



The relationship between GDP growth and digitalisation

Vzt'ah medzi rastom HDP a digitalizáciou

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Abstract:

This study starts with analysing previous literature to explain the impacts of digitalisation performance on economic development. The subjects of this study are the European Union member states, and their performances and development levels are considered. Member states' real GDP growth rate is collected to reveal the economic development levels. Digital Economy and Society Index (DESI) is used to understand their digital performance better. As a result of the analysis, member states with high digital performance are expected to be better off in the market, and their economic growth is estimated to have faster speed. Technological activities are assumed to have crucial roles in economic activity, including SMEs in e-commerce, mobile banking, and IT infrastructures. As a result of this study, less developed member states with low digital performances have higher GDP growth since they have more space for improvement. Therefore, the decisive effect of digitalisation on the economic growth rate cannot be presented in the expected way.

Keywords: GDP, Digital Economy and Society Index, Digitalisation, European Union.

Abstrakt:

Táto štúdia začína analýzou predchádzajúcej literatúry s cieľom vysvetliť dopady digitalizácie na ekonomický rozvoj. Predmetmi tejto štúdie sú členské štáty Európskej únie, zohľadňujúce ich výkonnosť a úroveň rozvoja. