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Bridging the Digital Divide: Pathways to a Competitive and Resilient European Union

Digitalisation is a key driver of economic transformation, influencing productivity, competitiveness and social inclusion across the European Union (EU). This study examines the macroeconomic impact of digitalisation, focusing on digital skills, digital business integration, digital infrastructures and the digitalisation of public services. The research explores the correlation between digitalisation and economic growth indicators such as labour productivity, gross value added (GVA) and exports, offering a comprehensive analysis of the EU's digital transition. Previous studies highlight the role of digitalisation in fostering innovation and improving efficiency, particularly through the integration of advanced technologies and digital infrastructures. However, digital disparities among EU Member States remain a challenge, necessitating coordinated policies to bridge the digital divide and ensure equitable access to digital benefits. This study contributes to the existing literature by analysing these disparities and assessing how digital transformation can support economic convergence and sustainability goals in the EU. Using a systematic review of academic literature and macroeconomic data, the study identifies key factors that drive digital competitiveness. Findings indicate that digital skills development, business digitalisation and strategic investments in digital infrastructure significantly enhance economic performance. Furthermore, digital public services play a crucial role in social inclusion, particularly in addressing youth unemployment and ensuring equitable access to opportunities. The results underscore the need for targeted policies that promote digital adoption across all EU regions, ensuring that the benefits of digitalisation extend beyond leading economies. By aligning digital strategies with broader economic and sustainability objectives, the EU can enhance its global competitiveness while fostering inclusive and resilient growth.

Keywords: digitalisation, European Union, economic competitiveness, labour productivity, digital skills, public services

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Introduction

Digitalisation has emerged as a pivotal force driving transformation across various sectors, fundamentally altering business operations, enhancing productivity and fostering economic growth. The integration of digital technologies into business processes not only streamlines operations but also creates new opportunities for innovation and competitive advantage. This transformation is particularly significant in the context of the ongoing digital revolution, which has been characterised by the rapid adoption of information and communication technologies (ICT) that reshape traditional business models and practices.[3]

Against this backdrop, the present study aims to examine and address the key elements driving digitalisation within the European Union, with a focus on digital skills, digital business integration, digital infrastructures and the digitalisation of public services. The study also aims to provide insights into the key macroeconomic context of digitalisation. In line with the objective, the central research question of the study can be formulated as follows: How can digitalisation drive competitiveness and resilience in the European Union, and what are the key macroeconomic factors influencing this transformation?

To answer this question, this study systematically reviews academic articles which focus on the macroeconomic context of digitalisation like labour productivity, gross value added and exports but also highlight important areas such as the digital skills, the digitalisation of businesses, the importance of building digital infrastructures and the digitalisation of public services, which are very important for improving the competitiveness of the European Union.

The impact of digitalisation and the development of technology on the European Union (EU) economy is profound and multifaceted, influencing productivity, economic growth and social inclusion. As the EU strives to become a leader in the digital economy, it faces both opportunities and challenges that vary significantly across its Member States.

Digitalisation has been identified as a critical driver of economic growth within the EU. Research indicates a strong correlation between digitalisation and productivity improvements, particularly through the adoption of advanced technologies and digital infrastructure. For instance, studies have shown that the integration of information and communication technologies (ICT) significantly enhances productivity levels across various sectors in the EU, with evidence supporting the positive effects of the Digital Economy and Society Index (DESI) on macroeconomic indicators.[4] Furthermore, the EU's strategic initiatives, such as the "Digital Europe Programme", aim to foster an innovative and sustainable economy, positioning Europe as a competitive global player.[5]

However, the benefits of digitalisation are not uniformly distributed across the EU. There exist considerable disparities in digital readiness and infrastructure among Member States, which can exacerbate existing economic inequalities. For example, while

[3] Wynn–Felser 2023; Ionașcu–Anghel 2020; Marienko et al. 2023.
[4] Mura–Donath 2023; Brodny–Tutak 2022a; 2022b.
[5] Małkowska et al. 2021; Pinto et al. 2023.

some countries have successfully harnessed digital technologies to boost economic performance, others lag behind, facing challenges such as inadequate digital skills and infrastructure.[6] This uneven progress necessitates coordinated policy efforts to harmonise digitalisation strategies across the EU, ensuring that all regions can benefit from technological advancements.[7]

Moreover, digitalisation plays a crucial role in enhancing social inclusion and addressing youth unemployment, particularly in rural areas. The digital transformation of public employment services (PES) is essential for engaging vulnerable populations, such as NEETs (Not in Education, Employment, or Training), in the labour market.[8] By leveraging digital tools, PES can better meet the needs of these individuals, fostering a more inclusive economy that capitalises on the potential of all citizens.[9]

In addition to economic and social dimensions, digitalisation is also pivotal in driving ecological transformation within the EU. The European Green Deal highlights the importance of integrating digital technologies to achieve climate neutrality by 2050. Digitalisation can facilitate more efficient resource management and promote sustainable practices across various sectors, including agriculture and energy.[10] For instance, precision agriculture, enabled by digital tools, enhances productivity while minimising environmental impact, thus aligning economic growth with sustainability goals.[11]

The main macroeconomic context of digitalisation

According to Halmai (2018), the fading of the European growth model can be attributed significantly to a slowdown in productivity dynamics, particularly in sectors that are crucial for digitalisation. The productivity gap between Europe and the United States is evident in industries that have embraced digital technologies. This gap underscores the necessity for Europe to prioritise its digital transition as a means to enhance growth potential and competitiveness.[12]

In line with this statement, it is certainly worth mentioning the report by Mario Draghi, which outlines a strategic framework for enhancing European competitiveness amid declining productivity and rising geopolitical challenges. It identifies three critical areas for action: closing the innovation gap with the U.S. and China, implementing a coherent decarbonisation plan and increasing investment to meet unprecedented needs. Europe must raise its investment-to-GDP ratio by 5 percentage points to levels not seen since the 1960s, while addressing high energy costs that are 2–3 times higher than in the U.S. The report emphasises the necessity for coordinated industrial, competition and trade policies, alongside a reform of governance structures to facilitate

6 Mura–Donath 2023; Neméný–Tóth 2023; Wigger 2022.
7 Mura–Donath 2023; Małkowska et al. 2021.
8 Simões–Marta 2024.
9 Simões–Marta 2024.
10 Belitz–Gornig 2023; Zēverte-Rivža et al. 2023.
11 Zēverte-Rivža et al. 2023.
12 Halmai 2018.

rapid decision-making and collective action among EU Member States.[13] The second part of the report analyses the EU's competitiveness challenges, particularly in energy and critical raw materials, exacerbated by high prices and volatility. Energy prices in the EU are currently two to five times higher than in the U.S., with 60% of companies citing energy costs as a major investment barrier. The EU's dependency on gas imports and spot markets contributes to this gap. Additionally, critical raw materials, essential for green technologies, face supply risks due to concentration in a few countries. The Critical Raw Materials Act aims to enhance domestic production and recycling, requiring at least 10% of mined materials and 40% of processed products to come from within the EU by 2030. Recommendations include improving joint procurement, diversifying supply sources and streamlining permitting processes.[14]

Research indicates that the impact of digitalisation on productivity is not uniform across Europe. For instance, companies in Eastern European nations have shown more pronounced benefits from investments in production digitalisation compared to their Western counterparts, largely due to their historical context and the rapid catch-up in digital capabilities post-Soviet era.[15] This suggests that targeted digital investments could yield significant productivity gains, particularly in regions lagging in digital adoption.

Moreover, the transition from a neo-industrial to a digital economy is characterised by the integration of advanced technologies such as artificial intelligence, data analytics and the Internet of Things (IoT). These technologies are pivotal in reshaping business models and enhancing operational efficiencies.[16] The European Union's Horizon Europe Programme exemplifies this commitment, as it allocates funding to accelerate the twin transition – both green and digital – across various sectors.[17] This strategic approach is essential for fostering innovation and improving competitiveness in the global market.

The construction sector, often cited as one of the least digitised industries in Europe, exemplifies the challenges faced in embracing digital innovations. Despite its significant contribution to GDP, the sector has struggled with productivity, highlighting the need for a concerted effort to overcome digitalisation barriers.[18] The integration of digital tools could streamline processes and enhance productivity, thereby contributing to the overall economic growth of the region.

Furthermore, the role of digital technologies extends beyond mere productivity improvements; they also influence business dynamism and competitiveness. Studies have shown that the adoption of information and communication technologies (ICT) is a strong predictor of business performance across various dimensions, including market and labour dynamics.[19] This correlation emphasises the critical role that digitalisation plays in enhancing the competitiveness of European economies.

13 Draghi 2024a.
14 Draghi 2024b.
15 Lastauskaite–Krušinskas 2024.
16 Ortega-Gras et al. 2021; Maucorps et al. 2023.
17 Ortega-Gras et al. 2021.
18 Torres et al. 2024.
19 Bacca-Acosta et al. 2023.

