

PRELIMINARY REPORT

Digital Development of Serbia Compared to Selected European Countries: A Comparative Analysis

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ABSTRACT

The aim of this research is to analyze the level of digital development achieved by sixteen European countries based on Microsoft's Digital Future Index from 2021. The countries analyzed in the report are classified into three groups: a) Digitally Advanced "Benchmark" Countries of Western Europe (the Netherlands, Denmark, Sweden, and Finland), b) Europe's Fast-Growing Digital Leaders (Czech Republic, Estonia, Malta, Slovenia, and Portugal), and c) Digital Followers of Central & Eastern Europe (Croatia, Hungary, Poland, Romania, Russia, Serbia, and Greece). By applying comparative graphical analysis, using a 45-degree line, the relationship between the Level of Digital Development and the Benefits of Digitization in these countries was examined. The findings indicate that economies with a relatively lower Digital Development Score achieved relatively higher Economic and Social Gains Scores. This highlights the need for more efficient management of digitalization factors in countries leading the digital development process. Furthermore, the inputs to the development of digitization and the economic and social results of achieved digital development were visually compared both for the three previously identified groups of European countries and specifically for the Republic of Serbia. The research findings demonstrate that the digital Followers of Central & Eastern Europe significantly lag behind the "Benchmark" countries of Western Europe and Europe's fast-growing digital leaders in terms of achieved digitalization levels. Serbia lags in the development of digital infrastructure, digital skills, the adoption of digital technologies, and the overall level of human capital development compared to other European countries.

Keywords: *digitization, development of digitization, Microsoft's Digital Future Index, Serbia, digital ecosystem*

JEL Classification: O10, O33, I25

INTRODUCTION

For some researchers, the beginning of digitization and the digital revolution is connected with the invention of the microprocessor in 1973 and its mass use. Others, on the other hand, believe that the general digitization of numerous social and economic activities began in the 1990s with the invention of the Internet. In any case, the digitization process is identified as the most significant technological trend that radically transforms society and all economic activities without exception (Fitzgerald et al., 2014).

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The modern economy is in the midst of a deep transformation, supported by the strong development of digitization in all spheres of society (Nedić et al., 2014). The comprehensive digitization of the economy and society is changing people's lifestyles and areas of interest, while simultaneously redefining the key principles of companies' operations (Bataev & Aleksandrova, 2020).

Bukht and Heeks (2017) point to the need to distinguish three levels of content coverage of the category of digital development: a wider range (digitalized economy), a narrower range (digital economy), and the central part - the ICT sector (Figure 1).

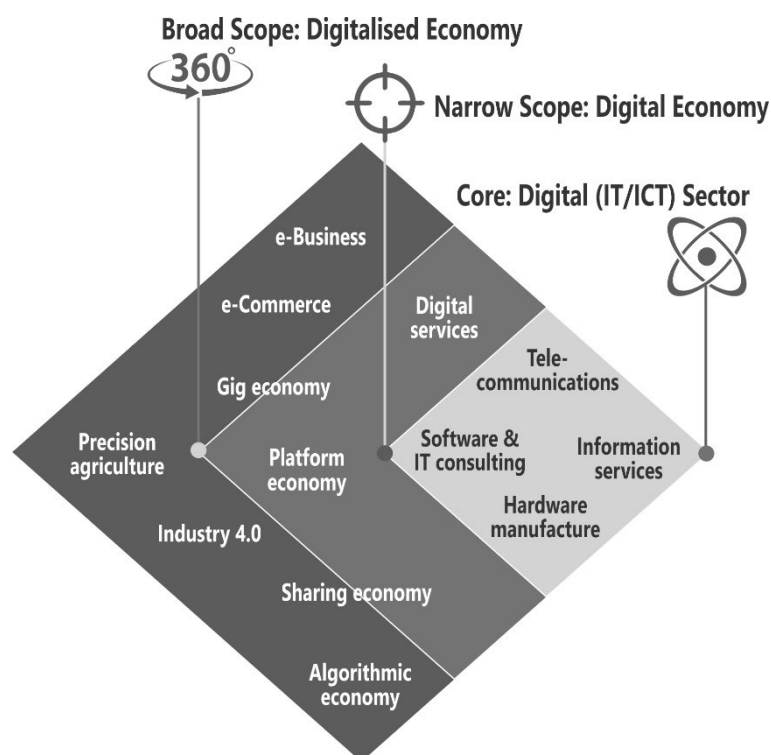


Figure 1: Ranges of digitization

Modified from: Bukht & Heeks, 2017

Digitization has the potential to increase productivity, facilitate access to new markets, create new industries and jobs, improve service delivery, enhance people's well-being, and enable more sustainable models of environmental protection (Singgalen et al., 2019). However, it can also introduce new sources of social exclusion, a greater concentration of wealth in the hands of a smaller number of economic subjects, and lead to the emergence of many new risks in terms of security and data protection, as well as increased energy consumption, among other challenges. The failure to advance in the digital transformation of the economy and society is inevitably connected to the slowing down of the economic growth of the country and the widening gap in competitiveness, along with the growth of inequality in the distribution of created value compared to technologically and economically leading economies.

Digitization is transforming the economy and society by enabling changes in models of interaction and social communication, business, production, and the provision of public services (Shkarlet et al., 2020). In the literature, it is often concluded that digital development enables the emergence of many business models that encourage innovation and efficiency, as this process improves connectivity, knowledge and experience, flexibility, and more (Bowman et al., 2018). This is how digital societies and economies are emerging, increasingly basing their activities

(education, healthcare, production, marketing, entertainment, etc.) on the combined use of various digital technologies.

Digitization generates new forms of value creation with the potential to increase productivity, competitiveness, well-being, and social inclusion while also promoting greater environmental sustainability (Lee et al., 2019). This value creation is based on knowledge generated from digital data obtained from production and consumption processes through intelligent systems that utilize advanced digital technologies.

The development of digitization favors the emergence of new business models for the provision of goods and services online (Dornberger et al., 2019). These digital platform models promote the generation and collection of data to offer new value in the provision of goods and services across various economic sectors. This transformation is facilitated by the adoption of advanced technologies such as fifth-generation (5G) mobile networks, the Internet of Things, cloud computing, artificial intelligence, virtual reality, big data analysis, and cognitive robotics.

Research has confirmed the positive effect of digitalization on economic efficiency (Gao et al., 2022; Niu et al., 2024). Digital transformation has become a necessary element for ensuring the sustainable economic development of many countries. Specifically, at the macro level, comprehensive digitization can shift the point of production closer to the production possibilities frontier, thereby increasing the allocative efficiency of the economy (Nambisan et al., 2019; Sanders et al., 2019; Mishra et al., 2022). Numerous studies have highlighted the positive impact of digitization on employment growth and the promotion of entrepreneurship (Zhang et al., 2022; Wu & Yang, 2022), as well as many positive changes in the structure of the industry (Wang & Chen, 2024).

