UNVEILING ROMANIA'S DIGITAL TRANSFORMATION: IMPLICATIONS FOR THE LABOR MARKET LANDSCAPE

Prof. Mirela Cristea Ph. D
University of Craiova
Faculty of Economics and Business Administration
Craiova, Romania
Catrinel Delia Talaban Ph. D Student
University of Craiova
Doctoral School of Economics "Eugeniu Carada"
Craiova, Romania

Abstract: In the context of globalization, new information and communication technologies are regarded as crucial drivers of daily life and economic activity, playing a strategic role in global development and holding significant potential for enhancing organizational efficiency. This research is grounded in societal changes catalyzed by the evolving trend of digitalization, which is fundamentally transforming the labour market, economy, and social life. Taking this into account, the primary objective of this research is to provide an overview of the stage of digitalization in Romania and the implications this phenomenon has on the labour market, in the present era of globalization. The methodological approach involves conducting a literature review in this domain, utilizing the VOSviewer tool, and adopting a statistical perspective based on DESI reports. Through this investigation, we aim to identify the fundamental elements characterizing the labour market and digital transformation in Romania, drawing upon existing literature.

JEL classification: J24, O33, O52

Key words: digital transformation, labour market, digital skills, Digital Economy and Society Index, Romania, VOSviewer.

1. INTRODUCTION

The rapid development of technologies, innovations, and digital devices, and their almost immediate integration into society and the economy, highlight the urgent need to comprehend their impacts and effects. The digital revolution is not merely a theoretical concept; it is a tangible reality that intersects with our daily lives, influencing and involving us all.

In this context, the new information and communication technologies (ICT) are considered a significant engine of everyday life and economic activity, thus holding a strategic role in global development and the potential for increasing organizations' efficiency (Ohlin, 2019). ICT development has imposed a different work rhythm and reaction capacity on companies operating in Romania. Considering that the economy is based on knowledge, access to data and resources has become imperatively necessary, facilitating the formation of skills and abilities of the employed personnel. The key to

success lies in a manager's/leader's ability to establish intelligent organizations where the human factor plays a central role, with innovation being the basis of obtaining a competitive advantage.

The research objective of this paper is to provide an overview of the stage of digitalization in Romania and the implications this phenomenon has on the labour market, by conducting a literature review in this field, applying the VOSviewer tool, and adopting a statistical perspective based on DESI reports. Living in a society characterized by a rapid pace of development, where technologies, innovations, and digital devices are gaining increasing significance, necessitates the analysis and understanding of the implications of these phenomena on the labour market, human resources, and strategies within the economic and business environment.

The structure of the paper comprises two main parts. The first part provides a review of the specialized literature in the field, presenting findings about the digitalization process and its implications in the economic and social environment. The second part of the paper encompasses the methodology, results, and discussions on the bibliometric analysis regarding the literature review, as well as the stage of digitalization in Romania, utilizing DESI indicators. In conclusion, the research findings are presented.

2. LITERATURE REVIEW

The concept of digitalization can be defined from several perspectives. From the academic perspective, Brennen and Kriess (2014) see digitalization as digital communication and, at the same time, as the influence of digital mass media on contemporary social life.

As conceptual perspective, the modern one, ”digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business” (Gartner Glossary, 2024).

Digital technologies are rapidly transforming the entire society. Some skills and jobs have become morally outdated, facing the risk of disappearing, while new ones are encountered due to the ever-expanding technology (Cetindamar et al., 2021).

Digital technologies based on hardware, software, and computer networks are not a novelty, but compared to the third industrial revolution, in the context of the fourth industrial revolution, they become more complex and integrated and, as a result, contribute to the transformation of society and the global economy. According to the opinion of the founder and executive director of the World Economic Forum, Schwab (2016), this phenomenon - Industry 4.0 - blurs the boundaries between the physical, digital, and biological spheres, being characterized as a revolution of platforms, networks, digital technology, digitization and, last but not least, a revolution of people.

Furthermore, according to the opinion of Dong and McIntyre (2014), this period is the second age of machines, arguing that the effect of these digital technologies will be felt globally. In simpler terms, the Fourth Industrial Revolution refers to how technologies such as artificial intelligence, autonomous vehicles, and the Internet of Things (IoT) are closely intertwined with human physical life.

