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DIGITAL TRANSFORMATION AND INDUSTRIAL COMPETITIVENESS OF SERBIA IN COMPARISON TO THE EUROPEAN UNION

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Abstract: In the scientific study, we attempt to examine Serbia's industrial competitiveness and digital transformation processes in relation to the European Union (EU). An empirical combined methodological approach was employed. The quick blending of quantitative and qualitative understanding of economic processes was indicative of this tendency. Data sets from the EU Digital Economy and Society Index (DESI) 2024, as well as development indicators from the World Bank, Eurostat, and the Statistical Office of the Republic of Serbia, all represented the quantitative component. The findings show that while there has been some progress in the digitalization of electronic administration and widespread improvement of internet infrastructure, there has been a decrease in the population's use of digital platforms, a decrease in their capacity for innovation, and an incomplete digitization of small and medium-sized businesses when compared to EU countries. According to empirical data, Serbia's digital alignment and competitiveness lag behind those of the EU. The study indicates that increased integration with EU digital policy, increased investments in educational innovation sectors, and increased coordination between the public, corporate, and academic sectors are all necessary. The ideas include boosting the industrial sector's and the general public's digital literacy process, encouraging more research and entrepreneurial endeavors, and facilitating more effective access to high-speed Internet in a wider context. The results, which indicate that Serbia's DESI index equivalent is still approximately 30% below the EU average, highlight the need for more effective harmonization in Serbia.

Keywords: *industrial competitiveness; Serbia; European Union; DESI; digital economy; innovation; digital skills; empirical analysis; policy alignment.*

Field: Social sciences.

1. INTRODUCTION

In the research overview of the key indicators of the development of the digital economy of Serbia in its approximation with the European Union, we used quantitative analytical data through data sets from the digital economy and society index EU (DESI) 2024, processes of development indicators of the World Bank, Eurostat and the Statistical Office of the Republic of Serbia., qualitative indicators are extracted from national documents on digital strategy and analytical approach of experts who have dealt with this field (Regodić, Matić, Regodić, & Živić, 2021).

The current state of Serbia's digital economy is reflected in the paradigm and challenges of global intensive transformations of the economic and business environment under the influence of Industrial Revolution 4.0. (Зековић & Хаџић, 2020; Komazec, Bukvić, Dimitrijević, & Petrović, 2022)

The necessity of a national approach through the improvement of institutional support for a more efficient digitalization of society and the economy is based on the Strategy for the Development of the Information Society until 2020, and then the key priorities in six segments were emphasized: necessity of constant development of digital communication in business, E-government, E-health, E-justice, ICT education, E-sciences and cultures.

This approach of the state is part of the Digital Agenda and refers to maximizing the use of ICT opportunities for the purpose of increasing economic growth, efficiency, employment, and improving the quality of life (Dakić, Heričko, Kljajić, & Todorović, 2025; Vidas-Bubanja & Popovčić-Avrić, 2018).

The transformative character of the fourth industrial revolution, labeled Industry 4.0, (Vidosav D. Majstorović, Mitrović, & Mišković, 2020), places innovations such as robotics, artificial intelligence (AI), the Internet of Things (IoT), and automation as the main elements of production processes in various aspects (Ali, Ali, Dakić, & Zoltan, 2024; Haiderzai, Dakić, Stupavský, Aleksić, & Todorović, 2025; Todosijević, Dakić, Heričko, Kljajić, & Todorović, 2025). Serbia lags behind the EU in comprehensive processes of digital transformation. This is especially related to innovative technological leadership and changes in companies and among the general population, which have not matured (Maksimović, Vlašković, & Damnjanović, 2025). Despite the efforts of the SMIC center and the DEAL laboratory, the lack of human expertise, insufficient financial investment, and the gap between cities and rural areas slow down the more effective application of new technologies. The necessity of rapprochement of the economic environment

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with the EU lies in the strengthening of the educational system, efficient education of the workforce, greater support for small and medium-sized enterprises, and greater investment in digital infrastructure (Dakić, Todorović, & Vranić, 2023).