The development of digitization results in numerous spillover effects and synergistic effects in mitigating disparities between urban and rural areas, regions, and industries. According to research, the advancement of digitalization in China has improved the entrepreneurial behavior of residents in rural areas, thus actively reducing development inequalities between cities and villages (Xie et al., 2020; Li, 2024). Moreover, through the synergistic effects of "industrial digitalization" and "digital industrialization," the development of digitalization fosters cooperative relationships along the entire production and sales chain. This creates a common industrial ecosystem connected by technological resources, driving the transformation and upgrading of industrial and supply chains, thereby promoting the coordinated development of individual industrial sectors (Vignaraja et al., 2016; An et al., 2024).

Without a comprehensive vision of digitization, positive impacts could turn into negative factors in terms of competitiveness, concentration, and inequality. For example, vulnerable segments of society could be marginalized in accessing online services, while a lack of digital skills could adversely affect employment opportunities. The net impact of digitization depends on people's awareness of the importance of digital transformation and timely policies to steer digitization toward sustainable development.

Integrating digital transformation efforts with productive development at the enterprise level is key. Digital development policies in the digital age should not be limited to production processes and structural changes. On the contrary, they should expand their sectoral focus, considering the transnational nature of digital flows and the inclusion of new strategic sectors, such as digital ecosystems. Similarly, social development policies in the digital age must adapt to this technological transformation by focusing on education and strengthening digital competencies and skills to ensure a larger pool of experts for the development and growing application of digital technology.

The aim of this research is to assess the level of digitization in the Republic of Serbia based on a comparison of the basic parameters of two key sub-indices that evaluate the drivers of digital development in individual countries and the socio-economic results of digital development.

Hypotheses:

- H1:** The level of digitization in the Republic of Serbia lags significantly behind the digitally advanced countries of Western Europe and most of Europe's fast-growing digital leaders.
- H2:** There are certain areas of digital development in the Republic of Serbia where results comparable to those of Central and Eastern European countries have been achieved.

Using Microsoft's Digital Future Index from 2021, this paper aims to present the key performance indicators of Serbia's achieved level of digital development in comparison with 14 European countries covered in the report, applying commonly used tools in comparative analyses. This is particularly important for shaping Serbia's development policy throughout this decade. It should be emphasized that the methodology for grouping countries based on their achieved level of digital development in this study is entirely arbitrary, as it has not been adopted from any other source but rather reflects solely the authors' approach to this issue.

INDICATORS OF DIGITAL DEVELOPMENT OF COUNTRIES WITH AN EMPHASIS ON THE DIGITAL FUTURE INDEX

A number of indexes have been created for monitoring and comparing the development of digitization. One of the indicators that is often used in economic research is the ICT Development Index (IDI) published by the International Telecommunication Union (ITU). The IDI is a composite index that measures the development of information and communication technologies (ICT) among countries. The index consists of various criteria, such as the population's access to ICT, the use of ICT by the population, and the ICT skills of the population in the country (ITU, 2017).

The Digital Adoption Index (DAI), published by the World Bank, observes the application of digital technology in three key areas: businesses, government, and people (World Bank, 2016). This indicator is important for discovering how digitization affects the country's economy as a whole. However, DAI data were only available during the years 2014-2016, so they were not included in the scope of this study.

The E-Government Index (EGI) is published by the United Nations. The EGI measures the willingness and ability of national governments to use ICT in the provision of public services (United Nations, 2020). The index summarizes the provision of e-government services online and provides an overview of how well governments are embracing digital technologies. The EGI consists of three sub-indices: the Online Service Index (OSI), the Telecommunication Infrastructure Index (TII), and the Human Capital Index (HCI).

Since 2014, the European Commission has been monitoring the progress in the digitization of member countries by publishing annual reports of the Digital Economy and Society Index (DESI). Each year, the reports include country profiles, which help member states to identify areas for priority action at the EU level in key areas of digital policy.

The Digital Economy and Society Index (DESI) was developed by the European Commission in 2014 for the purpose of evaluating the development of member countries in the direction of digitization of the economy and society. Its composition consists of packages of relevant indicators structured in four dimensions: human capital, connectivity, integration of digital technology, and digital public services. The DESI index can range from 0 to 1, where a higher value indicates greater success in the field of digitization (European Commission, 2024).

As a measure of the reached level of the digitized economy, Microsoft promoted the Index of the Digital Future of Countries in 2021. It is a composite index based on over 1,000 data sources obtained from reliable public institutions. These sources include organizations such as the European Commission, the European Investment Bank, Eurofound, UNESCO, the World Bank, the OECD, the World Trade Organization, and the United Nations (Microsoft News Center Europe, n.d.).

The Digital Future Index models the relationship between the digital development of society as an input aggregate and the key outcomes of social development as an output aggregate. The index is based on 55 indicators, of which 43 are used to evaluate digital development, while 12 indicators refer to the evaluation of key outcomes of digital transformations. It can be said that the choice of indicators largely ensures a holistic view of the achieved level of digital transformations of individual national economies, as well as the impact of these transformations on social and economic results (Figures 2).