The fourth industrial revolution is based on the real-time availability of all relevant information regarding all production elements (Lee et al., 2018). Companies thus can adapt and optimize their processes according to different criteria, such as costs, availability, and resource consumption. Therefore, good levels of broadband connectivity are an essential

prerequisite to allow the real-time circulation of information and for companies to enjoy the benefits of this latest industrial revolution (Wollschlaeger et al., 2017).

Digitalization is the primary process that has implications in several areas of the fourth industrial revolution, such as facilitating how people access information through well-known devices such as mobile phones, tablets, laptops, and smartwatches (Braña, 2019).

The logistics sector is also impacted by digital transformations that have an upward trend nowadays, with Industry 4.0 aiming to develop intelligent and interoperable work environments. Industry 4.0, or the fourth industrial revolution, is essentially an ascending process with tumultuous development so that, at present, no enterprise can function without having developed or developing a digital strategy. The business environment must be prepared to face changes generated by a series of factors such as speed, volume, and also the unpredictability of production, new relationships between research institutes, new links between large and small enterprises, new ways of cooperation between all business levels, whether we talk about design, production, sales, logistics, maintenance, the need for updated and new skills, alongside new ways of working, as well as closer links between the business environment and the user, all these being categorized as challenges of digital transformation (Schlosser et al., 2023).

In the current context, one of the main problems and even a barrier in the transition to the digital economy is the need for more human resources to work under the new conditions. In this era of digitalization and automation, developing employees' skills and work aptitudes are mandatory requirements for successful activity (Schislyaeva, Saychenko, 2022). Although the educational process is becoming increasingly continuous and implemented by individuals throughout their lives, the starting point in forming qualified labour resources in Romania is the professional education received in educational units (Barna, Epure, 2020; Trif et al., 2022).

The European Union (EU) comes to the aid of state authorities in this field with the Digital Education Action Plan (DEAP) (2021-2017) (European Commission), which can be considered the basis for forming digital competencies by using digital technologies in the educational process, thus contributing to the development of digital skills that are imperative to ensure the transition to the digital economy.

The priority areas on which the program mentioned above is based and which ensure the improvement of the educational process are:

- the use of digital technologies in the teaching and learning process of students;
- improving the development of digital skills and aptitudes.

Digital transformation has significantly changed society and the economy, having an increasing influence on everyday life. The COVID-19 pandemic highlighted the need for much more developed digital skills in education and training and various challenges for education and training systems regarding digital capabilities and training capacities in this field for teaching staff.

According to studies conducted before the onset of the Covid-19 pandemic, statistics show the following:

- the Organization for Economic Cooperation and Development (OECD, 2019) published a study according to which less than 40% of teachers at the EU level are prepared to use digital technologies in the teaching process;
- the International Computer and Information Literacy Study (ICILS, 2018) shows that more than 30% of children aged 13-14 still need to possess the minimum digital skills.

Adapting people to the new requirements generated by digital transformation is essential for success, as Smit et al. (2020), a new job in the information and digital technology sector supports the creation of 2-4 jobs in the overall economy.

Researchers' results in digital transformation and digital skills necessary for a successful profession allow the approach of these skills of employees working in the digital economy from different perspectives.

In the first approach, the focus is placed on people's behavioral skills. The World Economic Forum (2023, p. 38), through the ”Future of Jobs Report” presents the top 10 most relevant skills in 2023: ”analytical thinking”, ”creative thinking”, ”resilience, flexibility and agility”, ”motivation and self-awareness”, ”curiosity and lifelong learning”, ”technological literacy”, ”dependability and attention to detail”, ”empathy and active listening”, ”leadership and social influence”, ”quality control”.

Another approach involves the emergence of the population's digital literacy concept, constantly developing skills to adapt to new technologies, which simultaneously requires assessing the level of digital skills. The development of digital literacy skills is of significant importance for ensuring the employment rate at the EU level, as it is expected that most jobs in the European community will require such skills (Bejaković, Mrnjavac, 2020; Ollerenshaw et al., 2021).

In the context of technological development and the phenomenon of globalization, the need to shape the European training profile is emphasized, which involves acquiring several eight key competencies having the same level of importance, according to the Framework of the 8 Key Competencies:

• ”communication in the mother tongue;
• communication in foreign languages;
• mathematical competence;
• essential competencies in science and technology;
• digital competence;
• learning to learn;
• sense of initiative and entrepreneurship;
• social and civic competencies, cultural awareness and expression” (European Commission, Recommendation 2006/962/EC).