The current situation was observed through research on the level of the digital divide in the countries of the EBRD and the European Union. The stumbling block of the rapprochement between Serbia and the European Union lies in our National Education System, which should be systematically looked at and, as much as possible, encourage digital skills and competences of both individuals and society. Formal and non-formal education should aim to cancel the digital inequalities of the population in rural and urban areas. Skill building refers to:

- Developing the ability to access, find, select, and interpret adequate information on the Internet
- Improving critical thinking
- Willingness to exhaust the possibilities of the Internet to respond more readily and intuitively to challenges
- Motivating to access digital technologies
- Creating a creative environment for participating in online economic activities
- Creating new knowledge in a digital environment using digital technologies.

Within each section, different aspects are formed that are in direct connection with the topic and the defined abstract, and have the appropriate organization. So, the article is organized in the following sections and contains: Introduction, Materials and methods, results, discussion, and conclusion.

2. MATERIALS AND METHODS

In the research, we implemented a mixed method based on the placement of qualitative elements with quantitative ones. The quantitative analytical approach consisted of data taken from sources such as Eurostat, the World Economic Forum, the Digital Economy and Society Index (DESI. The information showed a comparative analytical overview of Serbia and the member states of the European Union regarding industrial competition and digital change processes. The qualitative approach in the research looked at strategic national documents (Regulatorna agencija za elektronske komunikacije i poštanske usluge-RATEL Palmotićeva 2, 2021) and relevant academic content in order to observe the convergence of Serbia's digital policies with EU standards and guidelines. By mixing qualitative observations with quantitative results, we observed the capacities of innovative technological applications of Serbia in relation to the European Union.

The results were measured through the prism of several quantitative and qualitative indicators. Quantitative indicators represent comparative indices (e.g., DESI value elements of Serbia and the EU average).

Then they showed the trends of digital changes in the previous 5 to 10 years. The indicators look at industrial values and competition in terms of productivity, investments in innovation, the share of the ICT sector in GDP, and the export of technology-intensive products.

In this research, the output results were measured through several quantitative and qualitative indicators:

1. Quantitative indicators

Comparative indices (e.g., DESI component values of Serbia and the EU average).

Changes over time - digital transformation trends in the past 5-10 years.

Indicators of industrial competitiveness: productivity, export of technology-intensive products, investment in innovation, share of ICT sector in GDP, composite evaluations in the form of calculation of normalized values and comparison of ranks.

2. Qualitative indicators related to the assessment of compliance with EU policies, the perception of barriers, composite evaluations - calculation of normalized values, and comparison of ranks, overview of policy implementation based on evaluation studies.

3. The comparative analysis referred to the comparison of Serbia with the EU average and selected member states, as well as the recognition of Serbia's lagging or progress in relation to the EU standard.

2.1. Selection Criteria

The initial basis for the selection of relevant literature was based on the actuality of the research topics. The selection process was carried out based on the use of segments of research works that are in line with sustainable housing trends.

Formulation of research questions

The use of digital technologies in the digital industry is a way of convergence with the European Union. Modern trends and innovations are standards that have been set at the global level and are

necessary for the future transformation of the Industrial Economy of Serbia and a better standard of the population.

Based on the defined strategies, the following research questions are proposed:

1) How should the National Strategy implement practical education of the population to acquire digital literacy that can be further used in the digital industry?

2) What are the challenges when integrating the digital processes of spreading fast internet?

