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Towards a Digital Europe: Cluster-Based Insights into Technology, Knowledge, and Readiness

Ion POPA[1], Ana Alexandra OLARIU[2], Ștefan Cătălin POPA[3], Corina-Elena MIRCIOIU[4]

[1] Bucharest University of Economic Studies, Bucharest, Romania; Corresponding member of the Academy of Romanian Scientists; https://orcid.org/0000-0003-0703-3828; ion.popa@man.ase.ro (corresponding author)

[2] Bucharest University of Economic Studies, Bucharest, Romania; https://orcid.org/0000-0002-1153-3502; anaalexandra.olariu@man.ase.ro

[3] Bucharest University of Economic Studies, Bucharest, Romania; https://orcid.org/0000-0001-9221-8936; catalin.popa@man.ase.ro

[4] Bucharest University of Economic Studies, Bucharest, Romania; https://orcid.org/0009-0004-2450-7903; corina.mircioiu@man.ase.ro

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Abstract:
Digital transformation is an essential process for contemporary economic and social development. This paper aims to explore the evolution and disparities of digital transformation across European Union (EU) member states by analyzing their digital profiles and classifying them into homogeneous groups based on their performance. Thus, the research draws on secondary quantitative data from the World Digital Competitiveness Rankings developed by International Institute for Management Development (IMD), focusing on three critical dimensions: knowledge, technology and futureproofing. These dimensions capture countries' educational and research capacity, digital infrastructure and societal adaptability to digital change. In this research, a cluster analysis was performed using SPSS Two-Step Clustering, supported by visual and statistical tools, to identify clustering patterns among 26 EU countries (excluding Malta due to missing data). The research design includes four steps: time trend analysis, geographical mapping, cluster identification, and testing the significance of inter-cluster differences using Mann-Whitney U-tests. The results show a clear bifurcation between digitally advanced countries (e.g., Denmark, Netherlands, Sweden) and those with lower performance (e.g., Romania, Bulgaria, Greece). Significant statistical differences exist across all three analyzed dimensions. These findings offer valuable insights for policymakers seeking to reduce the digital divide and improve regional competitiveness through targeted strategies.

Keywords: digital transformation, European Union, cluster analysis, technology, digital performance.

Introduction

Over time, digitalization has influenced internal and external perspectives on strategic direction, business models, competitiveness, decision-making, entrepreneurship, innovation, and business performance, as well as customer relationships (Ulrich-Diener, Dvouletý & Špaček, 2025). The improvement of societal well-being has recently become closely associated with significant changes in the global economic environment and the reorganization of economic interactions, spurred by the unparalleled speed of scientific and technological development, with a particular focus on digital technologies (Shostak et al., 2023). In the context of these transformative dynamics, the international community has given digital technologies a crucial role (Shostak et al., 2023).

Following the analysis of the literature, Morze and Strutynska (2021) state that digitalization should be understood as a process of transforming and/or improving the activities of an enterprise, a business model, communication, the use of online platforms,

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training and retraining of personnel to work in new conditions, etc., which is based on the widespread use of digital technologies and digitized data. Chen, Zhang, Cai and Chen (2024) consider that digitalization is more than just computerizing traditional business processes; it involves using state-of-the-art information technology to completely upgrade and transform every facet of product design, production, and marketing. Digital transformation is characterized as the integration of digital technologies into all key aspects of a business, being a crucial factor of organizational success (Adama & Okeke, 2024; Qadri et al., 2024; Vărzaru et al., 2023). According to Aleshkovski, Bondarenko and Ilyin (2020) findings, digital technologies are having a significant impact on how consumers and producers interact, how employees and employers interact, how governments and society function, and how people live, learn, work, unwind, think and make decisions. Furthermore, the use of digital technologies is transforming business models, resulting in new services, new products, new formats of work (online platforms, outsourcing, etc.) (Morze & Strutynska, 2021; Qadri et al., 2024; Wang et al., 2023; Zhao, Liu & Dai, 2021).

As Aleshkovski, Bondarenko and Ilyin (2020) state, nowadays most countries are developing digital economies, economic digitalization being broadly understood as a social transformation driven by the widespread adoption of digital technologies, that is, modern technology to generate, process, share or transact information. The degree of digitalization has become significant in today's society, where ongoing resource utilization difficulties are changing many of the characteristics used to optimize resource allocation (Constantin et al., 2023). Zhao, Liu and Dai (2021) found that the level of digitalization is linked to economic development, which means that in countries with a high degree of digitalization, their economic development and sustainable social development are better. Moreover, digitalization is at the heart of societal transformation through its presence in all areas of daily life, such as communication, media, and workplaces (Constantin et al., 2023). Today's world leaders in the digital economy are those countries that make significant and prudent investments in digital assets and leverage digital technology to capitalize on the increasingly multiplying impact of digitalization (Nosova et al., 2021). The growth and effectiveness of regional socio-economic systems is significantly shaped by innovations and digital transformation (Voronenko et al., 2024). Thus, at the level of a country, delivering better public services, boosting productivity and efficiency, and providing the same solutions as previously at a significantly lower cost and in a shorter amount of time are all made possible by digital transformation (Popescu, 2023). Furthermore, by taking advantage of multiple digital tools, digital transformation also enables the delivery of services that were previously unavailable and could only be imagined or not, and the governments can improve the general quality of life for citizens by using new digital technologies to automate repetitive tasks, streamline procedures, increase the responsiveness and accessibility of public services, lower bureaucratic costs, and provide real-time information and feedback (Popescu, 2023).

Although more and more studies have highlighted the importance of digitalization and digital transformation, there are still disparities in this regard at the level of European countries, and the digital divide is still a major problem, both within and between nations; while some nations are lagging behind, richer economies or those with superior infrastructure can maintain high levels of digital competitiveness (IMD, 2024). Given these gaps, it would be useful to identify the degree to which EU member states have implemented digital transformation in order to highlight both positive aspects and possible lagging behind. Such information could be useful for decision-makers at the EU level, but also at the national level in designing possible corrective measures.

Given this backdrop, this paper aims to provide answers to the following research questions:

RQ1. What is the evolution of the digital profile of the European Union member states?

RQ2. Which European Union member states have homogeneous profiles according to their digital performance?

Therefore, to address the issues outlined above, the purpose of this research is to examine the digital profile of EU member countries. This study is based on secondary data collected from 2020-2024, focusing on the Global Digital Competitiveness Ranking index, developed by International Institute for Management Development (IMD) (IMD, 2024), which is based on three key factors, namely knowledge, technology and future readiness. With the help of this data, the digital profiles of EU countries were analyzed, and it was identified how EU countries are grouped according to the homogeneity of their digital profile and what are the differences between these countries with regard to the three factors of digital performance.

In the following sections, this paper provides a review of the literature on digitalization, providing a concise examination of this concept at the country level in general, and at the EU level in particular. In addition, the paper presents the research methodology used in this study and highlights the research results together with the related discussions. The paper concludes with a series of conclusions and presents the theoretical and practical implications of the results obtained.

Literature review

Digitalization and its particularities

Nowadays, digitalization is seen as a key tool for ensuring progress and is becoming increasingly necessary for survival in more and more fields of activity (Hurduzeu et al., 2022). Tilibaşa et al., (2023) discover that when society chose to go down the route of digitalization, it started an irreversible process that is expanding at an alarmingly rapid pace without establishing ground rules intended to guarantee the stability and smooth operation of a completely new kind of society. Thus, digitalization is permanently transforming our society as economies globally are going through a revolutionary process that necessitates digital technology integration into everyday life (Crisan et al., 2023; Hadad & Bratianu, 2019). All facets of global activity have changed because of digitalization and digital transformation. Every nation must be innovative in the digital era for its economy, businesses, and citizens to adapt to the growing volume of data, information and digital innovations (Popa, Breazu & Popa, 2024b). The COVID-19 pandemic's impacts have expedited the upward trajectory of the digital transformation, which has already become a reality in the social and economic environment (Popa, Banciu & Ştefan, 2024a). Moreover, the pandemic also had a significant impact on the management system of public institutions, which required a digital transformation of all processes (Popa et al., 2024c). In this context, the management of organizations, whether public or private, must come up with the best ways to both address these challenges and seize the benefits presented by this new digital paradigm (Popa, Banciu & Ştefan, 2024a).