As we can observe, digital competence is part of the list of 8 competencies that define the European training profile, and, according to the opinion of Pettersson (2018), digital competence involves the responsible use of media and means of communication in every field, starting from education, to the work process and even in leisure time, so that activities are carried out as efficiently as possible.

The labour market in Romania is undergoing significant transformation due to digitalization. With the rapid advancement of technology, including the proliferation of artificial intelligence, automation, and digital platforms, traditional job roles are evolving, creating both opportunities and challenges for workers. Digitalization is reshaping industries, leading to the creation of new jobs requiring digital skills while rendering some traditional roles obsolete.

In Romania, efforts are being made to adapt to this digital shift, with initiatives aimed at upskilling the workforce and fostering digital literacy. However, disparities in access to digital infrastructure and education remain, posing barriers to fully realizing the benefits of digitalization in the labour market (units (Barna, Epure, 2020; Cristea et al., 2022; Trif et al., 2022).

3. METHODOLOGY

The methodological research used in this study, consists of a review of the existing literature in this field, by applying the VOSviewer tool, but also by the statistical point of view, based on indicators from DESI reports.

The data used for the analysis of the indicators was collected from DESI reports for a period of 3 years, from 2021 to 2023 (European Commission, 2023). The indicators presented for the EU Member States cover four complex areas: human capital, connectivity, digital technology integration and digital public services.

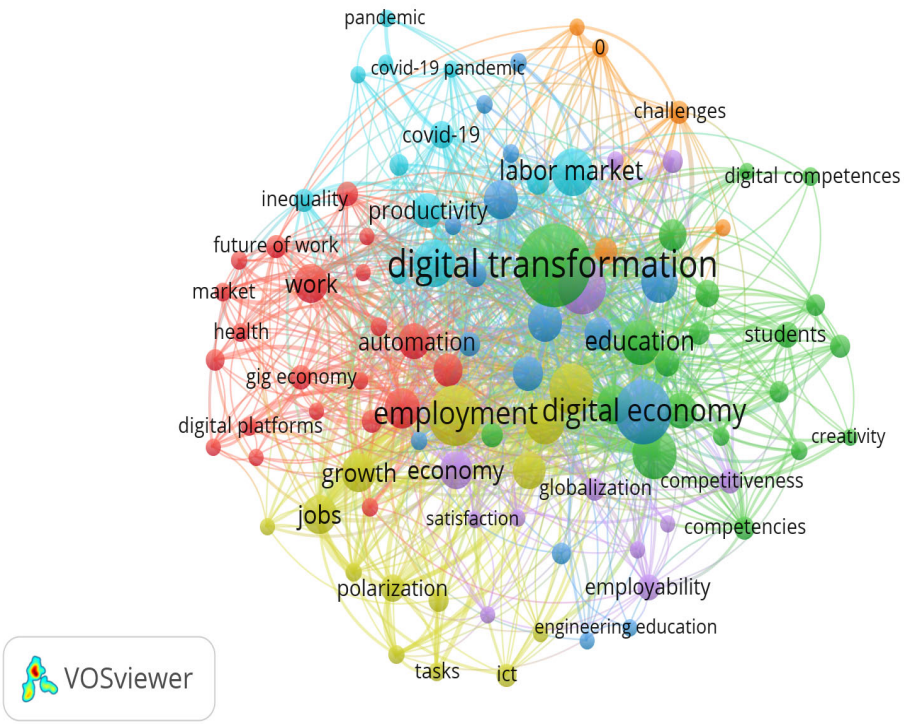
4. RESULTS AND DISCUSSIONS

4.1. Bibliometric analysis of the literature underpinnings

By applying the VOSviewer tool for the keywords digital transformation and labour market, used in articles published in the Web of Science Core Collection (Figure no. 1), 482 results were obtained.