The macroeconomic context of digitalisation in the European Union (EU) is characterised by a complex interplay of economic growth, innovation and policy frameworks aimed at enhancing competitiveness and addressing disparities among Member States. Digitalisation is increasingly recognised as a critical driver of economic transformation, influencing productivity, employment and overall economic resilience.

One of the primary aspects of digitalisation in the EU is its role in fostering economic growth. Research indicates that digitalisation significantly contributes to productivity enhancements across various sectors. For instance, Mura and Donath (2023) highlight that coordinated digitalisation policies are essential for harmonising productivity and growth across EU countries, particularly given the existing disparities in digital capabilities among Member States.[20] Furthermore, Brodny and Tutak (2022a) emphasise that institutional support for technological innovations is vital for developing an innovative economy, which is closely linked to digitalisation efforts.[21] This is echoed by Nemény and Tóth (2023), who assert that digitalisation, information and communication technologies (ICT) are crucial for driving economic growth and improving competitiveness.[22]

Moreover, the EU's strategic initiatives, such as the Digital Europe Programme, aim to position Europe as a leader in the global digital economy by promoting advanced technologies and fostering a knowledge-based economy.[23] The emphasis on digital transformation aligns with the EU's broader goals of achieving sustainable development and ecological transformation, as articulated in the European Green Deal.[24] This initiative underscores the importance of integrating digitalisation with environmental sustainability, thereby enhancing the EU's competitiveness on a global scale.

However, the digital landscape within the EU is marked by significant inequalities. The Digital Economy and Society Index (DESI) reveals persistent gaps in digitalisation across Member States, indicating that some countries lag in areas such as broadband connectivity and digital public services.[25] Addressing these disparities is crucial for ensuring that all EU nations can benefit from the economic advantages of digitalisation. Veugelers et al. (2023) further note that the Covid–19 pandemic has exacerbated these divides, with digitally advanced firms accelerating their digital transformation while lagging firms struggle to adapt.[26]

In addition to economic growth, digitalisation is also linked to social inclusion and the empowerment of vulnerable groups. The integration of digital technologies in public employment services, for instance, is essential for ensuring that young people, particularly those in rural areas, can access opportunities and resources.[27] This reflects a broader trend where digitalisation is seen as a means to enhance inclusivity and resilience in the face of economic challenges.

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20 Mura–Donath 2023.
21 Brodny–Tutak 2022a.
22 Nemény–Tóth 2023.
23 Małkowska et al. 2021.
24 Belitz–Gornig 2023.
25 Reggi – Gil-García 2021.
26 Veugelers et al. 2023.
27 Simões–Marta 2024.

The relationship between digitalisation and labour productivity

The relationship between digitalisation and labour productivity in the European Union (EU) is multifaceted and increasingly significant in the context of contemporary economic development. Digitalisation, defined as the integration of digital technologies into various sectors, has been shown to enhance productivity through improved efficiency, innovation and the transformation of traditional business models.

The following figure illustrates the relationship between digitalisation and labour productivity through interconnected factors. Digitalisation acts as the primary driver, influencing Automation, Data Utilisation and Skill Development.

- Automation enhances efficiency by reducing manual tasks and increasing output consistency.
- Data Utilisation helps optimise decision-making, streamline processes and improve productivity.
- Skill Development ensures that the workforce adapts to new technologies, enhancing their effectiveness.

These three factors collectively lead to Efficiency Gains, which ultimately boost Labour Productivity. Figure 1 highlights the importance of integrating digital tools, workforce training and data-driven strategies to enhance productivity in the modern workplace.

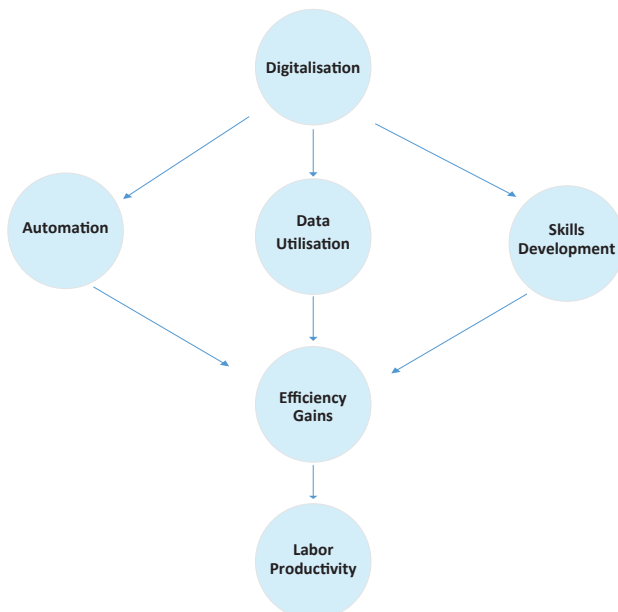

Figure 1: Key factors in examining the links between digitalisation and labour productivity
Source: compiled by the authors

One of the primary mechanisms through which digitalisation impacts labour productivity is by facilitating the efficient storage, transmission and manipulation of data. This capability allows for unprecedented levels of connectivity and innovation across industries, which has been evidenced in developed countries where digitalisation has positively influenced economic growth and productivity levels.[28] The integration of digital technologies into production processes not only streamlines operations but also fosters entrepreneurship, leading to a more dynamic economic environment.[29]

Moreover, the digital economy introduces new sectors and transforms traditional industries, contributing to economic development and social transformation. This phenomenon is often referred to as the fourth industrial revolution, characterised by rapid changes in production and digital technologies, which in turn intellectualises labour.[30] As industries adopt digital solutions, they experience significant shifts in labour processes, which can enhance productivity by optimising resource allocation and reducing operational costs.[31]

Research has highlighted a direct correlation between digitalisation and total factor productivity (TFP) in EU Member States. A model developed to analyse this relationship indicates that increased digitalisation correlates with higher productivity growth, as measured by TFP, which encompasses the efficiency of both labour and capital inputs.[32] This relationship is further supported by evidence that digital transformation leads to labour-saving costs and productivity increases, particularly in sectors that have embraced automation and digital tools.[33]

Additionally, the role of digitalisation in reshaping labour markets cannot be overlooked. The emergence of digital platforms has transformed employment relations, creating new forms of work and altering traditional labour regimes.[34] This shift has implications for labour productivity, as it often leads to more flexible work arrangements and can enhance the efficiency of labour deployment across various sectors.[35] However, it also raises concerns about job security and the quality of employment, particularly in the context of gig economy dynamics.[36]

The relationship between digitalisation and gross value added (GVA)

The relationship between digitalisation and gross value added (GVA) in the European Union (EU) is multifaceted, reflecting the impact of technological advancements on

28 Vysochan et al. 2024.
29 Vysochan et al. 2024; Balashova 2023.
30 Derhachova et al. 2024.
31 Mura–Donath 2023.
32 Balashova 2023.
33 Mura–Donath 2023.
34 Floros–Jørgensen 2022.
35 Altenried 2021.
36 Floros–Jørgensen 2022.

economic productivity and sectoral contributions to GVA. Digitalisation, defined as the integration of digital technologies into everyday business processes, has been shown to enhance the efficiency and competitiveness of various sectors, thereby positively influencing GVA.

Figure 2 illustrates the relationship between digitalisation and gross value added (GVA) through a network of interconnected factors. Digitalisation serves as the central driver, influencing three key areas: Technology Adoption, Data Analytics, Automation and AI:

- Technology Adoption contributes to Labour Productivity, which in turn enhances Cost Efficiency.
- Data Analytics plays a role in fostering Innovation, which further impacts Market Expansion.
- Automation and AI directly supports Innovation, creating synergies that contribute to GVA.
- The ultimate outcome of these interactions is an increase in Gross Value Added (GVA), achieved through improved Labour Productivity, Cost Efficiency, Innovation and Market Expansion.

Figure 2 highlights the multifaceted benefits of digitalisation, showing that its effects extend beyond simple efficiency gains to broader economic growth and competitiveness.