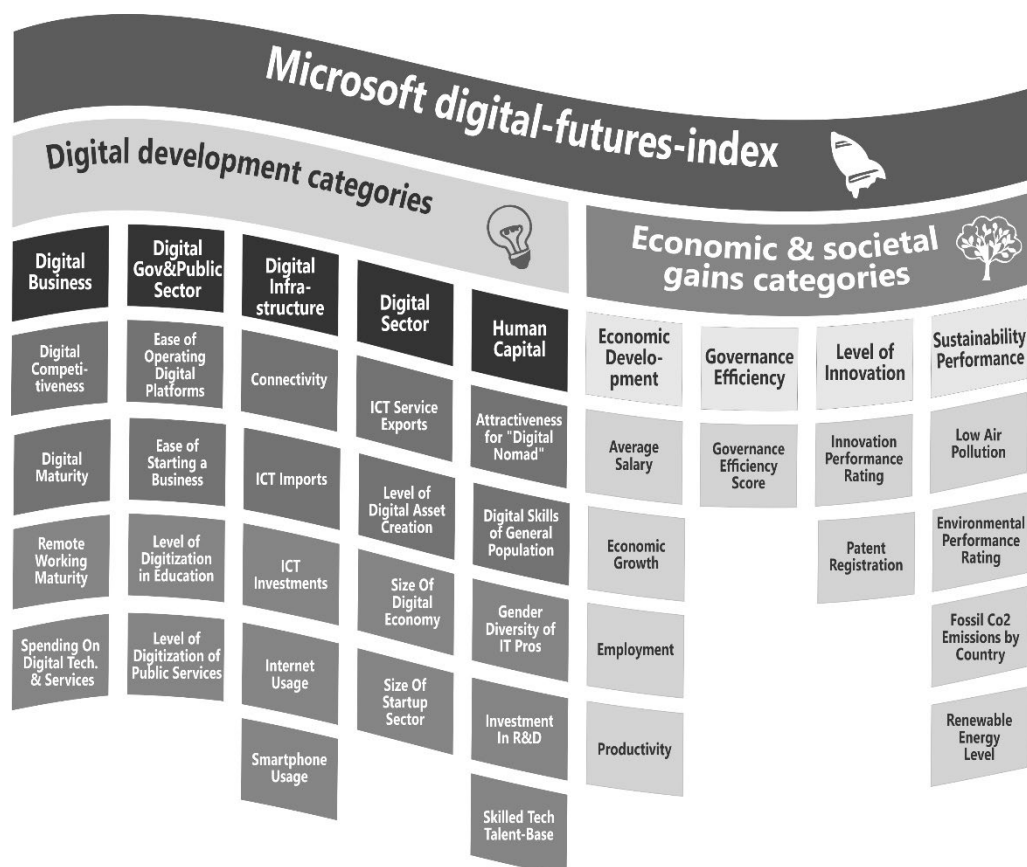


Figure 2. Structure of Microsoft's Digital Future Index

Source: Authors, based on CEE Multi-Country News Center, n.d.

Each category is divided into subcategories represented by one or an aggregation of two or more indicators. Incentive or input parameters define the potential and suitability of the environment for stimulating digital transformations in the economy, such as digital competitiveness, ease of starting a business, ICT import, ICT export, and the technical talent base. Outputs reflect the results of input indicators, including average salary, productivity, patent registration, air pollution levels, and evaluations of public administration efficiency.

The sixteen European countries present in the Report on the Digital Future are classified into three groups for the purposes of this research. The first group, referred to as "benchmark" countries, includes digitally advanced nations such as the Netherlands, Denmark, Sweden, and Finland. Generally, these countries achieve high results in all aspects of digital development. They are leaders in digital transformation, utilizing the most advanced technologies, maintaining developed digital infrastructures, and possessing high levels of digital skills among their citizens.

Another group, consisting of Europe's fast-growing new digital leaders, includes the Czech Republic, Estonia, Malta, Slovenia, and Portugal. These countries are undergoing a rapid digital transformation, showing significant progress in digital technologies and innovation, and achieving

good results in several key areas of digitization. Although they are not on par with benchmark countries, they demonstrate rapid growth in digitalization.

The third group includes seven countries labeled as advanced digital follower environments (learners) from Central and Eastern Europe: Croatia, Hungary, Poland, Romania, Russia, Serbia, and Greece. These countries are at different stages of digital transformation but generally lag behind more advanced European countries in terms of digital infrastructure, skills, and the application of digital technologies. Results in these countries are often lower compared to those of Western European and fast-growing digital leaders (Figure 3).

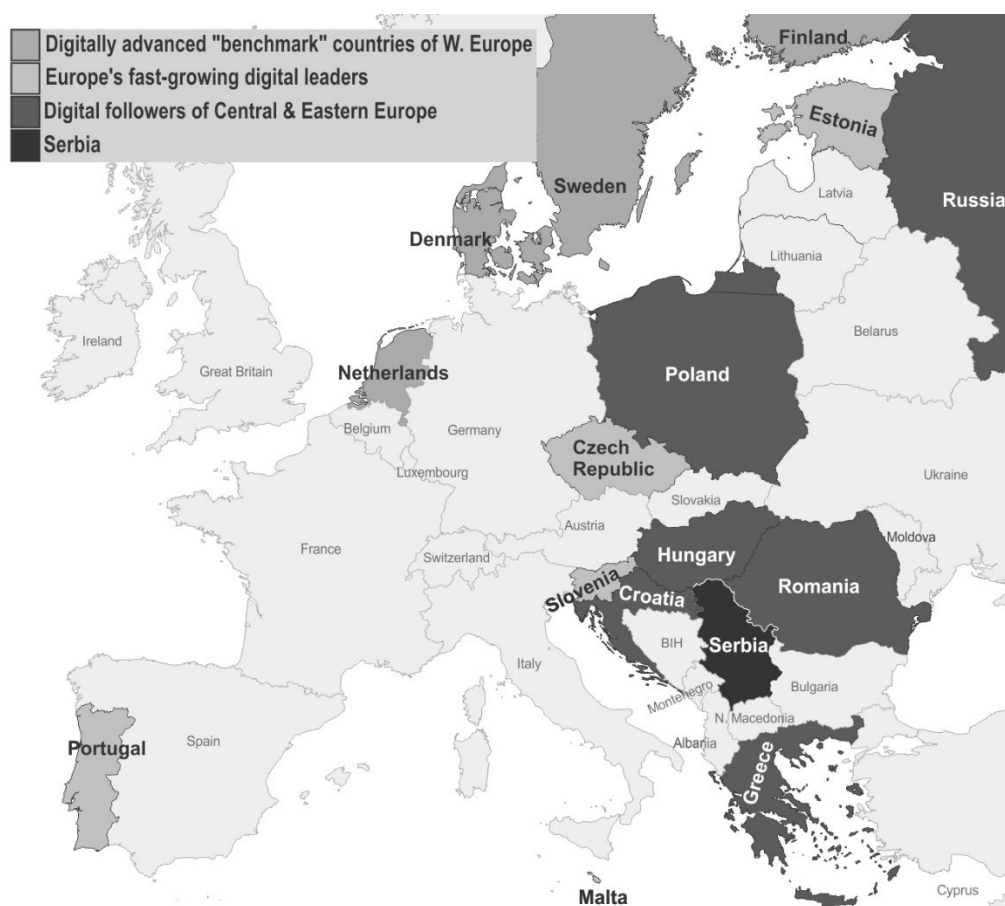


Figure 3. Countries Included in Microsoft's Digital Future Index

Source: Authors, based on Microsoft News Center Europe, n.d.

It should be noted that the selection of the 16 observed European countries by the creators of the Microsoft index is based on the assessment that these are national economies with significant capacity and potential for rapid further progress in the field of digitization. This selection allows the index to provide a comprehensive insight into the digital development of the selected European economies, taking into account the different contexts and specificities of individual regions.

EFFECTIVENESS OF DIGITAL DEVELOPMENT IN SELECTED EUROPEAN COUNTRIES

The question of the economic efficiency of the digital transformation process in countries can be examined as the relationship between the factors of digital development and the socio-economic effects of the achieved level of digital development. Figure 4 illustrates the relationship between the factors of digital development and the socio-economic effects of digitalization in 16

European countries, classified into three groups based on their level of digitalization, according to Microsoft's Digital Future Index from 2021.

On the x-axis are digital inputs—indicators that reflect the level of investment in building digital capacity, such as investments in IT infrastructure, the number of qualified IT experts, and the availability of digital technologies and services. The y-axis represents the economic and social benefits of these investments, including increases in GDP, productivity, innovation, and improvements in living standards.