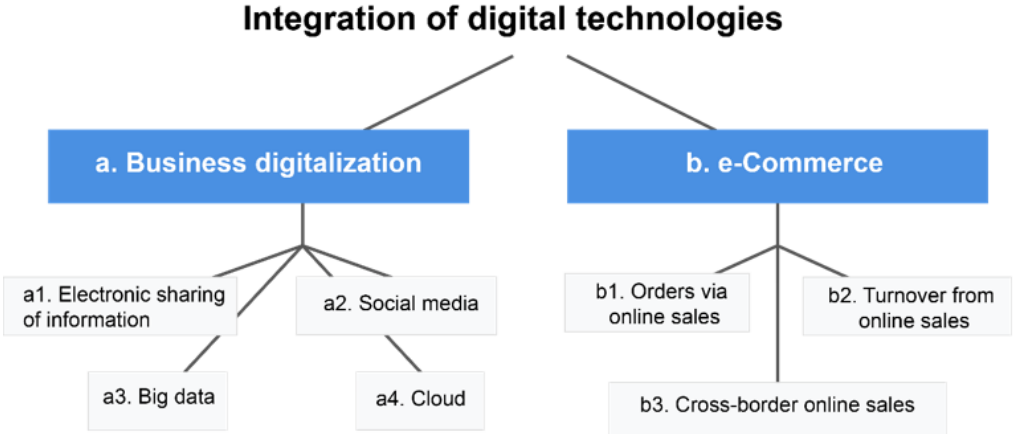
3. RESULTS

This chapter refers to the consideration of the key elements of the research in relation to the existing literature and theoretical frameworks. Discussion provides a link between the results of quantitative and qualitative analyses. The intention is to notice the differences between Serbia and the European Union in terms of digital transformation and industrial competitiveness (Dakić, Stupavský, & Todorović, 2024). A special focus is placed on explaining the observed trends, identifying factors that influence development, as well as on the implications these findings have for future policies and practices (Andrejević Panić, Milićević, Cvetanović, & Mulić, 2025).

New trends refer to the representation of various online contents (movies, music, video games, online social interaction, etc.), current forms of business communication (video calls), and electronic transactions (electronic banking and economic transactions of buying and selling via the Internet).

The subcategories included in the category use of internet services and their indicators are shown in Figure 1. The value of the category Use of internet services for Serbia in 2020 is slightly lower compared to the value of the previous year. A comparison with the countries of the European Union in this area is not possible, given that the category of using internet services is excluded from the DESI calculation methodology from 2021, according to which the values for the EU were calculated. The absence of this category is a consequence of the alignment of the Digital Economy and Society Index with the goals set by the European Commission in the field of digital transformation, which must be achieved by 2030. These goals are grouped into four basic areas: digital skills, digital infrastructure, digital transformation of companies, and digitalization of public services. Monitoring of the achievement of the set goals will be done through the Digital Economy and Society Index, which will accordingly be structured to monitor four areas of focus in digital transformation as shown on Figure 2. The values of individual indicators for Serbia in 2020 are listed below (Regulatorna agencija za elektronske komunikacije i poštanske usluge RATEL Palmotićeva 2, 2021).

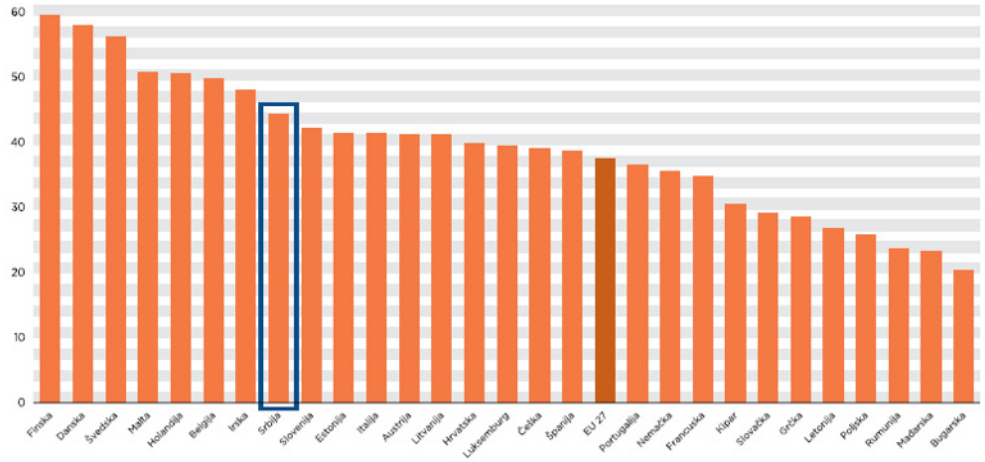
Figure 1. Integration of digital technologies: subcategories and their indicators.