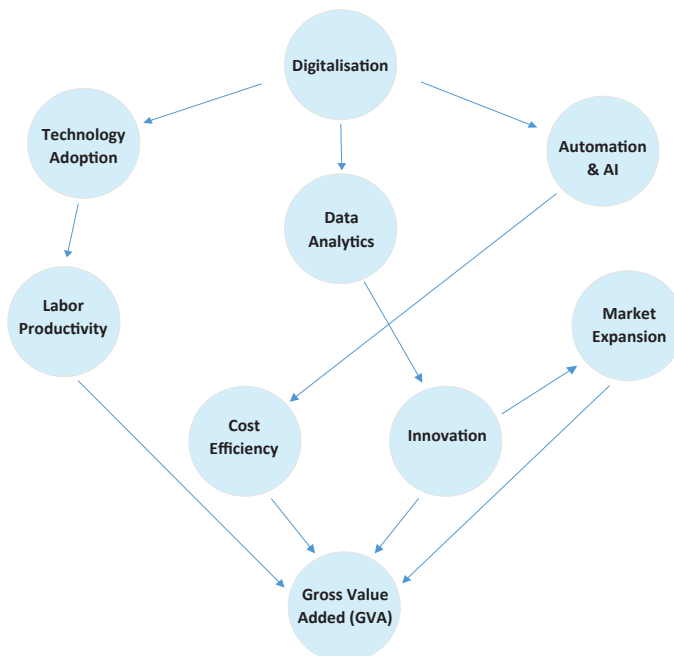

Figure 2: Key factors in examining the links between digitalisation and gross value added
Source: compiled by the authors

Digitalisation plays a crucial role in transforming traditional industries into more efficient, knowledge-based economies (KBE). Research indicates that countries with higher levels of digitalisation tend to have a more significant share of their GVA generated from the services sector, which is often more resilient and adaptable to changes in market conditions.[37] For instance, in countries like Luxembourg, Finland and Denmark, the services sector accounted for approximately 79.2%, 60% and 64% of GVA, respectively, highlighting the shift towards a KBE that leverages digital technologies.[38] This shift is indicative of economic development and correlates with increased innovativeness and competitiveness, as sectors that embrace digitalisation tend to exhibit higher productivity levels.[39]

Moreover, the integration of digital technologies has been linked to improved financial performance among businesses. Companies that adopt digitalisation report enhanced growth, performance and profitability, particularly during challenging economic periods, such as the Covid–19 pandemic. This resilience underscores the importance of digitalisation as a strategic asset that contributes to overall economic stability and growth, thereby positively affecting GVA at both the firm and national levels.

The agricultural sector, traditionally a significant contributor to GVA in the EU, is also experiencing transformations due to digitalisation. The adoption of smart farming technologies and data analytics is enhancing productivity and sustainability in agriculture, which in turn contributes to GVA.[40] As agricultural practices evolve through digitalisation, the sector's ability to generate value-added products increases, reflecting a broader trend of integrating technology across all economic sectors.[41]

Furthermore, the dynamics of global value chains (GVCs) illustrate how digitalisation affects GVA through enhanced trade efficiency and value creation. The ability to track and optimise value-added flows within GVCs is critical for understanding the true economic contributions of various sectors.[42] Digital tools facilitate better management of these chains, leading to increased GVA as firms optimise their operations and reduce costs associated with production and logistics.[43]

The relationship between digitalisation and exports

The relationship between digitalisation and exports within the European Union (EU) is increasingly significant as digital technologies reshape trade dynamics. Digitalisation facilitates trade by reducing transaction costs, enhancing market access and improving the efficiency of supply chains. This transformation is particularly evident in the context of the EU's trade policies and agreements, which increasingly emphasise digital trade as a critical component of economic growth.

37 Bąk et al. 2022.
38 Bąk et al. 2022.
39 Nowak et al. 2022.
40 Nowak–Kasztelan 2022.
41 Rađenović et al. 2022.
42 Vandenbussche et al. 2022.
43 Pasierbiak–Białowąs 2024.

Figure 3 visually represents the relationship between digitalisation and exports, highlighting key contributing factors. "Digitalisation" serves as a central node, linking to essential components such as "Digital Infrastructure" and "E-commerce". These factors, in turn, contribute to "Market Access" and "Trade Efficiency", both of which ultimately drive "Increased Exports".

- Digital Infrastructure: Forms the foundation for digitalisation, supporting the adoption of digital tools in trade.
- E-commerce: Enhances market access and enables businesses to reach global consumers more efficiently.
- Market Access: Facilitates entry into international markets, a critical factor in boosting exports.

Trade Efficiency: Streamlines trade processes, reducing costs and barriers.

Figure 3 shows that digitalisation, through its various channels, leads to an increase in exports by improving trade efficiency and market access. The size of the nodes may indicate their relative importance in this relationship, with "Increased Exports" being the most significant outcome.

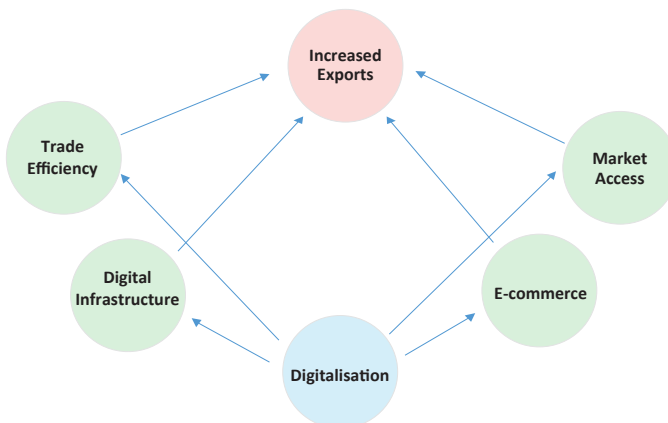

Figure 3: Key factors in examining the links between digitalisation and exports
Source: compiled by the authors

Digital technologies have been shown to significantly promote export activities. For instance, the digital economy enhances city export trade by lowering trade costs and expanding market reach, a finding supported by various studies that emphasise the role of digital technologies in facilitating trade. Similarly, digital transformation is closely linked to export performance, suggesting that enterprises that embrace digital tools can better navigate international markets and enhance their export capabilities. This relationship is further corroborated by Burri et al. (2024), who note that the EU's shift towards bi- and plurilateral agreements has prioritised digital trade, reflecting its importance in modern trade strategies.[44]

[44] BURRI et al. 2024.

Moreover, the integration of digital technologies into traditional manufacturing processes has been identified as a key driver of export growth. Korgun and Hoti (2023) point out that the convergence of digital technologies with manufacturing sectors in the EU enables the production and export of high-tech goods, thus enhancing the region's competitive edge in global markets.[45] The digital economy not only expands trade scales but also optimises resource utilisation, thereby improving the quality and sustainability of exports.

The EU's digital landscape is characterised by disparities in digital adoption among Member States, which can influence export performance. Bălăcescu et al. (2023) analyse these disparities and suggest that economic development plays a crucial role in bridging the digital divide, thereby enhancing overall export capabilities across the EU.[46] Furthermore, the European Commission's initiatives to bolster digital infrastructure and skills are essential for fostering a more integrated digital economy, which in turn supports export growth.[47]

The transformative role of the key drivers of digitalisation in Europe's economy

Navigating the digital frontier: The essential skills for thriving in a tech-driven EU

The concept of digital skills encompasses a wide range of competencies necessary for effective participation in the digital age. As technology continues to evolve, the demand for digital skills has become increasingly critical across various sectors, including education, logistics and business.

To fully grasp the scope and implications of digital skills, it is first necessary to define what they encompass and understand their core components.[48] The UNESCO Institute for Statistics (2009) defines digital skills as "a set of abilities for accessing and managing information using digital devices, communication applications, and networks". These talents enable you to create and share digital material, communicate and collaborate with others, solve issues and discover new creative opportunities.[49] Similarly, the European Commission (2019) also defined digital skills as "the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It is defined as a combination of knowledge, skills, and attitudes".[50]

45 Korgun–Hoti 2023.
46 Bălăcescu et al. 2023.
47 Kersan-Škabić – Vukašina 2023.
48 Sanz 2023.
49 UNESCO Institute for Statistics 2009.
50 European Commission 2019.

Building upon these foundational definitions, it becomes evident that digital skills are multifaceted, incorporating both technical and soft competencies that are critical in various sectors. Zielinska (2022) identifies six key factors that constitute digital skills: 1. access to and management of digital content; 2. use of digital means; 3. communication of digital content; 4. creation of digital content; 5. digital empathy; and 6. digital safety. This comprehensive framework emphasises the multifaceted nature of digital skills, which combine both technical and soft skills.[51] The importance of these skills is echoed by Ntule et al. (2024), who demonstrate that digital skills significantly enhance logistics performance, underscoring their relevance in the workforce.[52]

The digital economy is increasingly recognised as a cornerstone for innovation, growth, job creation and overall competitiveness within Europe. The rapid advancement of digital technologies has fundamentally altered the labour market, necessitating a shift in the skills required for success in both economic and societal contexts. This transformation is not merely a technological shift; it is a comprehensive change that impacts various sectors and necessitates a robust response from educational institutions, policymakers and businesses alike.

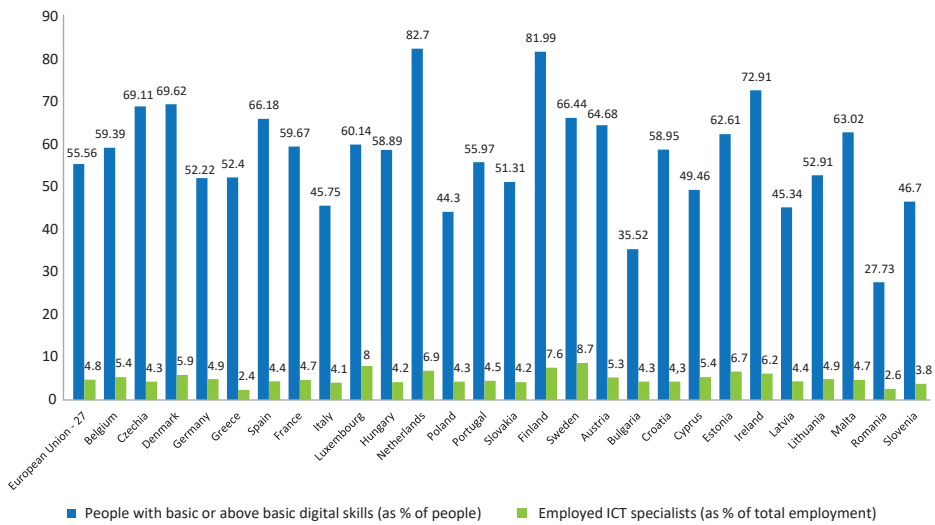

Figure 4: Digital skills and employment of IT professionals in the European Union
Source: compiled by the authors based on Eurostat 2024

The European Union (EU) is actively engaged in fostering a digital economy that can compete on a global scale. As Kolupaieva and Tiesheva (2023) highlight, digital innovations serve as a driving force for economic development and are essential for the well-being of citizens across EU Member States.[53] The EU's strategic frameworks aim to

51 ZIELINSKA 2022.
52 NTULE et al. 2024.
53 KOLUPAIEVA–TIESHEVA 2023.

implement digital transformation across all socio-economic sectors, thereby enhancing competitiveness against other global economies. This is echoed by Bacca-Acosta et al. (2023), who assert that the development of information and communication technologies (ICT) is vital for economic growth and productivity, positioning Europe favourably in an increasingly digitalised global market.[54]

Moreover, the educational landscape must adapt to meet the demands of this evolving digital economy. Simionescu (2022) emphasises the need for educational institutions to increase the number of programs that prepare graduates for careers in the digital economy, suggesting that those that fail to do so must revise their curricula to align with market needs.[55] This sentiment is supported by Morozova and Kurochkin (2021), who argue that enhancing digital competencies through public policy is crucial for fostering a digitally inclusive society.[56] The emphasis on skill development is further reinforced by Hurduzeu et al. (2022), who note that digitalisation significantly influences both individuals and businesses, necessitating a workforce equipped with relevant digital skills.[57]

The importance of digital proficiency cannot be overstated, as highlighted by Lucas et al. (2022), who point out that individuals with strong digital skills are more likely to secure employment in a competitive job market.[58] The ongoing digital transformation has revealed significant gaps in digital competencies among the workforce, which can exacerbate inequalities and limit job opportunities for those lacking these essential skills. The European Commission has recognised this challenge, noting that nearly half of the EU population lacks basic digital skills, a situation exacerbated by the Covid–19 pandemic.[59] This underscores the urgent need for targeted educational initiatives to equip individuals with the necessary competencies to thrive in a digital economy.

In addition to educational reforms, the integration of digital technologies into various sectors is crucial for enhancing competitiveness. The Digital Economy and Society Index (DESI) serves as a benchmark for assessing the digital performance of EU Member States, highlighting the importance of internet access, digital skills and the utilisation of online services.[60] The analysis of Csiszár (2023) demonstrates that digital intensity and technology adoption are pivotal in fostering innovation and economic growth across European enterprises.[61] This is particularly relevant in the context of the steel industry, where digital transformation is reshaping operational efficiencies and competitive dynamics.[62]

The interplay between digitalisation and economic competitiveness is further illustrated by the findings of Oloyede et al. (2023), who emphasise that the digital economy is a critical driver of growth and job creation across various sectors, including agriculture, commerce and education.[63] The ability to leverage digital technologies effectively can

54 Bacca-Acosta et al. 2023.
55 Simionescu 2022.
56 Morozova–Kurochkin 2021.
57 Hurduzeu et al. 2022.
58 Lucas et al. 2022.
59 Van Kessel et al. 2022.
60 Branca et al. 2020.
61 Csiszár 2023.
62 Branca et al. 2020.
63 Oloyede et al. 2023.

lead to significant advancements in productivity and innovation, which are essential for maintaining a competitive edge in the global market.

Furthermore, the role of digital skills extends beyond individual employability; it is also a key factor in the overall economic resilience of nations. As noted by Mirchevska et al. (2023), countries that invest in digital skills development are better positioned to adapt to changes in the global economy and to recover from economic shocks.[64] The Covid–19 pandemic has underscored the necessity for businesses and public sectors to embrace digital transformation to enhance their operational capabilities and service delivery.[65]

The EU's commitment to enhancing digital skills is reflected in its various initiatives aimed at fostering digital literacy and competency among its citizens. This includes the European Commission's Skills Agenda, which aims to address the digital skills gap and promote lifelong learning opportunities.[66] By prioritising digital competencies, the EU seeks to empower its workforce to navigate the complexities of the digital economy effectively.

Moreover, the development of digital skills is not solely the responsibility of educational institutions; businesses also play a crucial role in fostering a digitally competent workforce. As highlighted by Kessel et al. (2022), organisations must invest in training and development programs that enhance their employees' digital capabilities.[67] This investment is essential for maintaining competitiveness and ensuring that businesses can adapt to the rapidly changing technological landscape.

Shaping the digital future: The EU's path to a competitive, fair and sustainable economy

The European Union (EU) is actively enhancing its digital economy through a multifaceted approach that encompasses promoting competition, ensuring fair taxation, protecting consumers and creating a level playing field between digital and traditional businesses. This comprehensive strategy is essential for fostering innovation, economic growth and sustainability within the EU's digital landscape.

One of the pivotal elements of the EU's digital economy strategy is the promotion of competition. The European Commission (EC) has recognised the necessity of adapting competition laws to the unique challenges posed by digital markets. The introduction of the Digital Markets Act (DMA) exemplifies this effort, aiming to regulate large digital platforms that act as gatekeepers in the market. This legislation is designed to prevent anti-competitive practices and ensure that smaller businesses can compete effectively against dominant players like Google and Amazon.[68] The DMA, alongside the proposed New Competition Tool (NCT), reflects a shift from traditional ex-post competition

64 Mirchevska et al. 2023.
65 Boikova et al. 2021.
66 Van Kessel et al. 2022.
67 Van Kessel et al. 2022.
68 Wambach 2022.

policies to more proactive measures that can address potential market distortions before they occur. This proactive approach is crucial as the digital economy continues to evolve rapidly, presenting new challenges that require timely regulatory responses.

In addition to fostering competition, the EU is also focused on ensuring fair taxation within the digital economy. The complexity of digital services and the global nature of digital businesses have led to significant challenges in tax regulation. Countries like France have taken unilateral steps to implement digital services taxes in response to the deadlock at the OECD level regarding international tax reform. The EU's approach to taxation aims to create a fairer system that prevents tax avoidance and ensures that digital companies contribute their fair share to the economies in which they operate. This is particularly important as the digital economy expands, and traditional tax frameworks struggle to keep pace with new business models.[69] The EU's commitment to fair taxation is further underscored by its ongoing discussions to establish a unified digital tax framework that could serve as a model for other regions.[70]

Consumer protection is another critical aspect of the EU's digital economy strategy. The rapid growth of e-commerce and digital services has raised concerns about consumer rights and safety in the digital marketplace. The EU has implemented various regulations, including the General Data Protection Regulation (GDPR), which aims to safeguard personal data and enhance consumer trust in digital transactions.[71] These regulations are designed to empower consumers by providing them with greater control over their data and ensuring that businesses adhere to strict privacy standards. Furthermore, the EU has established mechanisms to address consumer complaints and disputes in the digital environment, thereby fostering a safer online shopping experience.[72] The emphasis on consumer protection not only enhances trust in digital services but also encourages more consumers to engage in online transactions, thereby driving economic growth.

Creating a level playing field between digital and traditional businesses is essential for the EU's economic strategy. The digital transformation of traditional industries is a key focus area, as the EU seeks to integrate digital technologies into various sectors to enhance productivity and competitiveness.[73] This transformation is supported by initiatives such as the Digital Europe Programme, which aims to promote digital skills and the adoption of advanced technologies across all sectors of the economy.[74] By fostering digitalisation in traditional industries, the EU is not only enhancing their competitiveness but also ensuring that they can thrive in an increasingly digital marketplace. This approach is particularly important for small and medium-sized enterprises (SMEs), which often face greater challenges in adapting to digital changes compared to larger corporations.[75]

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69 Geringer 2021.
70 Geringer 2021.
71 Younas–Mirzaraimov 2021.
72 Agibalova et al. 2021.
73 Małkowska et al. 2021.
74 Matrosova–Kononenko 2024.
75 Brodny–Tutak 2022a; 2022b.