Numerous studies have proven that digital development positively affects economic growth (Török, 2024; Voronenko et al., 2024; Zhao, Liu & Dai, 2021). In the digital transformation, every macroeconomic actor has distinct duties, responsibilities, and interests. Because the state must create programs that encourage digitalization in all facets of society's digital evolution and provide funding for their implementation, its role in the transformation is greatly increased (Török, 2024). In the case of the digital transition, however, state (and supra-state bodies like the EU) obligation starts earlier, even while national and EU legislation establishes the principle and function of digitization and defines support for the digital transition as an essential goal (Török, 2024).

A key factor in Europe's quick development and its acquisition of a distinct position in the social and economic structure has been digitalization; the fact that societies are growing more digital has an impact on everyday activities as well as how people work, communicate, and learn (Hurduzeu et al., 2022). Over time, researchers have studied the phenomenon of digitalization at the level of a country in general, and at the level of EU

countries in particular. Thus, Kolupaieva and Tiesheva (2023) claim that digitalization raises a country's level of competitiveness, guarantees economic growth and environmental protection, enhances people's lives, and improves education, and compared to nations with entry-level economies in the region, many EU countries have been able to attain a high degree of digitalization and enjoy 20% more economic and social benefits.

Digitalization in European Union member countries

Although the digital divide—the widening difference between those who have and do not have access to the internet and beyond—is not new, it is getting more complicated considering constant geopolitical conflicts and ever-increasing technological breakthroughs (IMD, 2024). As a result, digital competitiveness faces more and more difficulties. Digital competitiveness has become essential for economic growth as the twenty-first century has gone on, and the rapid adoption of digital technologies by businesses, governments, and industries highlights the necessity of a dependable digital infrastructure to support a successful digital transformation (IMD, 2024). Furthermore, important developments like automation, the emergence of data-driven economies, and the way technology is influencing sectors like manufacturing and healthcare underscore the necessity of maintaining long-term digital competitiveness (IMD, 2024).

At EU level, a digital gap has been identified between member countries, reflected by the Digital Economy and Society Index (DESI), which summarizes indicators on Europe's digital performance and tracks the progress of EU countries; thus, in 2022 Finland, Netherlands and Ireland were digital leaders, while Romania, Bulgaria and Greece were in the last positions (European Commission, 2025). Similarly, Török (2024) analyzes the International Digital Economy and Society Index (I-DESI) indicator with which the European Commission tracks the digital development of EU member states and compares it with the results of the rest of the world, and based on the average I-DESI values for the period 2015-2020, it highlights that Finland, Denmark, the Netherlands, Sweden, Luxembourg, Estonia and Ireland are at the top of the EU ranking, while at the bottom of the ranking are Lithuania, Slovenia, Slovakia, Poland, Hungary, Romania and Bulgaria. Furthermore, the value of I-DESI index shows a positive relationship with the GDP per capita, which highlights that more digital developed member countries have a higher GDP per capita (Török, 2024).

Moreover, to determine the priority directions of the digitalization strategy of EU countries, Kolupaieva and Tiesheva (2023) group EU countries according to the correlation indicators between digitalization indicators, digital divide and competitiveness into three clusters as follows: (1) North Macedonia, Serbia, Bosnia and Herzegovina, Croatia, Poland, Slovakia, Latvia, Italy, Lithuania, Portugal, Cyprus, Czechia, Slovenia, Bulgaria, Greece, Hungary, Romania, and Montenegro comprised Cluster 1. The lowest rates of digitalization are found in these nations, and the growth of transactional digital technology is the top digitalization strategy for these nations; (2) Germany, Iceland, the UK, Estonia, Spain, France, Luxembourg, Austria, Ireland, Malta, Finland, and Belgium made up Cluster 2. When developing a digitalization strategy, these nations prioritize the advancement of information technologies; (3) Cluster 3 was made up of Denmark, the Netherlands, Sweden, and Norway, which had the highest digitalization metrics. The strategy for creating functional digital technologies is a top concern for these nations.