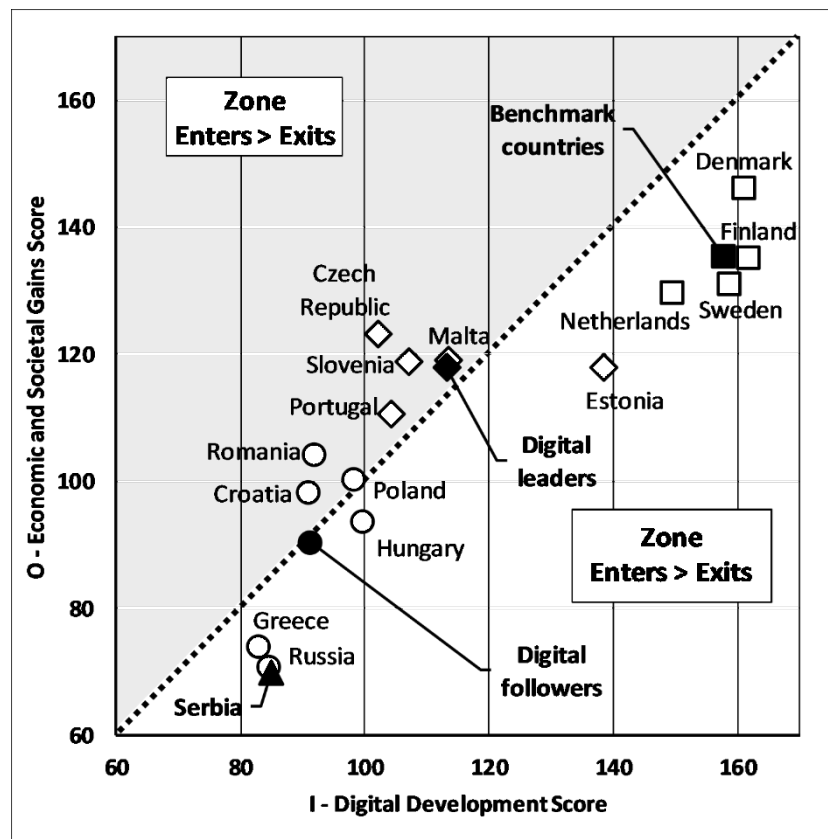


Figure 4: Level of Digital Development and Benefits of Digitization

Source: Authors, based on the CEE Multi-Country News Center database, n.d.

Countries in the zone where investments are < results (upper left side) achieve relatively greater economic and social effects compared to total investments in the development of digitalization of the economy. This may indicate efficient use of digital resources, where even smaller investments lead to relatively larger benefits. The countries in this zone are: the Czech Republic, Slovenia, and Portugal. Romania and Croatia are close to this threshold, implying that their level of digitalization brings proportional or even higher returns on investment.

Countries in the zones where investments in drivers > digital results (bottom right side of Figure 4) have high investments in the development of the digital economy, but they have not yet reached the level of economic and social benefits that would be proportional to their investments in digitalization development. This may indicate the need to optimize resources or align their digital strategy to increase the effectiveness of their investments. The countries in this group are: Denmark, Finland, Sweden, the Netherlands, and Estonia.

Borderland countries are located on or near the equilibrium line between digital inputs and outputs. These countries record proportional results in terms of investments and outcomes. These are the following countries: Poland, Hungary, Greece, the Russian Federation, and Serbia.

Based on the diagram, countries with lower investments (digital inputs) achieve similar or even greater benefits compared to those with higher investments, suggesting the need for better implementation and more effective management of digitization factors. The question arises as to why the most economically developed countries in the diagram show relatively weaker economic and social effects of digitalization compared to their large investments in the drivers of digitalization development.

The answer can be:

a) Market Saturation and Reduced Return on Investment

The most developed countries have already achieved a high level of digitization, making additional investments in digital infrastructure less effective at generating new economic benefits. For instance, once basic digital infrastructure (such as high-speed internet and widespread digital device usage) is in place, further investments in digitalization yield progressively smaller economic and social effects.

According to the economic theory of diminishing marginal returns, investing in resources that are already at a high level results in diminishing returns in terms of benefits. This means that countries that are already highly developed digitally do not achieve the same gains in digital economic and societal growth as countries that are at earlier stages of the digital transition.

b) Structural and Regulatory Factors

In developed countries, complex regulations may slow the application of digital technologies, even when there are significant investments in digitalization. For example, strict regulations on data privacy, consumer protection, or labor rights can hinder or slow the implementation of new digital solutions. Traditional economic sectors, such as industry or services, may resist the introduction of new technologies. In these countries, the adoption of digitization in traditional industries might be slower due to the need for a radical restructuring of existing production methods.

c) High Starting Base

Economically advanced countries already experience significant economic and social benefits from digitization. However, since they are at a high level, further growth becomes limited. Countries starting from a lower base can achieve relatively better results from investments in digitalization compared to more developed nations that are nearing the upper limits of their technological potential. Innovation in highly developed digital economies may also be more challenging, as many of the obvious and readily available benefits of digitization have already been realized. Moreover, these countries might be investing in research and development that will yield long-term benefits, which can impact the current correlation between digital development investments and their economic and social outcomes.

d) Social and Cultural Factors

Even with a high level of digital infrastructure, developed countries may face societal challenges in adapting to rapid technological advancements. For example, an aging population or a traditional workforce may struggle with adopting new technologies, thereby reducing the economic benefits of digital investments. In these countries, there may also be a stronger emphasis on social aspects that are not always easily measured economically. For instance, investments in technology may not yield direct economic returns but may instead improve quality of life through better healthcare, a higher quality education system, or reduced inequality in the distribution of income and wealth. These benefits may not be fully captured by traditional economic indicators.

e) Transition to More Complex Technologies

The most developed countries are now investing in advanced technologies such as artificial intelligence, quantum computing, and cutting-edge research, the benefits of which may not be immediately apparent. These technologies demand significant investment and extended periods

for research and development, with the effects often becoming visible only after many years. As a result, in highly developed nations, additional investments in digital technology development do not necessarily lead to proportionally higher economic and social outputs. This is due to factors like market saturation, diminishing returns on investment, regulatory challenges, an already high starting base, and a focus on long-term innovation.

In contrast, countries at earlier stages of digital development have the potential to realize faster and more substantial benefits from their investments. These nations, by focusing on foundational digital infrastructure and technologies, can achieve more immediate and visible improvements in economic and social outcomes.

This raises an important question, as seen in Figure 2: How do digital leaders manage to achieve relatively high economic and social effects from existing investments in digitalization development?