Source: adapted from (Regulatorna agencija za elektronske komunikacije i poštanske usluge RATEL Palmotićeva 2, 2021) translated into the English language.

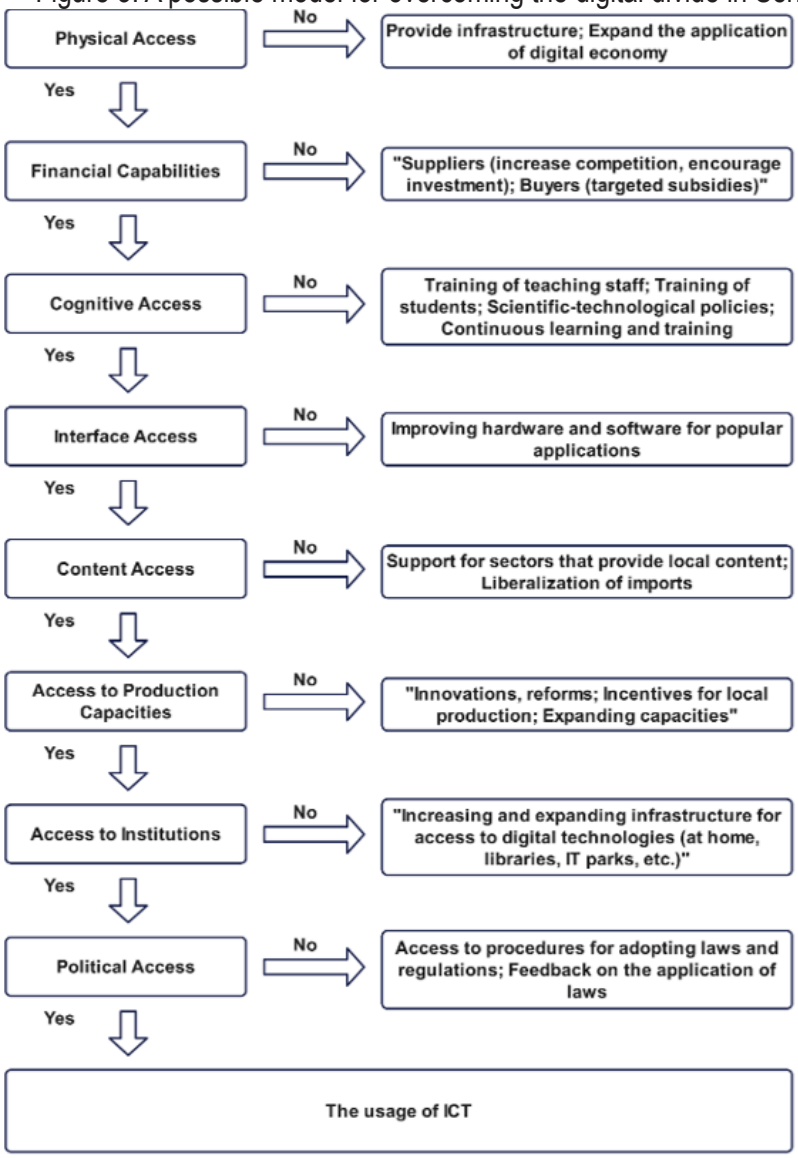
The most successful countries in this area are Finland, Denmark, and Sweden, while Bulgaria, Hungary, and Romania have the lowest values in the EU as shown on Figure 2. The values of the category Integration of digital technologies for EU countries and Serbia are presented in Figure 2, while the comparison of Serbia with a cluster of comparable countries and neighboring countries is shown in Figures 2 and 3. Although the values in this area are slightly lower than the previous year, Serbia, according to the indicators in the category Integration of digital technology.

Figure 2 Values of the category Integration of digital technologies for EU countries and Serbia for the year 2020



Source: (Regulatorna agencija za elektronske komunikacije i poštanske usluge RATEL Palmotićeva 2, 2021)

Figure 3. A possible model for overcoming the digital divide in Serbia.



Source: adapted from (Mitrović, 2022) translated into the English language.