The digital divide is still a major problem, both inside and between nations; while some nations lag, wealthier economies or those with superior infrastructure can maintain high levels of digital competitiveness (IMD, 2024). Additionally, in many countries, rural residents lack access to high-speed internet, for instance, but their urban counterparts do, which exacerbates discrepancies in how they participate in the digital economy (IMD, 2024).

Research Methodology

The purpose of this research is to analyze the evolution of the digital profile of the European Union member states and to determine the groups in which they fall based on it. The index underlying the analysis is the World Digital Competitiveness Ranking developed by International Institute for Management Development (IMD, 2024), which is based on three key factors, namely knowledge, technology and future readiness. These factors are briefly presented below (IMD, 2024):
- *Knowledge factor* focuses on capturing the development and quality of human capital, education and research output by measuring indicators in areas such as talent, workforce training and scientific research.
- *Technology factor* aims to assess whether a country's regulatory environment, financial investment framework and physical technological infrastructure support improved digital progress.
- *Future readiness factor* assesses how ready an economy is to embrace digital change, focusing on societal adaptability, business agility in adopting new technologies and the integration of IT across all sectors.

The data used in the analysis process come from the report prepared by the International Institute for Management Development for the year 2024 (IMD, 2024), which includes information on 67 economies of the EU. Of these, 26 countries were considered in our study, almost all EU members, except for Malta, as the report does not present data on its situation.

The research included four stages: (1) presenting the temporal evolution of the digital portraits of the 26 EU member states associated with the period 2020 - 2024, which helped to identify trends of change in the European technological landscape; (2) the geographical representation of the European continent through the index, consisting of the three key factors mentioned above; (3) cluster analysis of the countries participating in the study to identify the manner in which they associate themselves with a group and (4) testing the differences between the two clusters. The IT support used to complete the analysis stage consisted of the Datawrapper online application (2025) and the IBM SPSS Statistics software program (2019).

Results and Discussions

EU Countries' Digital Performance

The following Figure 1 maps the ranking of the digital profiles of the European Union countries for the last full year of analysis, namely 2024. Countries that occupy higher positions in the top are highlighted with lighter shades, and as the shades become more pronounced, the place in the ranking also decreases.