The answer to the question raised earlier suggests that new digital leaders achieve relatively high economic and social results from their investments in digitalization due to the efficient use of digital resources:

a) Effective Application of Digital Technologies

Digital leaders integrate digital technologies across all sectors of the economy, including industry, services, agriculture, and the public sector. These countries use digital tools to optimize business processes, leading to greater productivity and efficiency, which, in turn, amplifies the economic and social effects of digital development. Automation and artificial intelligence enable leaders to improve efficiency in production, analytics, and decision-making, allowing them to rapidly scale economic and social benefits with relatively modest additional investments.

b) Focus on Research and Innovation

Digital leaders invest in innovative startups, research centers, and collaborations between the private sector and universities. These investments foster the continuous development of new technologies and solutions, driving economic growth. Furthermore, these countries often attract investment from international funds, venture capital firms, and global technology leaders, which bolsters their research and development capacities.

c) High Level of Digital Skills in the Population

Digitalization leaders invest heavily in their education systems, ensuring that their workforce possesses advanced digital skills. A focus on science, technology, engineering, and mathematics (STEM) in educational programs enables the creation of a highly skilled workforce that can quickly adopt new technologies, thereby increasing productivity. Leaders in digitalization also promote a culture of lifelong learning and adaptation, allowing employees and businesses to keep pace with technological innovations, maximizing the benefits.

d) Support for Entrepreneurship and Small Businesses

Digitalization leaders support small and medium-sized enterprises (SMEs) through digital transformation programs, subsidies, and training. SMEs that embrace digital technologies experience significant gains in productivity and competitiveness, contributing to overall economic growth. Additionally, these countries often develop digital platforms that facilitate easier access to markets, financing, and new customers for SMEs, thus enhancing both social and economic outcomes.

e) Digitally Driven Government and Public Services

Digital leaders frequently implement digital public services that enhance government efficiency, reduce costs, and improve service quality for citizens. E-government, e-health, and digital education platforms, for example, provide faster and more cost-effective access to services. These countries also promote open data and transparency through digital technologies, helping to combat corruption, build public trust, and foster sustainable social development.

f) International Integration and Digital Cooperation

Digital leaders integrate their economies into global digital value chains, allowing them to capitalize on international markets for greater economic benefits. These nations play key roles in setting global standards for digitalization, enabling them to align their digital strategies with international rules and markets, thereby maximizing the returns on their digitalization investments.

g) Favorable Business Climate for Digital Innovation

Digital leaders create regulatory frameworks that foster innovation and adapt to the fast-changing dynamics of the digital landscape. These frameworks make it easier to start and manage digital businesses and adopt new technologies. By offering tax incentives and subsidies for digital transformation, governments help businesses invest in digital infrastructure without straining their budgets.

h) Agility and Adaptability in Policy

Digital leaders are adept at quickly adjusting their strategies to align with emerging digital trends and technologies. For example, recognizing the rapid potential of 5G networks, cloud computing, or blockchain solutions allows them to realize significant benefits ahead of other countries. Strong collaboration between government, tech companies, and academic institutions enables these leaders to fully exploit the potential of new technologies through partnerships and joint initiatives.

THE POSITION OF THE REPUBLIC OF SERBIA IN RELATION TO THE COUNTRIES INCLUDED IN THE DIGITAL FUTURE INDEX

The effectiveness of the digitalization process in the economy of the Republic of Serbia, in comparison to the other 15 European countries classified into the three previously defined groups, can be illustrated as a ratio between investments in the development of digitalization and the economic and social benefits derived from such investments. This relationship is depicted in Figure 5.

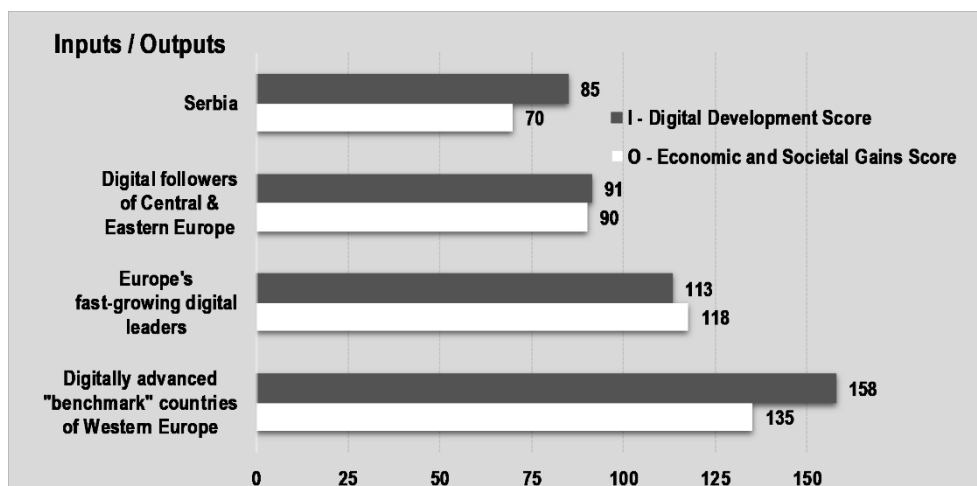


Figure 5. Comparative Presentation of Inputs to the Development of Digitization and the Economic and Social Results of Achieved Digital Development

Source: Authors, based on the CEE Multi-Country News Center database, n.d.

Based on the data and analysis presented in Figure 5, it is evident that Serbia significantly lags behind in overall investments in digital development and the associated benefits compared to other European countries. Specifically, Serbia's entry sub-index for digital development stands at 85, markedly lower than the average of the leading benchmark countries in Western Europe

(158) and the new digital leaders in Europe (113). Furthermore, when compared to the average of Central and Eastern European countries, Serbia's index of 91 indicates a deficiency in digital infrastructure and a lack of investments in digital technology.

The gap becomes even more pronounced in the output sub-index, which measures the economic and social benefits of digitization. Serbia's score of 70 is considerably below the averages of Western Europe (135) and the new digital leaders in Europe (118). This indicator suggests that Serbia has yet to fully capitalize on the potential of digital development, in contrast to both Western European countries and those in Central and Eastern Europe.

A further analysis of the five key categories of digital development, as defined by the Microsoft Digital Future Index, reveals that Serbia has fallen behind in recent years across all areas, with the exception of the development of the Digital Sector, when compared to the leading countries in Western Europe as well as those in Central and Eastern Europe (see Figure 6). The most significant gaps are observed in the categories of digital business, digital infrastructure, and human capital, where Serbia shows considerably lower results. These areas are crucial for successful digital development; therefore, it is imperative for Serbia to make substantial improvements in these segments to enhance its competitiveness with leading European countries in the realm of digital advancement.

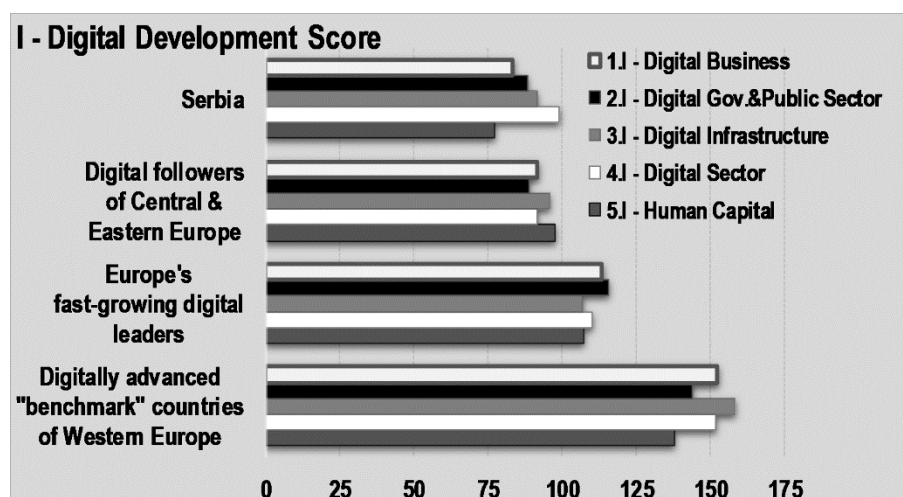


Figure 6. Comparative presentation of the value of individual digitization areas

Source: Authors, based on the CEE Multi-Country News Center database, n.d.

Although Serbia is relatively well-positioned in the digital sector, with a score exceeding the average of the Central and Eastern European digital followers, serious interventions are required in other categories. Particularly concerning is Serbia's position in the area of human capital, where the lag is most pronounced. Insufficient investments in education and the development of digital skills pose significant obstacles to enhancing Serbia's competitiveness in the European digital market.

If the necessary improvements are not made in these critical areas, there is a genuine risk that Serbia will fall further behind in the digital transformation process, potentially resulting in long-term negative consequences for the economy and society as a whole. Prioritizing the enhancement of human capital, the improvement of digital infrastructure, and the support of digital businesses must become central to Serbia's development strategy in order to narrow the existing gap and facilitate sustainable digital progress.

According to the data presented in Figure 7, Serbia trails behind leading "benchmark" countries in Europe across all categories of economic and social benefits, as measured by the Microsoft Digital Future Index. The most significant deficit is observed in management efficiency, where

Serbia's results are considerably lower compared to the new digital leaders in Europe and the average of digital follower countries in Central and Eastern Europe. This indicator highlights a serious shortfall in administrative capacity and effectiveness, potentially linked to the inadequate modernization of administrative processes and ineffective measures against corruption.

Furthermore, Serbia's economic development and innovation levels are below average, signaling an urgent need for increased investments and reforms in these areas. Without adequate support for innovation, Serbia risks further stagnation in global competition, which could limit its economic growth and development. Additionally, Serbia demonstrates significantly weaker performance in sustainability compared to digital follower countries in Central and Eastern Europe. This situation underscores the necessity for substantial investments and reforms in management, innovation, and sustainable development to improve Serbia's standing on the European stage and foster greater economic and social progress.

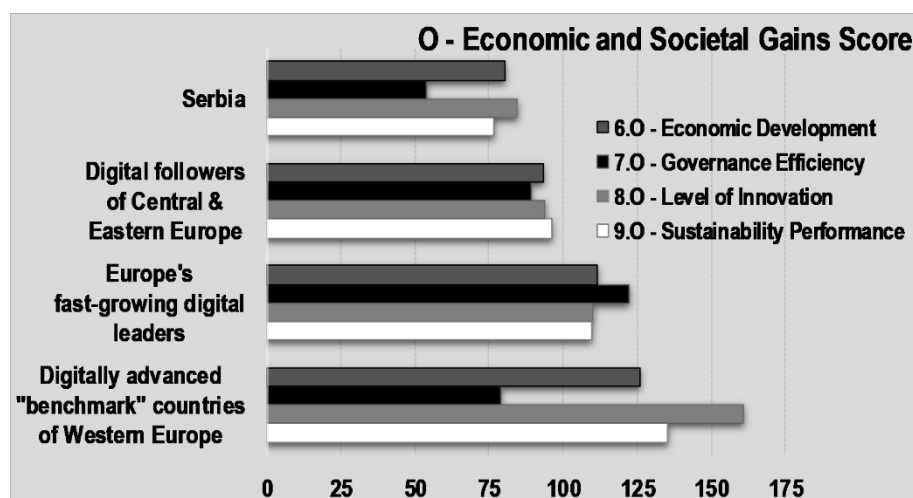


Figure 7. Comparative Presentation of the Values of Categories of Economic/Social Results as Output

Source: Authors, based on the CEE Multi-Country News Center database, n.d.

Several factors contribute to the relative position of the Republic of Serbia in relation to the three selected groups of European countries within the digital economy domain. Primarily, the lack of institutional reforms in public administration and an ineffective fight against corruption significantly undermine governance effectiveness and impact overall economic development. Additionally, insufficient systemic investments in fostering economic innovation, education, and research and development activities further hinder progress.

The low competitiveness of Serbia's economy is largely attributable to an inadequate business environment and insufficient infrastructure development. Moreover, inefficient sustainable and responsible business policies may further weaken Serbia's position relative to other European countries concerning digital development.

To analyze Serbia's standing in relation to the average values of the three groups of countries, the next phase of this research will involve a detailed examination of individual attributes within the previously presented categories of the Digital Future Index, as illustrated in Tables 1 and 2. This approach will provide deeper insights into specific weaknesses and identify potential areas for improvement.

Table 1. Comparative Presentation of All Attributes of Digital Development as Input

Attribute name	Digitally advanced "benchmark" countries of Western Europe	Europe's fast-growing digital leaders	Digital followers of Central & Eastern Europe	Serbia
1.1-Digital Competitiveness	155.74	121,568	86.00667	76.09
1.2-Digital Maturity	141,633	110.218	94.99167	78.95
1.3-Remote Working Maturity	125,083	104.078	96.81833	98.75
1.4-Spending On Digital Tech & Services	155.06	109,936	93.50833	89.28
2.1-Ease of Operating Digital Platforms	147,705	123,948	84.55333	72.99
2.2-Ease of Starting a Business	137.6	106,852	93.48333	104.81
2.3-Level of Digitization in Education	122,613	106,036	94.58167	102.3
2.4-Level of Digitization of Public Services	143.358	117,994	88.49667	79.06
3.1-Connectivity	141.153	107,696	95.29333	89.76
3.2-ICT Imports	152.68	98.22	97.13667	126.14
3.3-ICT Investments	163,708	106,906	95.89333	90.17
3.4-Internet Usage	153,793	109,638	95.80333	77.02
3.5-Smartphone Usage	157,905	107,786	96.62333	81.39
4.1-ICT Service Exports	122.79	93.214	98.97	140.14
4.2-Level of Digital Asset Creation	151,058	113,522	90.76167	87.87
4.3-Size Of Digital Economy	150.27	116.308	88.73	86.11
4.4-Size Of Startup Sector	152.423	110,982	92.59333	89.57
5.1-Attractiveness for "Digital Nomad"	141.175	101,742	105,275	59.63
5.2-Digital Skills of General Population	152,478	116,494	88.96	83.83
5.3-Gender Diversity of IT Pros	116.263	89,892	101.8283	139.57
5.4-Investment In R&D	130.198	107.22	101.5483	54.62
5.5-Skilled Tech Talent Base	113,983	106,772	93.14	107.36

Source: Authors, based on CEE Multi-Country News Center, n.d

Based on the analysis of digital input indicators, Serbia demonstrates varied performance in aspects of digital development; however, it significantly lags behind leading European countries in many key areas. Notably, Serbia's scores in digital competitiveness, digital maturity, and internet usage are concerning, given the critical importance of these factors for comprehensive digital development.