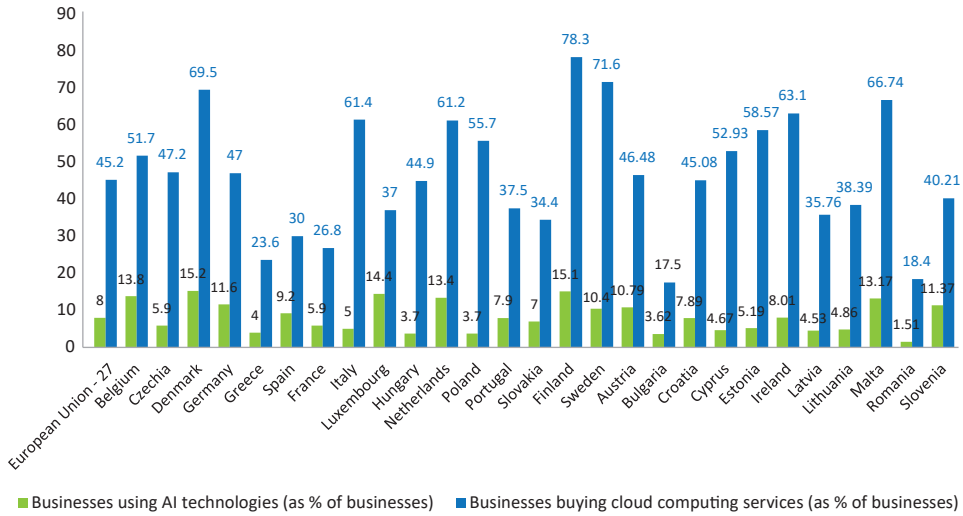

Figure 5: Use of artificial intelligence and cloud-based computing services in EU countries – Adaptation level of businesses by country

Source: compiled by the authors based on Eurostat 2024

The EU's digital economy strategy is also characterised by a commitment to sustainability and innovation. The concepts of Economy 4.0 and Society 4.0 are central to the EU's vision for a future where digital technologies drive sustainable economic growth.[76] The integration of digital technologies into various sectors is expected to lead to more efficient resource use, reduced environmental impact and the creation of new business models that prioritise sustainability.[77] The EU's focus on innovation is further evidenced by its investment in research and development initiatives aimed at fostering technological advancements that can benefit the entire economy.[78] This commitment to innovation not only enhances the EU's global competitiveness but also positions it as a leader in the transition to a sustainable digital economy.

Moreover, the EU's efforts to enhance its digital economy are supported by a robust framework of policies and initiatives that promote collaboration among Member States. The Digital Economy and Society Index (DESI) serves as a critical tool for assessing the digital progress of EU countries and identifying areas for improvement.[79] By tracking digital performance across various dimensions, the DESI enables the EU to tailor its policies to address specific challenges faced by different Member States. This collaborative approach ensures that all countries can benefit from the digital economy, thereby reducing disparities and promoting convergence within the EU.[80]

76 MAŁKOWSKA et al. 2021.
77 BOROWIECKI et al. 2021.
78 MAŁKOWSKA et al. 2021.
79 KOVÁCS et al. 2022.
80 HUŇADY et al. 2022.

Digital frontiers: Infrastructure investments as the catalyst for Europe's competitive edge

Digital infrastructure investments are increasingly recognised as pivotal to enhancing Europe's global competitiveness. The integration of advanced digital technologies into the economic fabric of nations fosters innovation and enhances operational efficiencies across various sectors. This multifaceted approach to digital infrastructure encompasses a broad spectrum of elements, including telecommunications, broadband access and the implementation of smart technologies, all of which are essential for driving economic growth and attracting foreign direct investment (FDI).[81]

The role of digital infrastructure in boosting competitiveness is underscored by its capacity to facilitate digital transformation within organisations. Investments in information technology (IT) infrastructure are crucial for creating competitive advantages, particularly when aligned with a robust digital transformation strategy. Such investments enhance operational capabilities and enable firms to adapt to rapidly changing market conditions, thereby positioning them favourably in the global landscape.

Moreover, the relationship between digital infrastructure and foreign direct investment is significant. Rehman et al. (2022) highlight that improved infrastructure, including digital networks, can substantially increase a country's attractiveness to foreign investors.[82] This is particularly relevant for European nations, where enhanced digital capabilities can lead to lower operational costs and improved business environments, thus fostering a more conducive atmosphere for FDI. The International Telecommunication Union supports this notion, asserting that mobile broadband is a primary driver of economic development, particularly in developing countries.[83] As such, European nations must prioritise digital infrastructure to remain competitive on the global stage.

The impact of digital infrastructure extends beyond mere economic metrics; it also plays a crucial role in addressing social inequalities. Digital infrastructure can help bridge the digital divide, thereby reducing income inequality and enhancing overall regional development.[84] This is particularly pertinent in the context of the European Union's initiatives aimed at digitalising lagging regions, as evidenced by the allocation of substantial funds for infrastructure development in Central Europe. Such investments promote economic growth and ensure that the benefits of digitalisation are equitably distributed across various demographics.

Furthermore, the concept of "new infrastructure", which includes digital information technology such as 5G networks and artificial intelligence, is gaining traction as a critical component of economic growth strategies. Investments in new digital infrastructure have contributed significantly to economic growth, accounting for a remarkable percentage

81 Rehman et al. 2022; Doran et al. 2022.
82 Rehman et al. 2022.
83 Doran et al. 2022.
84 Hakim–Rosini 2022.

of overall economic development in certain regions. Furthermore, digital infrastructure development can lead to enhanced consumption capabilities and economic performance in urban areas. Thus, the strategic investment in digital infrastructure is not merely a matter of technological advancement but a fundamental driver of economic prosperity.

In addition to fostering economic growth, robust digital infrastructure is essential for ensuring the security and resilience of digital services. A resilient digital infrastructure is indispensable for delivering efficient services and fostering economic growth, particularly in the context of cybersecurity. The ability to maintain robust cybersecurity measures instils trust in digital services, which is crucial for both consumers and businesses alike. This trust is a prerequisite for the widespread adoption of digital technologies, which in turn drives economic competitiveness.

Moreover, the strategic alignment of digital infrastructure investments with broader economic policies is crucial for maximising their impact. Doran et al. (2022) emphasise the importance of combining broadband coverage and speed to improve fiscal system efficiency, particularly in Eastern European Union countries.[85] This approach underscores the need for a holistic strategy that integrates digital infrastructure development with fiscal policies to enhance overall economic performance.

The implications of digital infrastructure investments extend to environmental sustainability as well. Digital business innovations can drive financial inclusion and contribute to sustainable economic growth. By enabling access to digital financial services, investments in digital infrastructure can empower marginalised communities, thereby promoting inclusive growth that aligns with environmental, social and governance (ESG) principles.

Empowering citizens in the digital era: Trust, inclusion and innovation in public services

The digital transformation of public services is a critical factor in enhancing the resilience, competitiveness and innovation of European society and economy. As governments increasingly integrate digital technologies into public service delivery, the need for fair, inclusive, open and trusted digital public services becomes paramount. This transformation is not merely a technological upgrade; it represents a fundamental shift in how citizens interact with their governments and access essential services. The successful digitalisation of public services hinges on several interrelated factors, including trust, digital literacy and the active engagement of citizens in the design and delivery of these services.

[85] Doran et al. 2022.

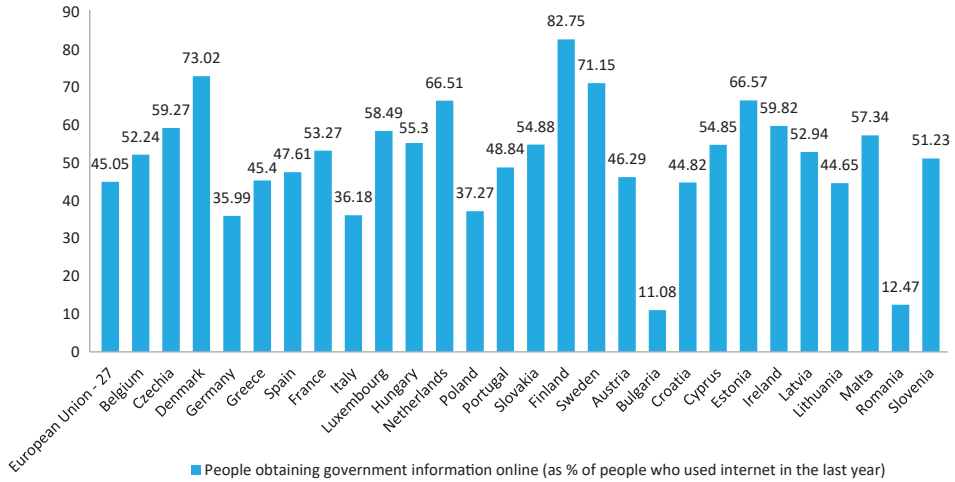

Figure 6: Rate of access to online government information among internet users in EU Member States
Source: compiled by the authors based on Eurostat 2024

Trust plays a pivotal role in the successful adoption and utilisation of digital public services. Research indicates that the quality of public services significantly influences public trust in government institutions. High-quality services foster satisfaction and strengthen the relationship between citizens and the government, ultimately enhancing trust. Moreover, the perception of security and privacy in digital interactions is crucial. Citizens are more likely to engage with digital services when they feel their personal information is secure. This is particularly relevant in the context of e-government, where the lack of trust can hinder the effective use of digital platforms.[86] The establishment of trust through transparent practices and high-quality service delivery is essential for fostering a positive relationship between citizens and public institutions.