The results were grouped in 7 cluster that were generated, as follows:

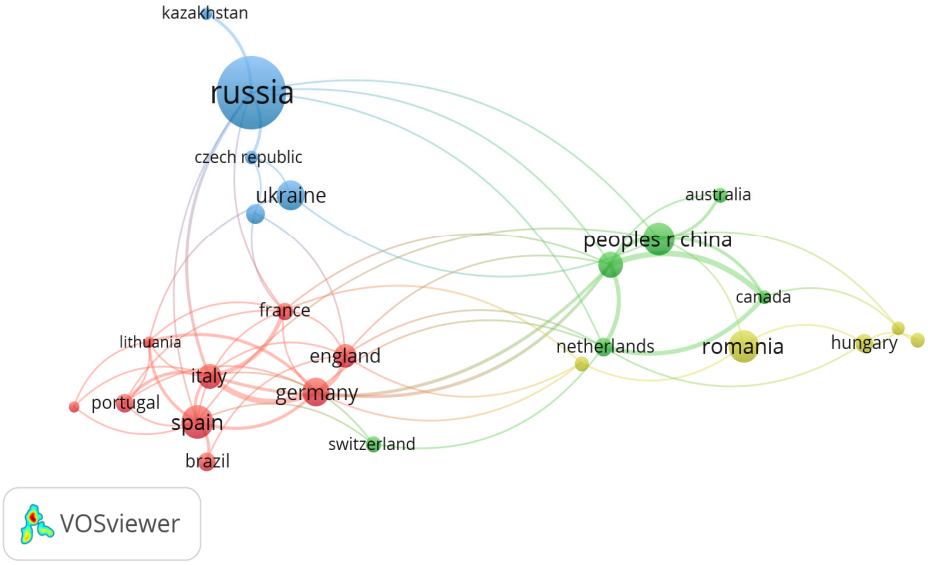
- cluster 1 (red cluster), with 21 items/keywords such as labour, work, automation, gig economy, digital platforms, future of work, digitization;
- cluster 2 (green cluster), comprising 20 items/keywords such as digital transformation, education, students, creativity, digital competencies, innovation, soft skills;
- cluster 3 (blue cluster), comprising 16 items/keywords such as digital economy, human capital, labour market, artificial intelligence, regional development, sustainable development;
- cluster 4 (yellow cluster), comprising 14 items/keywords such as employment, growth, jobs, tasks, ICT, polarization, technological change;
- cluster 5 (purple cluster), comprising 12 items/keywords such as competitiveness, globalization, employability, knowledge economy, labour productivity, unemployment;
- cluster 6 (blue light cluster), comprising 12 items/keywords such as labour market, covid-19 pandemic, productivity, technology, wages;
- cluster 7 (orange cluster), comprising 7 items/keywords, such as challenges, industry 4.0, performance.



Source: Authors' contribution in VOSviewer

Figure no. 1. VOSviewer results of the co-occurrence of all keywords used in articles published in the Web of Science Core Collection – search items digital transformation and labour market

As regards the results of the co-authorship used in articles published in the Web of Science Core Collection, searching the items digital transformation and labour market (Figure no. 2), the authors of the 482 published articles were grouped in 4 clusters, with the main countries in Russia, Spain, Italy, Germany, Portugal, Lithuania, China, but also Hungary and Romania.



Source: Authors' contribution in VOSviewer

Figure no. 2. VOSviewer results of the co-authorship used in articles published in the Web of Science Core Collection – search items digital transformation and labour market

4.2. Analysis of the level of digitalization in Romania

The Digital Economy and Society Index (DESI) represents a composite index created and published by the European Commission (2023), which synthesizes and presents indicators on the digital performance of EU member states and tracks annual progress at the European level.

Since 2014, the European Commission has been creating and publishing these reports, which are a tool for monitoring the state of digitalization in EU member states. DESI includes country profiles that help member states identify areas that need to be treated with higher priority and thematic chapters that provide a European-level analysis of essential digital areas to support policy decisions.

In 2021, the European Commission (2023) adjusted the DESI report, from the five major areas based on which the analyses of the state of digitalization at the European level were carried out - human capital, connectivity, integration of digital technology, use of the Internet, and digital public services – to the four main areas of the Digital Compass, namely: "human capital, connectivity, integration of digital technology, and digital public services". Therefore, starting from 2021, DESI includes the analysis of indicators structured around on the four pillars.

Digitalization is correlated with better company performance in terms of productivity, management practices, innovation, and job creation, which means that digitalization becomes essential for any company that wants to ensure a competitive advantage.