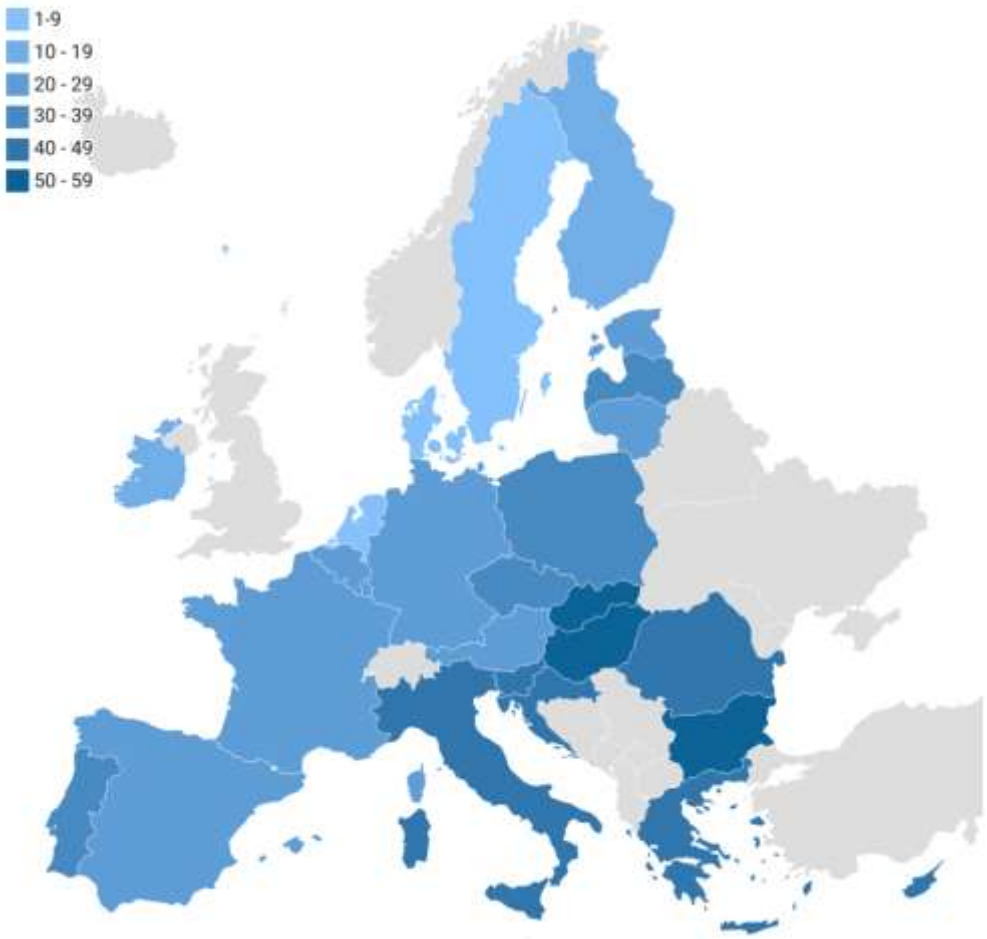

Figure 1. 2024 Mapping European Union Countries in the IMD World Digital Competitiveness Ranking
Source: Authors's research using Datawrapper (2025)

The best-positioned digital countries are Denmark, Sweden and the Netherlands, occupying positions between 1 and 9 in the 2024 ranking, followed by Finland and Ireland, between 10 and 19. Places 20 - 29 are occupied by France, Belgium, Lithuania, Germany, Estonia, Austria, Spain and Luxembourg. From 30 to 39 are the Czech Republic, Portugal, Latvia and Poland, and towards the 40 - 49th positions of the ranking we find Italy, Slovenia, Croatia, Romania, Cyprus and Greece, while on the last positions are Slovenia, Hungary and Bulgaria. In addition, Table 1 shows the general evolution of the digital performance of the European Union countries for the period 2020-2024, based on the three factors underlying the World Digital Competitiveness Ranking (IMD, 2024), namely knowledge, technology and future readiness. These support the analysis of how the world's economies have progressed digitally in a comparative manner.

Table 1. Overall Digital Competitiveness Factors Evolution in the period 2020-2024

	2020	2021	2022	2023	2024
Austria	17	16	18	22	25
Belgium	25	26	23	15	21
Bulgaria	45	52	48	55	56
Czech Republic	35	33	33	24	32
Cyprus	40	43	45	51	48
Croatia	52	55	43	44	46
Denmark	3	4	1	4	3
Estonia	21	25	20	18	24

Finland	10	11	7	8	12
France	24	24	22	27	20
Germany	18	18	19	23	23
Greece	46	44	50	52	49
Hungary	47	45	42	47	53
Ireland	20	19	24	21	17
Italy	42	40	39	43	40
Latvia	38	37	34	40	38
Lithuania	29	30	25	28	22
Luxembourg	28	22	30	26	29
Netherlands	7	7	6	2	8
Poland	32	41	46	39	39
Portugal	37	34	38	36	35
Romania	49	50	49	48	47
Slovakia	50	47	47	46	52
Slovenia	31	35	37	37	41
Spain	33	31	28	31	28
Sweden	4	3	3	7	5

Source: Authors' research processing after IMD (2024)

The countries under analysis are ranked between positions 1 and 56. Considerable differences are observed in the EU countries from year to year in terms of the variation of the index, while some general trends of stability are observed for each. Thus, their situation does not change significantly over time. Among the countries that have performed the best in terms of their digital profile over time are Denmark, Sweden, the Netherlands, Finland and Austria, while at the opposite pole, of the countries that have not ranked higher in the digitalization top, are Bulgaria, Greece, Hungary, Romania, Slovakia and Croatia.

Digital clusters of EU countries

Table 2 presents the specific framework of the Cluster Analysis carried out. This involves two steps, namely: (1) preclustering, which helps to reduce the size of the matrix within which the distances between all possible pairs of cases are found and (2) hierarchically grouping the preclusters, generating a series of solutions that are subsequently reduced to the optimal number of clusters (Tkaczynski, 2017).

Table 2. Cluster Analysis Framework Coordinates

Two-Steps Algorithm		
Inputs		3
Clusters		2
Cluster quality (Average silhouette)		0.6
Size of smallest cluster		10 (38.50%)
Size of largest cluster		16 (61.50%)
Ratio of sizes		1.60
Predictor importance	Technology	1.00
	Knowledge	0.98
	Future readiness	0.82

Source: Authors's research using IBM SPSS Statistics (2019)

The three factors representative of digital evolution scores, namely knowledge, technology and future readiness (IMD, 2024) were included in the analysis to serve as predictors of the grouping of countries. Thus, they represented the three inputs and participated in the creation of two clusters, the solution being characterized by a good quality represented by an average silhouette of 0.6, an aspect supported by Shahapure and Nicholas (2020), who claim that a silhouette score close to the threshold of 1 shows the correctness of the data point placement in the cluster. The two resulting clusters have

approximately equivalent sizes, one including 10 states and representing 38.50% of the total, and the other containing 16 states and meaning 61.50%. The ratio between the sizes of these two clusters is 1.60.

Regarding the three predictors with the help of which the two groups of countries were outlined, technology has a value of 1.00, which reflects its maximum importance for the grouping process, followed by knowledge with an associated importance of 0.98 and then future readiness, with 0.82. Table 3 presents the two groups of countries from the EU resulting from the cluster analysis.

Table 3. EU Countries Clusters

Cluster 1	Cluster 2
Bulgaria, Cyprus, Croatia, Greece, Hungary, Italy, Latvia, Romania, Slovakia, Slovenia	Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Spain, Sweden

Source: Authors's research using IBM SPSS Statistics (2019)

Cluster 1 consists of Bulgaria, Cyprus, Croatia, Greece, Hungary, Italy, Latvia, Romania, Slovakia and Slovenia, these being countries that do not excel much in the ranking of digital economies, while Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Spain and Sweden participate in the formation of the cluster 2, these states being middle and superior in terms of the evolution of the digital profile worldwide in 2024. In this sense, the differences between the two clusters of European countries were further tested with the help of Mann-Whitney U test (Table 4).

Table 4. Differences between clusters

Variables	Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Asymptotic
Knowledge (KC)	Cluster 1	10	5.80	58.00	3.000	-4.058	0.000
	Cluster 2	16	18.31	293.00			
Technology (TC)	Cluster 1	10	5.50	55.00	0.000	-4.216	0.000
	Cluster 2	16	18.50	296.00			
Future readiness (FRC)	Cluster 1	10	6.10	61.00	6.000	-3.901	0.000
	Cluster 2	16	18.13	290.00			

N - states number

Source: Authors's research using IBM SPSS Statistics (2019)

The differences between the two groups prove to be significant and easily noticeable in all three aspects associated with digital evaluation, respectively knowledge ($U = 3.00;, Z = -4.058;\ p < 0.001$), technology ($U = 0.00;, Z = -4.216;\ p < 0.001$) and future readiness ($U = 6.00;, Z = -3.901;\ p < 0.001$). Therefore, the cluster 2 countries, namely Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Spain and Sweden, register significantly higher mean ranks for knowledge ($MR_{KC2} = 18.31$), technology ($MR_{TC2} = 18.50$) and future readiness ($MR_{FRC2} = 18.13$) compared to the countries that composing cluster 1 ($MR_{KC1} = 5.80;\ MR_{TC1} = 5.50;\ MR_{FRC1} = 6.10$), respectively Bulgaria, Cyprus, Croatia, Greece, Hungary, Italy, Latvia, Romania, Slovakia and Slovenia.

These results are in line with other studies that have analyzed digitalization advance in EU countries. Thus, the results of another study (Török, 2024) show that countries in Cluster 1, such as Slovenia, Slovakia, Hungary, Romania and Bulgaria occupy the last positions in terms of digital development, while countries in Cluster 2, such as Finland, Denmark, the Netherlands, Sweden, Luxembourg, Estonia and Ireland are at the top of the EU ranking. Similarly, Kolupaieva and Tiesheva (2023) find that Denmark, Netherlands,

Sweden, and Norway have the highest digitalization metrics, while countries such as Croatia, Slovakia, Latvia, Italy, Cyprus, Slovenia, Bulgaria, Greece, Hungary, Romania present the lowest rates of digitalization. Furthermore, these results are also in line with the results of the DESI index measuring the digital performance of EU countries, which indicated that in 2022 Finland, Netherlands and Ireland were digital leaders, while Romania, Bulgaria and Greece were in the last positions (European Commission, 2025). Crisan et al. (2023) also find that countries like the Netherlands and Finland stand out as leaders in the EU in shaping their digital transformation process, while countries like Romania, Bulgaria and Greece register the lowest degree of digitalization.