Digital literacy is another critical component of effective digital public service delivery. The digital divide remains a significant challenge, particularly among marginalised groups who may lack the necessary skills to navigate digital platforms.[87] Addressing this divide requires targeted investments in digital literacy programs and infrastructure to ensure that all citizens can access and benefit from digital services. For instance, rural populations often face barriers such as poor digital literacy and limited access to technology, which can impede their ability to utilise digital public services effectively. By investing in training and resources, governments can empower citizens to engage with digital services, thereby enhancing overall service utilisation and satisfaction.

The role of citizens in the co-design and co-delivery of digital public services is increasingly recognised as a vital aspect of digital governance. The shift from viewing

86 Hooda et al. 2022.
87 Hooda et al. 2022.

citizens as mere consumers of services to active collaborators in the service design process can lead to more responsive and effective public service.[88] This participatory approach not only enhances the relevance of services but also fosters a sense of ownership among citizens, which can further strengthen trust in public institutions.[89] Engaging citizens in the development of digital services ensures that these services meet the actual needs of the community, thereby increasing their effectiveness and uptake.

Moreover, the Covid–19 pandemic has accelerated the digital transformation of public services, highlighting the importance of adaptability and resilience in public administration.[90] The necessity for remote service delivery during the pandemic underscored the potential of digital technologies to maintain service continuity in times of crisis.[91] As governments adapt to these new realities, it is crucial to ensure that digital services are designed with inclusivity in mind, addressing the needs of all citizens, particularly those who may be digitally marginalised.[92] This includes considering the unique challenges faced by vulnerable populations, such as the elderly or those with limited digital skills, in accessing essential services.[93]

The integration of smart applications and digital tools in public service delivery can enhance the efficiency and accessibility of services. For instance, the use of real-time data can improve service responsiveness and transparency, fostering greater trust among citizens. However, the implementation of these technologies must be accompanied by robust security measures to protect user data and privacy, as concerns in these areas can significantly impact user trust and engagement. Ensuring that citizens feel secure in their interactions with digital services is essential for promoting widespread adoption and effective utilisation.

Discussion

This study explored the relationship between digitalisation and economic competitiveness and inclusivity within the European Union (EU). The research identified that digital skills, business digitalisation, digital infrastructure and digital public services play essential roles in fostering economic growth. A strong correlation was found between digitalisation and key macroeconomic indicators such as labour productivity, gross value added (GVA) and exports. The findings demonstrate that investment in digital skills and infrastructure leads to increased efficiency, economic convergence and sustainability across the EU. Furthermore, digital public services contribute to social inclusion by addressing youth unemployment and promoting equitable access to digital opportunities. These results affirm the central research question: How can digitalisation drive competitiveness and resilience in the European Union, and what are the key macroeconomic factors influencing this transformation?

88 Sharma et al. 2022.
89 Sharma et al. 2022.
90 Agostino et al. 2021.
91 Agostino et al. 2021.
92 Kaihlanen et al. 2022.
93 Kaihlanen et al. 2022.

Previous studies have emphasised the role of digitalisation in productivity and innovation. Research on the Digital Economy and Society Index (DESI) supports the argument that digital readiness improves economic performance. This study reinforces such literature by providing empirical evidence that strategic digital investments can reduce the productivity gap between EU regions. Additionally, literature on institutional support for digitalisation[94] aligns with the findings, as targeted policies enhance economic sustainability and resilience. The results also extend previous research by demonstrating that digitalisation not only improves business efficiency but also supports ecological transformation through initiatives like the European Green Deal.

An unexpected result emerged regarding the digitalisation benefits in Eastern European countries, where businesses have exhibited more pronounced productivity gains from digital investments compared to their Western counterparts. This outcome suggests that less digitally advanced regions may experience higher marginal benefits due to rapid technological adoption, similar to the 'leapfrogging' effect observed in developing economies. Furthermore, while digitalisation was expected to uniformly enhance export performance, disparities among EU Member States indicate that digital skills and infrastructure gaps limit some countries from fully leveraging digital trade advantages. These findings highlight the need for region-specific digital policies.

While this study provides a comprehensive analysis, several limitations must be acknowledged. First, the study relies on macroeconomic indicators that may not fully capture industry-specific digitalisation effects. Additionally, the research is based on existing datasets, which may not account for real-time technological advancements. Another limitation is the lack of qualitative insights into the social impacts of digitalisation, such as job displacement due to automation. Addressing these limitations would require further empirical studies incorporating microeconomic data and case studies from diverse industries.

Future research should explore the long-term effects of digitalisation on employment structures, particularly concerning automation and workforce adaptation. Further investigation into the effectiveness of EU digital policies in reducing disparities across Member States would provide valuable insights. Additionally, examining the role of emerging technologies, such as artificial intelligence and blockchain, in enhancing digital competitiveness would offer new perspectives on economic transformation. Lastly, studying the impact of digitalisation on environmental sustainability in various industries could deepen understanding of how digital strategies align with climate goals.

This study underscores the transformative role of digitalisation in shaping a competitive and inclusive European economy. The findings confirm that digital skills, infrastructure and public services are fundamental drivers of productivity and economic growth. While disparities in digital readiness persist, targeted policies can ensure that all EU regions benefit from digital advancements. The implications of this research extend to policymakers, businesses and educators who play crucial roles in fostering digital adoption. Ultimately, aligning digital strategies with broader economic and sustainability objectives will enhance the EU's global position while fostering resilient and inclusive growth.

94 Brodny–Tutak 2022a.

Conclusion

This study set out to examine the impact of digitalisation on economic competitiveness and inclusivity within the European Union (EU). The research explored key macroeconomic factors – such as digital skills, digital business integration, digital infrastructures and the digitalisation of public services – and their role in fostering economic growth. The central issue addressed was the digital divide among EU Member States, which poses significant challenges to ensuring equitable access to the benefits of digital transformation.

Through a comprehensive analysis of academic literature and macroeconomic data, our findings highlight that digitalisation serves as a crucial driver of economic performance. Investments in digital skills development, business digitalisation and strategic digital infrastructure significantly enhance productivity, gross value added (GVA) and export growth. Moreover, digital public services contribute to social inclusion, particularly in addressing youth unemployment and bridging regional disparities.

Key takeaways from this study underscore the need for targeted policy interventions that promote digital adoption across all EU regions. To ensure that the benefits of digitalisation extend beyond the most technologically advanced economies, coordinated EU policies must focus on reducing disparities in digital readiness, investing in digital literacy programs and integrating digital strategies with broader sustainability objectives. Furthermore, aligning digital transformation with environmental and social goals can foster a resilient, competitive and inclusive European economy.

References

Agibalova, Elena – Ilovaysky, Igor – Kayl, Yanina – Usanova, Viktoria (2021): Consumer Protection in the Digital Environment. *SHS Web of Conferences,* 109. Online: https://doi.org/10.1051/shsconf/202110901002

Agostino, Deborah – Arnaboldi, Michela – Lema, Melisa D. (2021): New Development: Covid-19 as an Accelerator of Digital Transformation in Public Service Delivery. *Public Money & Management,* 41(1), 69–72. Online: https://doi.org/10.1080/09540962.2020.1764206

Altenried, Moritz (2021): Mobile Workers, Contingent Labour: Migration, the Gig Economy and the Multiplication of Labour. *Environment and Planning A: Economy and Space,* 56(4), 1113–1128. Online: https://doi.org/10.1177/0308518X211054846

Bacca-Acosta, Jorge – Gómez-Caicedo, Melva I. – Gaitán-Ángulo, Mercedes – Robayo-Acuña, Paula – Ariza-Salazar, Janitza – Mercado Suárez, Álvaro L. – Alarcón Villamil, Nelson O. (2023): The Impact of Digital Technologies on Business Competitiveness: A Comparison between Latin America and Europe. *Competitiveness Review,* 33(7), 22–46. Online: https://doi.org/10.1108/CR-10-2022-0167

Bąk, Iwona – Wawrzyniak, Katarzyna – Oesterreich, Maciej (2022): Competitiveness of the Regions of the European Union in a Sustainable Knowledge-Based Economy. *Sustainability,* 14(7). Online: https://doi.org/10.3390/su14073788

Bălăcescu, Aniela – Pătrașcu, Aurelia – Tănăsescu, Ana (2023): Analysis of Disparities in Internet Purchases by Individuals at the EU State Level. *Electronics,* 12(4). Online: https://doi.org/10.3390/electronics12040982

Balashova, Valeriya (2023): Impact of Digitalisation on Productivity Growth in EU Member States. *Green, Blue and Digital Economy Journal,* 4(3), 8–14. Online: https://doi.org/10.30525/2661-5169/2023-3-2

Belitz, Heike – Gornig, Martin (2023): Digitalisation and Modernity of Capital Stock in Europe. *Intereconomics,* 58(5), 260–266. Online: https://doi.org/10.2478/ie-2023-0054

Boikova, Tatyana – Zēverte-Rivža, Sandija – Rivža, Peteris – Rivža, Baiba (2021): The Determinants and Effects of Competitiveness: The Role of Digitalization in the European Economies. *Sustainability,* 13(21). Online: https://doi.org/10.3390/su132111689

Borowiecki, Ryszard – Siuta-Tokarska, Barbara – Maroń, Jolanta – Suder, Marcin – Thier, Agnieszka – Żmija, Katarzyna (2021): Developing Digital Economy and Society in the Light of the Issue of Digital Convergence of the Markets in the European Union Countries. *Energies,* 14(9). Online: https://doi.org/10.3390/en14092717

Branca, Teresa A. – Fornai, Barbara – Colla, Valentina – Murri, Maria M. – Streppa, Eliana – Schröder, Antonius J. (2020): Current and Future Aspects of the Digital Transformation in the European Steel Industry. *Matériaux & Techniques,* 108(5–6). Online: https://doi.org/10.1051/mattech/2021010

Brodny, Jarosław – Tutak, Magdalena (2022a): Analyzing the Level of Digitalization among the Enterprises of the European Union Member States and Their Impact on Economic Growth. *Journal of Open Innovation Technology Market and Complexity,* 8(2). Online: https://doi.org/10.3390/joitmc8020070

Brodny, Jarosław – Tutak, Magdalena (2022b): Digitalization of Small and Medium-Sized Enterprises and Economic Growth: Evidence for the EU-27 Countries. *Journal of Open Innovation Technology Market and Complexity,* 8(2). Online: https://doi.org/10.3390/joitmc8020067

Burri, Mira – Kugler, Kholofelo – Ker, Anna D. (2024): Digital Trade in the EU – New Zealand Free Trade Agreement: An Appraisal. *Legal Issues of Economic Integration,* 51, 11–46. Online: https://doi.org/10.2139/ssrn.4679068

Csiszár, Csilla M. (2023): Digital Intensity and Technology Adoption in European Enterprises: Comparative Analysis Using NRI and DESI 2023 Data. *Theory Methodology Practice,* 19(2), 103–113. Online: https://doi.org/10.18096/TMP.2023.02.10

Derhachova, Victoriia – Khlebynska, Oleksandra – Saloid, Stanislav – Lytvynenko, Pavlo – Bondar, Valeriia (2024): Implementing Digital Solutions to Safeguard the Economic and Legal Stability of Industrial Enterprises. *Journal of Information Systems Engineering and Management,* 8(6), 2450–2466. Online: https://doi.org/10.52783/jisem.v10i2s.326

Doran, Marius D. – Puiu, Silvia – Berceanu, Dorel – Țăran, Alexandra M. – Para, Iulia – Popescu, Jenica (2022): Combining the Broadband Coverage and Speed to Improve Fiscal System Efficiency in the Eastern European Union Countries. *Electronics,* 11(20). Online: https://doi.org/10.3390/electronics11203321

DRAGHI, Mario (2024a): *The Future of European Competitiveness. A Competitiveness Strategy for Europe.* European Commission. Online: https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en?filename=The future of European competitiveness _ A competitiveness strategy for Europe.pdf

DRAGHI, Mario (2024b): *The Future of European Competitiveness. In-Depth Analysis and Recommendations*. European Commission. Online: https://commission.europa.eu/document/download/ec1409c1-d4b4-4882-8bdd-3519f86bbb92_en?filename=The future of European competitiveness_ In-depth analysis and recommendations_0.pdf

European Commission (2019): *Key Competences for Lifelong Learning.* Online: https://data.europa.eu/doi/10.2766/569540

Eurostat (2024): Digitalisation in Europe – 2024 Edition. Online: https://ec.europa.eu/eurostat/web/interactive-publications/digitalisation-2024

FLOROS, Konstantinos – JØRGENSEN, Martin B. (2022): Danish Is Never a Requirement for These Jobs: Platform Housecleaning in Denmark through a Migration Lens. *Glocalism,* (3). Online: https://doi.org/10.12893/gjcpi.2022.3.5

GERINGER, Stefanie (2021): National Digital Taxes – Lessons from Europe. *South African Journal of Accounting Research,* 35(1), 1–19. Online: https://doi.org/10.1080/10291954.2020.1727083

HALMAI, Péter (2018): Az európai növekedési modell kifulladása [The Exhaustion of the European Growth Model]. *Közgazdasági Szemle,* 65(2), 122–160. Online: https://doi.org/10.18414/KSZ.2018.2.122

HAKIM, Dani Rahman – ROSINI, Iin (2022): Regional Income Inequality in Indonesia: The Role of Public and Private Investment. *Jurnal Ekonomi Malaysia,* 56(3). Online: https://doi.org/10.17576/JEM-2022-5603-05

HOODA, Apeksha – GUPTA, Parul – JEYARAJ, Anand – GIANNAKIS, Mihalis – DWIVEDI, Yogesh K. (2022): The Effects of Trust on Behavioral Intention and Use Behavior within E-Government Contexts. *International Journal of Information Management,* 67. Online: https://doi.org/10.1016/j.ijinfomgt.2022.102553

HUŇADY, Ján – PISÁR, Peter – VUGEC, Dalia S. – BACH, Mirjana P. (2022): Digital Transformation in European Union: North Is Leading, and South Is Lagging Behind. *International Journal of Information Systems and Project Management,* 10(4), 39–56. Online: https://doi.org/10.12821/ijispm100403

HURDUZEU, Gheorghe – LUPU, Iulia – LUPU, Radu – FILIP, Radu I. (2022): The Interplay between Digitalization and Competitiveness: Evidence from European Countries. *Societies,* 12(6). Online: https://doi.org/10.3390/soc12060157

IONAȘCU, Elena – ANGHEL, Ion (2020): Improvement of the Real Estate Transparency through Digitalisation. *Proceedings of the International Conference on Business Excellence,* 14(1), 371–384. Online: https://doi.org/10.2478/picbe-2020-0036

JAFAR, Zain – QUICK, Jonathan D. – RIMÁNYI, Eszter – MUSUKA, Godfrey (2024): Social Media and Digital Inequity: Reducing Health Inequities by Closing the Digital Divide. *International Journal of Environmental Research and Public Health,* 21(11). Online: https://doi.org/10.3390/ijerph21111420

Kaihlanen, Anu-Marja – Virtanen, Lotta – Buchert, Ulla – Safarov, Nuriiar – Valkonen, Paula – Hietapakka, Laura – Hörhammer, Iiris – Kujala, Sari – Kouvonen, Anne – Heponiemi, Tarja (2022): Towards Digital Health Equity – A Qualitative Study of the Challenges Experienced by Vulnerable Groups in Using Digital Health Services in the Covid-19 Era. *BMC Health Services Research,* 22(1). Online: https://doi.org/10.1186/s12913-022-07584-4

Kersan-Škabić, Ines – Vukašina, Martina (2023): Contribution of ESIFs to the Digital Society Development in the EU. *Journal of International Studies,* 16(2), 195–210. Online: https://doi.org/10.14254/2071-8330.2023/16-2/13

Kolupaieva, Irina – Tiesheva, Larysa (2023): Asymmetry and Convergence in the Development of Digital Technologies in the EU Countries. *Equilibrium Quarterly Journal of Economics and Economic Policy,* 18(3), 687–716. Online: https://doi.org/10.24136/eq.2023.022

Korgun, Irina – Hoti, Altin (2023): Dynamics of Bilateral Digital Trade: The Case of a Korea–EU Digital Partnership. *Economies,* 11(10). Online: https://doi.org/10.3390/economies11100248

Kovács, Tünde Z. – Bittner, Beáta – Huzsvai, László – Nábrádi, András (2022): Convergence and the Matthew Effect in the European Union Based on the DESI Index. *Mathematics,* 10(4). Online: https://doi.org/10.3390/math10040613

Lastauskaite, Aiste – Krušinskas, Rytis (2024): The Impact of Production Digitalization Investments on European Companies' Financial Performance. *Economies,* 12(6). Online: https://doi.org/10.3390/economies12060138

Lucas, Margarida – Bem-Haja, Pedro – Santos, Sandra – Figueiredo, Hugo – Dias, Marta F. – Amorim, Marlene (2022): Digital Proficiency: Sorting Real Gaps from Myths among Higher Education Students. *British Journal of Educational Technology,* 53(6), 1885–1914. Online: https://doi.org/10.1111/bjet.13220

Małkowska, Agnieszka – Urbaniec, Maria – Kosała, Małgorzata (2021): The Impact of Digital Transformation on European Countries: Insights from a Comparative Analysis. *Equilibrium Quarterly Journal of Economics and Economic Policy,* 16(2), 325–355. Online: https://doi.org/10.24136/eq.2021.012

Marienko, Victoria – Nikitenko, Vitalina – Voronkova, Valentina (2023): Informatisation of the Digital Economy as the Main Trend of Exponential Development. *Baltic Journal of Economic Studies,* 9(4), 178–183. Online: https://doi.org/10.30525/2256-0742/2023-9-4-178-183

Matrosova, Liudmyla – Kononenko, Yana (2024): Strategic Development of Modern Business in the Conditions of Digitalization and European Integration. *SWorld Journal,* 2(23, Part 2), 144–154. Online: https://doi.org/10.30888/2709-2267.2024-23-00-063