Particularly alarming is Serbia's position regarding investments in research and development, where it records a score of 55 - significantly lower than the average score of 130 for the leading "benchmark" countries in Western Europe. Additionally, Serbia's attractiveness for digital nomads is low, with a score of 60, compared to the Western European average of 141. When compared to the other two groups of observed countries, Serbia's results are also subpar, with scores of 107 and 102, respectively.

These weaknesses underscore the urgent need for Serbia to implement measures aimed at enhancing its research and development landscape and creating a more favorable environment

for digital nomads. Improvements in these areas could be pivotal in strengthening Serbia's competitiveness within the digital ecosystem. This situation serves as a crucial signal for public policymakers to prioritize increasing investments in research and development and to formulate stimulating policies that would attract digital nomads, thereby enhancing the country's digital maturity and competitiveness.

Despite its challenges in various areas of digital development, Serbia possesses certain advantages that cast it in a more favorable light. For instance, Serbia exceeds the leading countries in the region in both the import of ICT, with a score of 126, and the export of ICT services, scoring 140. These figures indicate a robust presence in the international trade of IT products and services. Such advantages suggest that Serbia holds significant potential for further development in the digital economy, particularly through the strengthening of its IT sector (Figure 8).

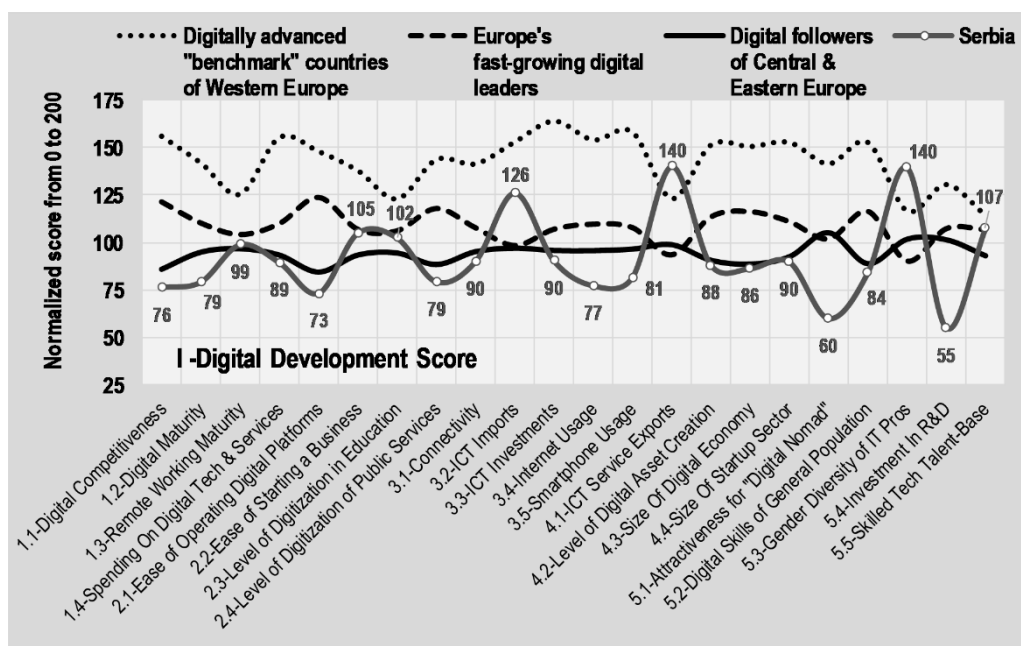


Figure 8. Diagram of Digital Development Attributes

Source: Authors, based on the CEE Multi-Country News Center database, n.d.

Serbia also demonstrates a high level of gender diversity among IT professionals, scoring 139. This figure serves as a significant indicator of inclusiveness and balance within the technology sector. Additionally, Serbia boasts a solid base of qualified technical talent, with a score of 107, which provides a strong foundation for further advancement and innovation within the IT industry.

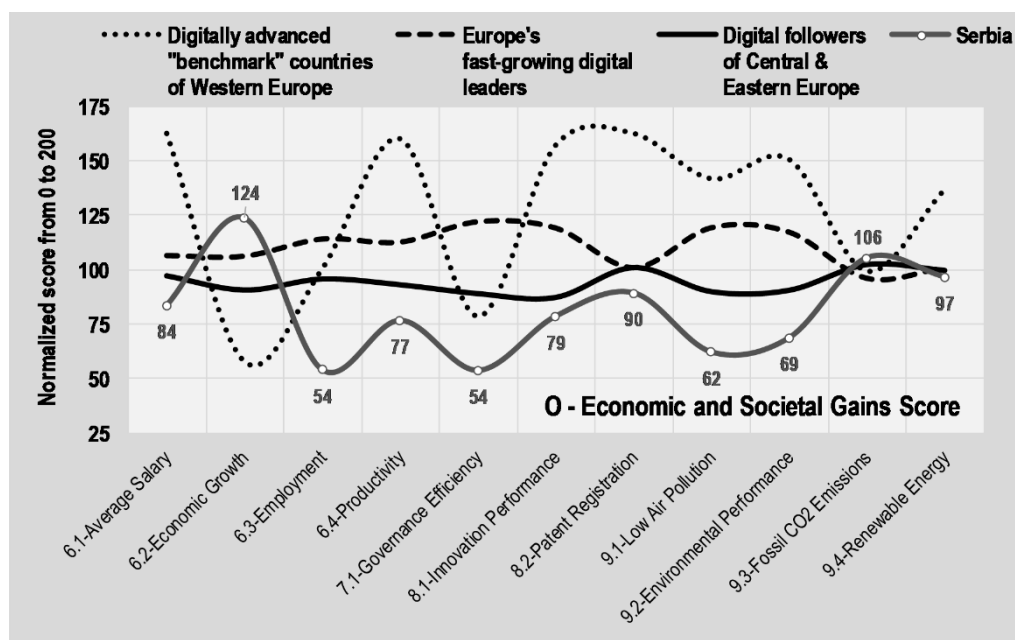
However, for Serbia to enhance its competitiveness in the global digital market and better harness the potential of the digital economy, it is imperative to improve results across most other areas. This necessitates increasing investment in research and development, strengthening digital infrastructure, and fostering a more conducive environment for digital innovation and business. Establishing a balance between existing advantages and necessary improvements is crucial for the successful digital development of Serbia.