By analyzing the current level of the digital divide in the countries of the EBRD and the European Union, to slow down the digital convergence between the countries of Serbia and the European Union is the National Education System in Serbia, which should recognize and encourage digital skills and competences so that a percentage of the population becomes digitally involved when conducting business correspondence, more efficient functioning of society (Mitrović et al., 2019). Some of the digital skills that residents should improve through the system of formal and informal education to reduce social and digital inequalities are:

- the ability to access, find, select, and interpret information and knowledge on the Internet;
- think critically;
- willingness to respond practically and intuitively to challenges and opportunities in ways that fully exploit the potential of the Internet;
- have a motive to access and use digital technologies;
- digital creativity that encourages individuals to actively participate in online activities;
- the ability to create an opinion in a digital environment, to create and accept new knowledge using digital technologies.

4. DISCUSSIONS

Applying the research opus, we noticed the possibilities of advancing the digital economy as a prospective potential of Serbia. We created the conditions for further research in this branch of the industrial economy as a prerequisite for future European and world trends that increasingly rely on innovations in AI and digital resources. The necessity of a national strategy to more efficiently and concretely enable the wider masses of the population in rural areas to use digital technologies, with the accompanying transformation of the educational system, which will be in line with the most developed countries of the European Union and the world, will contribute to comprehensive progress.

RQ1: The national strategic approach should enable a multi-layered and practical approach to the digital process by specifying operational steps through professional training at all levels of education and age of the population. This includes the implementation of digital classrooms at all school and college levels, the development of effective specialized programs that rely on Industry 4.0 technologies. The emphasis is on the involvement of the private sector in order to comply with the real needs of the industrial sector in terms of programming, data analysis, cybersecurity, and digital project management. It is necessary to engage rural areas through the implementation of local digital centers, public workshops, and online learning platforms. Activating practical knowledge, private-state partnership with formal education enables rapprochement with the EU.

RQ2: The application of faster Internet encounters barriers in the processes of digital changes. First of all, significant investments in the improvement of networks are necessary, especially in rural and remote areas.

Second, there are technical challenges such as inadequate equipment, lack of standardization, and complex applications of advanced technological solutions.

Third, existing network infrastructures are slower and more unstable, which creates inefficient operations in industrial branches, economic and economic flows.

Fourth, there are barriers related to regulatory and administrative requirements through slow procedures for obtaining permits, ineffective local and national bodies.

Greater synchronization of the state, private sector, and local communities is necessary. Society's needs include uneven access to the Internet, low digital awareness in certain communities, and the need to educate the population to make better use of innovative technologies in everyday life and the business world. An integrated strategy can enable widely available and fast internet connectivity that supports digital transformation and industrial competitiveness.

5. CONCLUSIONS

The implemented analytical framework confirms the necessity of a synchronized digital transformation of the industrial competitiveness of Serbia in a comparative perspective with the countries of the European Union. Regardless of the fact that some progress has been observed in the areas related to the improvement of digital skills, the application of digital infrastructure, and the growth of the ICT sector, there is a noticeable lag behind the EU average values. This is especially related to the degree of digitization of companies, the capacity of innovative resources, and the more efficient application

of innovative technological changes, which limits the full adherence to the standards of the European digital and industrial environment. The indicators show that only through continuous investments in digital infrastructure, stronger support for industrial modernization, and practices of harmonization with European digital policies can we take the next step.

Qualitative analysis identifies room for further advancement of regulatory frameworks, digitization of public administration, and improvement of human potential.

The conducted research shows that digital policy is a key driver of Serbia's industrial competitiveness in relation to the European Union. According to information from the Western Balkans DESI (Digital Economy and Society Index) from 2022, Serbia had a DESI score of 34.9 points on a scale from 0 to 100. The analysis showed that, although Serbia is making progress in the domain of digital infrastructure, skills development, and the growth of the ICT sector, it still lags behind in the digitization of companies and the implementation of the most current technological solutions. Compared to the EU's average DESI score of 52.3 points, digital backwardness can be seen.

The practice of future research should be the basis for influencing national competitiveness through contributions to the creation of policies that are based on greater investments in the application of artificial intelligence, automation of cloud technologies, and Industry 4.0.

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