators, Slovakia is in the 15th position for the 'At least Basic Digital Skills' indicator and in the 19th position for the 'ICT Skills in the Education System' indicator.

5. FUTURE RESEARCH DIRECTIONS

According to the official European Commission website data.europa.eu (2022) more than three-quarters of companies in the EU report difficulties to find workers with the appropriate skill set. In future research, emphasis will be placed on a deeper study of other indicators that can help improve information about digital skills in the broader context of societal needs. It will be studied whether socio-economic indicators such as gross domestic product, income, or population size have an impact on digital skills or digital education. Workers with advanced digital skills can earn more than those without digital skills, which can contribute to the profitability of companies and lead to an increase in the GDP of countries.

6. CONCLUSION

In the present era, technology plays a central role in both society and business, and data stands as a crucial asset for fostering economic and societal advancement. To actively contribute to this progress and harness its advantages, it is imperative to equip individuals with the necessary digital skills and an understanding of data. According to the results of the DESI, countries with a high percentage of citizens possessing at least basic digital skills or above are ranked as leaders within the EU. These countries include Finland, the Netherlands, and Sweden, where 75% of individuals have at least basic

digital skills, and 45% have above-basic digital skills. Additionally, these nations boast a significant number of ICT specialists (7%) and enterprises offering ICT training (31%). On the other end of the spectrum, the worst-performing countries according to these indicators are Bulgaria and Romania. Slovakia falls within the group of countries positioned in the lower half of the ranking. Similar findings can be observed in the NRI index, which underscores the need to increase the number of ICT specialists. As per the DESI results, all European countries are grappling with this challenge.

The European Commission is actively engaged in initiatives aimed at bolstering the advancement of digital skills. Among these initiatives is the Digital Europe Programme (DIGITAL), a newly established EU funding programme with a primary focus on facilitating the integration of digital technology into businesses, enhancing digital literacy among citizens, and streamlining digital processes within public administrations. Additionally, there is the Digital Skills and Jobs Platform, which has been launched to provide accessible information and resources pertaining to digital skills. In ongoing research, it will be imperative to investigate the influence of digital skills on socioeconomic indicators, including GDP. It is crucial to share the findings of this research with fellow researchers and, more importantly, with the general public.

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