Conclusions

The aim of this paper was, on the one hand, to analyze the evolution of the digital profile of the member states of the European Union, and on the other hand, to identify which European Union member states have homogeneous profiles according to their digital performance. These analyses were carried out based on the World Digital Competitiveness Ranking (IMD, 2024), focused on three key factors: knowledge, technology and future readiness. Furthermore, the analysis was carried out at the level of 26 European Union member states of, except for Malta, which is not included in this ranking,

Thus, to answer the first research question, RQ1, first, the main results presented the general evolution of the digital performances of the EU member states for the period 2020-2024 based on the three factors analyzed. Thus, these results illustrated the fact that Denmark, Sweden, Netherlands, Finland and Austria are among the countries that have recorded the best performances from the perspective of the digital profile, while Bulgaria, Greece, Hungary, Romania, Slovakia and Croatia are at the opposite pole of the ranking. Strictly related to the year 2024, the results indicated that Denmark, Sweden and Netherlands are at the top of the digital profile ranking, while Romania is towards the 40-49th steps of the ranking, alongside Italy, Slovenia, Croatia and Greece, the last positions being occupied by Slovenia, Hungary and Bulgaria.

Secondly, the aim was to answer the second research question, RQ2, namely, to highlight how EU member states are grouped as homogeneous according to their digital performance. In this regard, the research results indicated that depending on the three factors representative of digital evolution scores, namely, knowledge, technology and future readiness, EU member states can be grouped into two clusters, one including 10 states, and the other the other 16 states included in the analysis. Cluster 1 consists of Bulgaria, Cyprus, Croatia, Greece, Hungary, Italy, Latvia, Romania, Slovakia and Slovenia, which are countries that do not excel much in the ranking of digital economies, while Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Ireland, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Spain and Sweden participate in the formation of Cluster 2, these states being average and superior in terms of the evolution of the digital profile at a global level in 2024. In addition, the research also analyzed whether there are differences between the two clusters of European countries, and the findings highlighted the fact that there are statistically significant differences between the two groups regarding all three aspects associated with the representative factors of a state's digital evolution. Specifically, countries included in Cluster 2 recorded significantly higher digital performances for knowledge, technology and future readiness compared to countries comprising Cluster 1.

Implications of the study

The practical implications of this study stem from its potential to inform policymakers, government officials and other stakeholders about the digital profile of 26 European Union member states. By using the World Digital Competitiveness Ranking index and its three fundamental factors - knowledge, technology and future readiness - this research provides a nuanced understanding of each country's strengths and weaknesses in terms

of their level of digitalization. Moreover, these results can be useful to decision-makers at the country level in that, by grouping them into the two clusters and testing the differences between them in terms of the determinants of a country's digital profile (knowledge, technology and future readiness), they show them where a country stands compared to other European Union member states, contribute to understanding regional differences and provide strategic directions for improving digital performance.. At the same time, the results of this research can serve as a guide for strategic decision-making, resource allocation and policy formulation at both national and European Union levels, by highlighting the particularities of the digital profile of EU countries.

The theoretical implications of this study emerge from its contributions to expanding the literature by improving the academic understanding of digitalization at the national level, especially in the unique context of the European Union member states. A notable aspect that contributes to the theoretical discourse is the temporal focus of the study on the period 2020-2024. This temporal specificity reveals the dynamic nature of digitalization, providing valuable insights into the ongoing evolution of the digital profile of EU member states.

Limitations and future directions

The study's limitations are caused by the fact that it only uses one digital profile analysis index, the World Digital Competitiveness Ranking. A better grasp of the notion could be achieved by investigating several specific markers for gauging a nation's level of digitalization, as suggested by the recognition of this constraint. A more focused analysis of a particular country's digitalization, taking into consideration a wide range of impacting factors, may also be a viable avenue for future research.

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