Table 2. Comparative Presentation of All Attributes of Economic/Social Results as Output

Attribute name	Digitally advanced "benchmark" countries of Western Europe	Europe's fast-growing digital leaders	Digital followers of Central & Eastern Europe	Serbia
6.1-Average Salary	162,555	106,566	97.24	83.81
6.2-Economic Growth	58,035	106.28	90.80	123.77
6.3-Employment	100.6125	114.184	95.81	54.28
6.4-Productivity	160.1275	112,764	93.21	76.91
7.1-Governance Efficiency	78.7375	122.136	89.21	54.05
8.1-Innovation Performance	157.0725	119,256	87.48	78.84
8.2-Patent Registration	162.5975	100.96	100.94	89.55
9.1-Low Air Pollution	141.8025	119,382	90.11	62.49
9.2-Environmental Performance	150,715	117,364	90.71	68.95
9.3-Fossil CO2 Emissions	99.4825	96,098	102.31	105.59
9.4-Renewable Energy	136.8525	101.006	99.69	96.86

Source: Authors, based on CEE Multi-Country News Center, n.d.

Based on the analysis of economic and social output indicators, Serbia exhibits significant lags compared to the averages of the observed groups of countries, particularly pronounced in several key economic and social outcomes. The country faces serious challenges concerning average wages, productivity, employment, and management efficiency, with its results trailing behind those of leading European nations. For instance, Serbia's average salary score is 84, which is considerably lower than the average score of the group of new digital leaders in Europe (106) and that of digital followers in Central and Eastern Europe (97) (see Figure 8). This situation underscores the urgent need for improved economic policy and enhanced competitiveness within the Serbian economy to elevate living standards and attract foreign investments.

**Figure 9.** Chart of Economic/Social Performance Attributes for Cluster 2 Countries

Source: Authors, based on the CEE Multi-Country News Center database, n.d.

Moreover, Serbia's performance in environmental indicators is concerning, with scores of 68 for environmental performance and 62 for air pollution. These figures reveal significant weaknesses in Serbia's environmental and sustainable development policies. It is evident that Serbia must implement urgent measures to align its environmental standards with European sustainability norms.

On the other hand, Serbia is relatively well-positioned according to the indicator measuring the reduction of fossil CO₂ emissions, with a score of 105. This is a positive development in the context of global environmental standards and sustainability, indicating progress in implementing certain measures toward a green transition. While Serbia is achieving commendable results in areas such as patent registration and the utilization of renewable energy, significant challenges still need to be addressed to enhance competitiveness and sustainability. Comprehensive improvements in productivity, innovation, and environmental performance could substantially elevate Serbia's position on both the European and global stages, enabling the country to fully harness its economic potential and contribute to international efforts in combating climate change.

The analysis demonstrates that Serbia lags behind Western European countries, which are at the forefront of digital transformation, in all key aspects of digital development. These results confirm that Serbia is unable to reach the level of digitization exhibited by these advanced nations. Although some progress has been made in various areas, Serbia continues to fall behind in most critical indicators of digital development when compared to Europe's rapidly growing digital leaders. These leaders are making faster advancements in digital technologies and infrastructure investments, thus confirming the hypothesis of Serbia's relative lag. In some respects, Serbia is comparable to the digital followers in Central and Eastern Europe, indicating that in certain areas - such as economic indicators and innovation - Serbia can be compared with countries in this group. Nonetheless, significant challenges persist in many key areas.

Based on the conducted analysis, hypothesis H1 was confirmed: the level of digitization in the economy of the Republic of Serbia is indeed lagging behind that of the digitally advanced countries in Western Europe and most of the rapidly growing digital leaders in Europe. Additionally, the research validated hypothesis H2, indicating that there are specific areas of digital development in the Republic of Serbia where results comparable to those of the digital follower countries in Central and Eastern Europe have been achieved.

The Strategy for Digital Skills Development 2020–2024 (Government of the Republic of Serbia, 2020) and the Action Plan for the Implementation of the Digital Skills Development Strategy in the Republic of Serbia 2021–2022 (Government of the Republic of Serbia, 2021) serve as the foundation for the further development of digitalization in the country. The "Digital Serbia" Strategy for the period 2025–2027 is a document that defines key initiatives for the accelerated development and global positioning of Serbia's digital ecosystem. The strategy focuses on: a) developing globally successful startups through mentorship, community building, and access to capital, b) promoting the application of AI technologies and enhancing digital skills, c) fostering a new generation of experienced entrepreneurs, and d) strengthening international cooperation and improving the regulatory framework for innovation (Digital Serbia Initiative, 2025).

CONCLUSION

The Republic of Serbia is currently navigating the path of digital transformation but faces significant challenges in comparison to economically and digitally more advanced European countries. While progress has been made in certain segments of digitalization, such as the IT sector and e-government initiatives, Serbia continues to lag behind the leading nations of Western Europe in terms of overall digital infrastructure, integration of digital technologies within the economy, and the digital literacy of its population. Although Serbia exhibits moderate growth when compared to Europe's fast-growing digital leaders, it is imperative to accelerate digital reforms to narrow the gap with these more advanced countries.

An analysis of Serbia's standing relative to three observed groups - digitally advanced "benchmark" countries in Western Europe, fast-growing digital leaders, and digital followers in Central and Eastern Europe—reveals significant shortcomings in key areas of digital development, economic performance, and social outcomes. Notably, Serbia records considerably lower scores in digital competitiveness, productivity, management efficiency, average wages, and employment compared to leading European nations. This underscores the urgent need for comprehensive reforms and increased investments to close the gap with more developed European counterparts.

Conversely, Serbia does exhibit positive trends in certain domains, such as economic growth, where it even surpasses some of the new digital leaders in Europe. Additionally, the country shows commendable progress in reducing fossil CO₂ emissions and increasing the utilization of renewable energy sources. These aspects serve as bright spots in Serbia's overall development, indicating potential that can be further harnessed through targeted policies and strategic initiatives.

To enhance its position relative to other European countries, Serbia must prioritize the improvement of digital infrastructure, boost innovation levels, enhance environmental performance, and strengthen capabilities in patent registration and the development of the startup ecosystem. Investments in research and development, alongside efforts to cultivate a skilled technical workforce, are essential for achieving long-term sustainability and competitiveness within the European market.

It is necessary to identify financial sources that would further support the improvement of the country's digital infrastructure, particularly in segments where, according to the results of this research, Serbia performs significantly worse compared to the digitally leading European nations. This situation highlights the urgency of increasing investments that are crucial for reducing the still-existing digital gap between Serbia and its more developed European partners.

Through economic development policy instruments, the state must act to enhance the digital literacy of the population, despite the fact that Serbia has made some progress in developing its digital ecosystem and moving closer to digitally advanced European economies. The development of the digital ecosystem contributes to increased productivity, the creation of new jobs, and the promotion of innovation. Countries with well-developed digital ecosystems achieve better positioning in the global market thanks to innovative products and services.

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