Maucorps, Ambre – Römisch, Roman – Schwab, Thomas – Vujanović, Nina (2023): The Impact of the Green and Digital Transition on Regional Cohesion in Europe. *Intereconomics,* 58(2), 102–110. Online: https://doi.org/10.2478/ie-2023-0021

Mirchevska, Tatiana P. – Daniloska, Natasha – Boshkovska, Diana – Mirchevska, Luiza (2023): Training as a Tool for Acquiring Skills for Digitalization of the Human Resource Management in the Republic of North Macedonia. *Economic Development,* 25(1–2), 6–19. Online: https://doi.org/10.55302/ED23251-206pm

Morozova, Svetlana – Kurochkin, Alexander (2021): Formation of Digital Competencies in the Public Policy Sphere: The EU and Russia Experience. *SHS Web of Conferences,* 129. Online: https://doi.org/10.1051/shsconf/202112906006

Mura, Petru O. – Donath, Liliana E. (2023): Digitalisation and Economic Growth in the European Union. *Electronics,* 12(7). Online: https://doi.org/10.3390/electronics12071718

Neményi, Dorka V. – Tóth, Balázs I. (2023): Assessing Digital Divide in European Transition Economies: The Application of Multidimensional Scaling to ICT-Related Data. *Külgazdaság,* 67(2), 1–28. Online: https://doi.org/10.47630/KULG.2023.67.eng.2

Nowak, Anna – Jarosz-Angowska, Aneta – Krukowski, Artur (2022): Potencjał biogospodarki w Polsce na tle krajów Unii Europejskiej [The Potential of Polish Bioeconomy Compared to the European Union Countries]. *Przegląd Prawno-Ekonomiczny,* (4), 97–116. Online: https://doi.org/10.31743/ppe.13792

Nowak, Anna – Kasztelan, Armand (2022): Economic Competitiveness vs. Green Competitiveness of Agriculture in the European Union Countries. *Oeconomia Copernicana,* 13(2), 379–405. Online: https://doi.org/10.24136/oc.2022.012

Ntule, Ngangwa D. – Emmanuel, Ongo N. B. – Vera, Fuein (2024): Effect of Digitalization on Logistics Performance among Logistics Related Companies in Cameroon. *American Journal of Supply Chain Management,* 9(3), 1–16. Online: https://doi.org/10.47672/ajscm.2099

Oloyede, Abdulkarim A. – Faruk, Nasir – Noma, Nasir – Tebepah, Ebinimi – Nwaulune, Augustine K. (2023): Measuring the Impact of the Digital Economy in Developing Countries: A Systematic Review and Meta-Analysis. *Heliyon,* 9(7). Online: https://doi.org/10.1016/j.heliyon.2023.e17654

Ortega-Gras, Juan-José – Bueno-Delgado, María-Victoria – Cañavate-Cruzado, Gregorio – Garrido-Lova, Josefina (2021): Twin Transition through the Implementation of Industry 4.0 Technologies: Desk-Research Analysis and Practical Use Cases in Europe. *Sustainability,* 13(24). Online: https://doi.org/10.3390/su132413601

Pasierbiak, Paweł – Białowąs, Tomasz (2024): Imbalance in EU Trade with Selected Asian Economies – A Comparative Analysis Based on Gross Exports and Domestic Value-Added. *Humanities and Social Sciences Quarterly,* 31(1), 133–148. Online: https://doi.org/10.7862/rz.2024.hss.09

Pinto, Hugo – Nogueira, Carla – Vieira, Gabriela (2023): Digitalisation Landscape in the European Union: Statistical Insights for a Digital Transformation. *European Public & Social Innovation Review,* 8(1), 20–38. Online: https://doi.org/10.31637/epsir.23-1.2

Rađenović, Žarko – Krstić, Bojan – Marković, Milan (2022): Economic Performance of Agriculture in the European Union Countries. *Problems of Agricultural Economics,* 370(1), 5–21. Online: https://doi.org/10.30858/zer/145686

Reggi, Luigi – Gil-García, Ramon J. (2021): Addressing Territorial Digital Divides through ICT strategies: Are Investment Decisions Consistent with Local Needs? *Government Information Quarterly,* 38(2). Online: https://doi.org/10.1016/j.giq.2020.101562

Rehman, Faheem U. – Islam, Monirul – Sohag, Kazi (2022): Does Infrastructural Development Allure Foreign Direct Investment? The Role of Belt and Road Initiatives. *International Journal of Emerging Markets,* 19(4), 1026–1050. Online: https://doi.org/10.1108/IJOEM-03-2022-0395

Sanz, Luis F. (2023): Digital Skills: A Deep-Dive. *Digital Skills and Jobs Platform,* 29 August 2023. Online: https://digital-skills-jobs.europa.eu/en/latest/briefs/digital-skills-deep-dive

Sharma, Swapnil – Kar, Arpan K. – Gupta, M. – Dwivedi, Yogesh K. – Janssen, Marijn (2022): Digital Citizen Empowerment: A Systematic Literature Review of Theories and Development Models. *Information Technology for Development,* 28(4), 660–687. Online: https://doi.org/10.1080/02681102.2022.2046533

Simionescu, Mihaela (2022): The Insertion of Economic Cybernetics Students on the Romanian Labor Market in the Context of Digital Economy and Covid-19 Pandemic. *Mathematics,* 10(2). Online: https://doi.org/10.3390/math10020222

Simões, Francisco – Marta, Elena (2024): Public Employment Services and Vulnerable Youth in the EU: The Case of Rural NEETs. *Politics and Governance,* 12. Online: https://doi.org/10.17645/pag.7432

Torres, Jorge – San-Mateos, Rosa – Lasarte, Natalia – Mediavilla, Asier – Sagarna, Maialen – León, Iñigo (2024): Building Digital Twins to Overcome Digitalization Barriers for Automating Construction Site Management. *Buildings,* 14(7). Online: https://doi.org/10.3390/buildings14072238

UNESCO Institute for Statistics (2009): Guide to Measuring Information and Communication Technologies (ICT) in Education. *Technical Paper,* (2). Online: https://uis.unesco.org/sites/default/files/documents/guide-to-measuring-information-and-communication-technologies-ict-in-education-en_0.pdf

Van Kessel, Robin – Wong, Brian Li H. – Rubinić, Ivan – O'Nuallain, Ella – Czabanowska, Katarzyna (2022): Is Europe Prepared to Go Digital? Making the Case for Developing Digital Capacity: An Exploratory Analysis of Eurostat Survey Data. *Plos Digital Health,* 1(2). Online: https://doi.org/10.1371/journal.pdig.0000013

Vandenbussche, Hylke – Connell, William – Simons, Wouter (2022): Global Value Chains, Trade Shocks and Jobs: An Application to Brexit. *World Economy,* 45(8), 2338–2369. Online: https://doi.org/10.1111/twec.13259

Veugelers, Reinhilde – Faivre, Clémence – Rückert, Désirée – Weiss, Christoph (2023): The Green and Digital Twin Transition: EU vs US Firms. *Intereconomics,* 58(1), 56–62. Online: https://doi.org/10.2478/ie-2023-0010

Vysochan, Lesya – Koziar, M. – Stelmah, Nina – Vasylyuk-Zaitseva, Svitlana (2024): Digital Transformation in Education: Using Technologies for Enhancement of Efficiency of Teaching. *Futurity Education,* 4(1), 186–209. Online: https://doi.org/10.57125/FED.2024.03.25.10

Wambach, Achim (2022): Wettbewerb in der digitalen Ökonomie [Competition in the Digital Economy]. *List Forum für Wirtschafts- und Finanzpolitik,* 48(1–2), 35–52. Online: https://doi.org/10.1007/s41025-022-00242-x

Wigger, Angela (2022): The New EU Industrial Policy and Deepening Structural Asymmetries: Smart Specialisation Not So Smart. *Journal of Common Market Studies,* 61(1), 20–37. Online: https://doi.org/10.1111/jcms.13366

Wynn, Martin – Felser, Kerstin (2023): Digitalisation and Change in the Management of It. *Computers,* 12(12). Online: https://doi.org/10.3390/computers12120251

YOUNAS, Ammar – MIRZARAIMOV, Bakhodir Tohir ogli (2021): To What Extent Are Consumers Harmed in the Digital Market from the Perspective of the GDPR? *International Journal of Multidisciplinary Research and Analysis,* 4(8). Online: https://doi.org/10.47191/ijmra/v4-i8-17

ZĒVERTE-RIVŽA, Sandija – GIRDŽIŪTĖ, Laura – PARLIŃSKA, Agnieszka – RIVŽA, Peteris – NOVIKOVA, Anastasija – GUDELE, Ina (2023): Digitalisation in Bioeconomy in the Baltic States and Poland. *Sustainability,* 15(17). Online: https://doi.org/10.3390/su151713237

ZIELINSKA, Agnieszka (2022): Developing Digital Skills: Results of a Social Innovation Project in the Technology Sector. *European Research Studies Journal,* 15(2), 684–701. Online: https://doi.org/10.35808/ersj/2989