For Romania, digitalization still represents a challenge that is quite difficult to overcome. Whether we are talking about the low level of human resources trained in this

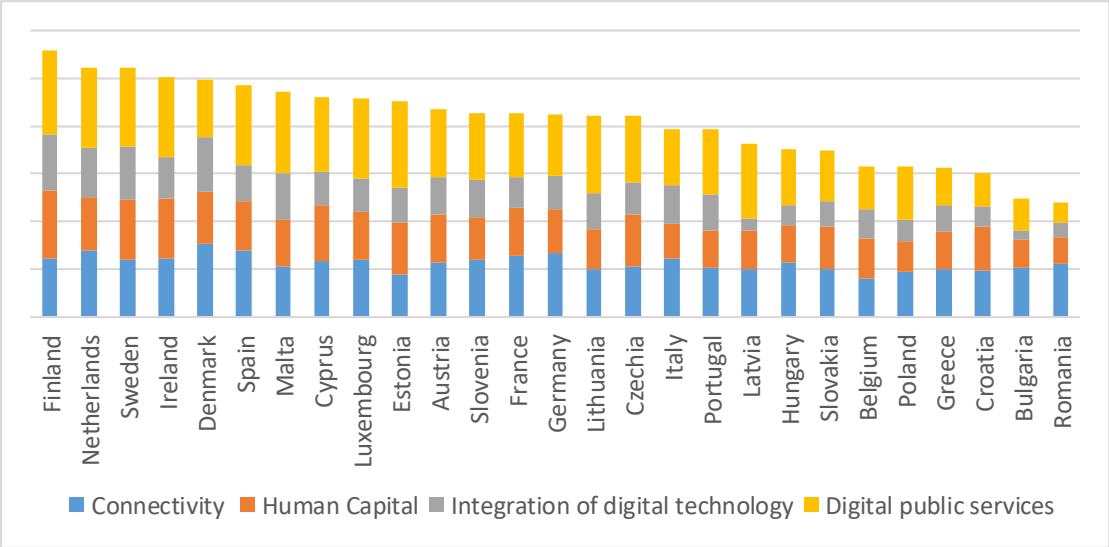
field or the lack of a national strategy for digital transformation, the state of digitalization in Romania is deficient, being in last place for a long time in the DESI reports, thus moving away from the EU member states.

The analysis period of the DESI indicators (European Commission, 2023) that will outline an overview of the state of digitalization in Romania is 2020-2022 with the help of the following DESI reports:

- DESI 2021 - data presented from 2020;
- DESI 2022 - data presented from 2021;
- DESI 2023 - data presented from 2022.

In 2020, according to the data presented by the European Commission in the DESI 2021 report, Romania is overall in the last place compared to EU member states (Figure no. 3). The low overall score is because the scores recorded in each domain are very low.

In human capital, Romania ranks 26th; in the integration of digital technologies, it ranks 25th; in digital public services, it ranks last; the only area where the score is higher is connectivity, where it ranks 10th, but it is not enough to consolidate its position in terms of digitalization compared to EU member states.

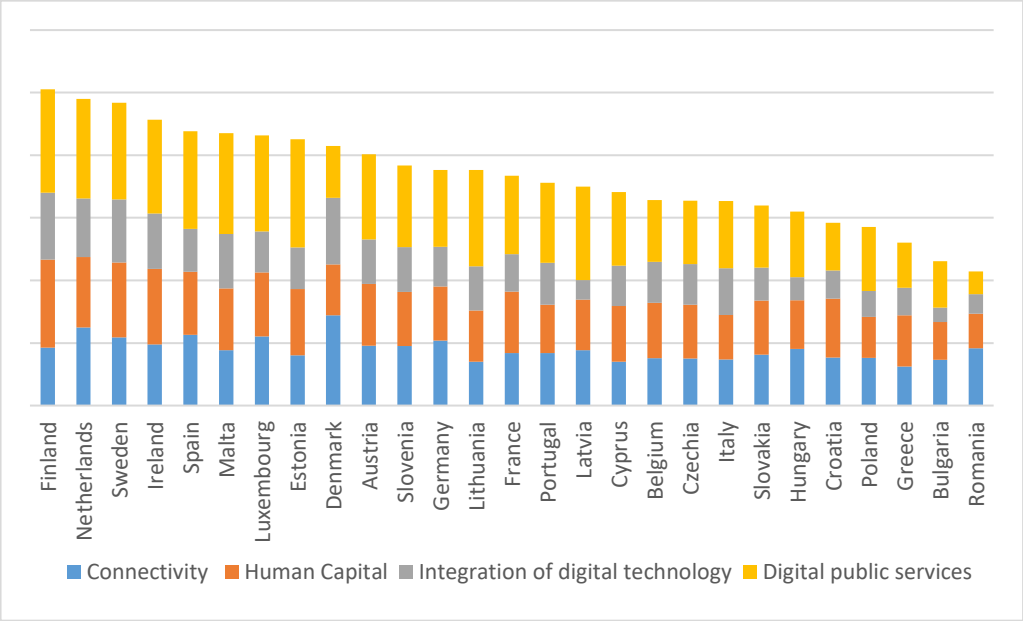


Source: European Commission, DESI Report 2021

Figure no. 3. Ranking of EU member states according to DESI 2020

Even in 2021, Romania's situation has remained the same, at the bottom of the DESI ranking, in 27th place, as the Figure no. 4 shows.

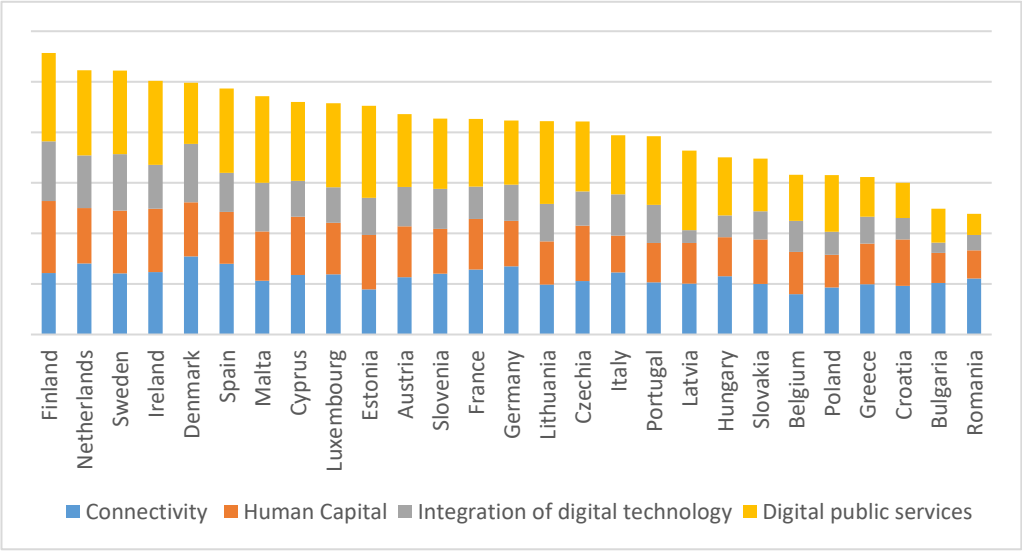
The year 2021 brings less good results in the field of connectivity, with Romania registering a lower score than in 2020 and dropping to 15th place from 10th. In the other domains, human capital, integration of digital technologies, and digital public services, it ranks last, in 27th place, registering the lowest score among EU member states.



Source: European Commission, DESI Report 2022

Figure no. 4. Ranking of EU member states according to DESI 2021

The most recent data published by the European Commission, those from 2022 which are presented in DESI Report 2023, also show a deficient score recorded by Romania.



Source: European Commission, DESI Report 2023

Figure no. 5. Ranking of EU member states according to DESI 2022

The unfavorable situation illustrated with the help of Figure no. 5 is caused by the slow progress generally recorded in digitalization and digital transformation.

Romania records good results in the connectivity domain, but more than this aspect is needed, given that the other domains, such as human capital and digital public services, record the lowest scores compared to other EU member states.

The results of analysis of the DESI indicators give us an unfavorable image of Romania compared to the EU Member States, because it ranks last, according to the latest DESI report.

Therefore, Romania has to invest and work in terms of digitalization and digital transformation, in order to be able to ensure its sustainable development and to gain competitive advantage.

5. CONCLUSIONS

The fact that we live in a society characterized by a very fast pace of development, in which technologies, innovations and digital devices are gaining more and more importance, requires analysis and knowledge of the implications of these phenomena on the labour market, human resources and strategies in the economic and business environment.

With the help of this research and the results obtained from the statistical analysis of indicators specific to digitalization, it was found that in Romania digitalization is only at an early stage, ranking towards the last places and even on the last place in terms of DESI indicators: human capital, connectivity, digital public services, and integration of digital technology. Therefore, we propose measures for each component of DESI to enhance digital connection with the labour market in Romania.

As regards *connectivity*, DESI evaluates the quality and accessibility of broadband networks in Romania. Improved connectivity allows businesses to adopt digital technologies more effectively, facilitates remote work arrangements, and enables individuals to access online job opportunities. A robust digital infrastructure contributes to a more dynamic and connected labour market by reducing geographical barriers to employment and increasing access to digital resources for job seekers.

Regarding *human capital*, DESI assesses the availability of digital skills training and education in Romania. A skilled workforce in digital technologies is crucial for businesses to innovate, compete globally, and adapt to digital transformation. Investing in digital skills development programs can enhance employability, enable career advancement, and address skill mismatches in the labour market (Noja et al., 2022). Moreover, according to Boucher (2020), when human resources lack a high level of digital skills and are not fully prepared to face the challenges posed by digital transformation, digitalization, and artificial intelligence, there will be a reluctance among companies to utilize digital services and make them available to people.

In terms of *integration of digital technology in businesses,* DESI evaluates the digitalization of businesses in Romania, including the adoption of digital tools, e-commerce platforms, and digital marketing strategies. Businesses that embrace digital technologies are better positioned to create new job opportunities, increase productivity, and respond to evolving market demands. Digitalization also drives demand for skilled workers in fields such as software development, data analysis, and digital marketing, shaping the composition of the labour market.

As regards *digital public services*, these play a role in supporting labour market policies and employment services in Romania. DESI assesses the availability and accessibility of digital public services, including online job portals, unemployment benefits

platforms, and skills training programs. Streamlining administrative procedures, improving access to information, and enhancing digital literacy can facilitate labour market participation, support job seekers, and promote workforce development.

In summary, DESI provides valuable insights into the digital dimensions that influence the labour market in Romania. By addressing challenges and leveraging opportunities identified in DESI, policymakers, businesses, and stakeholders can promote a more inclusive, dynamic, and resilient labour market that harnesses the benefits of digitalization for economic growth and societal development.

To effectively address both current challenges and those impending, a crucial step involves boosting investment in development and innovation while concurrently raising awareness and fostering the enhancement of staff digital skills to their utmost levels. Additionally, a significant consideration is the absence of internet coverage in certain areas of Romania. To expedite the transition to a digital society, these gaps must be swiftly eradicated.

Future research directions will bring to the fore the econometric modelling of the interplay of digital transformation and innovation credentials with the main sectors of the labour market both in Romania, and in the all EU Member States.

References

1. Barna, C., Epure, M — Analyzing Youth Unemployment and Digital Literacy Skills in Romania in the Context of the Current Digital Transformation. Review of Applied Socio-Economic Research, 20(2), 17-25, 2020. Available at Retrieved from https://www.reaser.eu/ojs/ojs-3.1.2-1/index.php/REASER/article/view/61
2. Bejaković, P., Mrnjavac, Ž. — The Importance of Digital Literacy on the Labour Market. Employee Relations: The International Journal, 42(4), 921-932, 2020. https://doi.org/10.1108/ER-07-2019-0274
3. Braña, F.J. — A Fourth Industrial Revolution? Digital Transformation, Labor and Work Organization: A View from Spain. Journal of Industrial and Business Economics, 46(3), 415-430, 2019. https://doi.org/10.1007/s40812-019-00122-0
4. Brennen S., Kriess D. — Digitalization and Digitization. International Encyclopedia of Communication Theory and Philosophy, 2014
5. Cetindamar, D., Abedin, B., Shirahada, K. — The Role of Employees in Digital Transformation: A Preliminary Study on How Employees' Digital Literacy Impacts Use of Digital Technologies. IEEE Transactions on Engineering Management, 2021. https://doi.org/10.1109/TEM.2021.3087724
6. Cristea, M., Noja, G.G., Găinaru, T.A. — Education and Labour Market Performance in Romania. An Empirical Analysis of the Urban-Rural Gap. Journal of Financial Studies, 12(7), 89-104, 2022.
7. Dong, X., McIntyre, S. — The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies. Quantitative Finance, 14(11), 1895-1896, 2014. DOI: 10.1080/14697688.2014.946440
8. European Commission — Digital Economy and Society Index (DESI). 2023. Available at https://digital-strategy.ec.europa.eu/en/policies/desi
9. European Commission — Digital Education Action Plan (2021-2017). Available at https://education.ec.europa.eu/focus-topics/digital-education/action-plan

10. European Commission — Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning. Available at http://data.europa.eu/eli/reco/2006/962/oj
11. Gartner Glossary — Information Technology Glossary. Available at https://www.gartner.com/en/information-technology/glossary/digitalization
12. International Association for the Evaluation of Educational Achievement — International Computer and Information Literacy Study 2018 (ICILS). 2018. Available at https://www.iea.nl/studies/iea/icils/2018
13. Lee, M., Yun, J.J., Pyka, A., Won, D., Kodama, F., Schiuma, G., Park, H., Jeon, J., Park, K., Jung, K., Yan, M.R. — How to Respond to the Fourth Industrial Revolution, or the Second Information Technology Revolution? Dynamic New Combinations Between Technology, Market, and Society Through Open Innovation. Journal of Open Innovation: Technology, Market, and Complexity, 4(3), 21, 2018. https://doi.org/10.3390/joitmc4030021
14. Noja, G.G., Cristea, M., Sîrghi, N., Vădăsan, I. — The Role of Digitalisation in Reducing Risks and Bridging Regional Economic Welfare Gaps within a Sustainable Development Framework: The Case of Romania. In Managing Risk and Decision Making in Times of Economic Distress, Part B (pp. 131-142). Emerald Publishing Limited, 2022.
15. OECD — TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners. TALIS, OECD Publishing, Paris, 2019. https://doi.org/10.1787/1d0bc92a-en
16. Ollerenshaw, A., Corbett, J., Thompson, H. — Increasing the Digital Literacy Skills of Regional SMEs through High-Speed Broadband Access. Small Enterprise Research, 28(2), 115-133, 2021. https://doi.org/10.1080/13215906.2021.1919913
17. Ohlin, C.L. — Information and Communication Technology in a Global World. Research in Social Sciences and Technology, 2019, 4(2), 41-57. https://doi.org/10.46303/ressat.04.02.4
18. Pettersson, F. — On the Issues of Digital Competence in Educational Contexts–A Review of Literature. Education and Information Technologies, 23(3), 1005-1021, 2018. https://doi.org/10.1007/s10639-017-9649-3
19. Schislyaeva, E.R., Saychenko, O.A. — Labor Market Soft Skills in the Context of Digitalization of the Economy. Social Sciences, 11(3), 91, 2022. https://doi.org/10.3390/socsci11030091
20. Schlosser, K.P., Volkova, T., Noja, G.G., Cristea, M., Maditinos, D. — Strategic Leadership Attributes for Adopting Digital Technology and Ensuring Organisational Resilience. In Digital Transformation, Strategic Resilience, Cyber Security and Risk Management (pp. 159-173). Emerald Publishing Limited, 2023
21. Schwab, K. — The Fourth Industrial Revolution: What It Means and How to Rrespond. World Economic Forum, 2016. Available at https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/
22. Smit, S., Tacke, T., Lund, S., — The Future of Work in Europe. Automation, Workforce Transitions, and the Shifting Geography of Employment. McKinsey Global

Manyika, J., Thiel, L.. Institute, 2020

23. Trif, S.M., Noja, G.G., Cristea, M., Enache, C., Didraga, O. Modelers of Students' Entrepreneurial Intention during the COVID-19 Pandemic and Post-Pandemic Times: The Role of Entrepreneurial University Environment. Frontiers in Psychology, 13, 976675, 2022. https://doi.org/10.3389/fpsyg.2022.976675
24. Wollschlaeger, M., Sauter, T., Jasperneite, J. The Future of Industrial Communication: Automation Networks in the Era of the Internet of Things and Industry 4.0. IEEE Industrial Electronics Magazine, 11(1), 17-27, 2017. https://doi.org/10.1109/MIE.2017.2649104
25. World Economic Forum Future of Jobs Report 2023. Available at https://www.weforum.org/reports/the-future-of-jobs-report-2023/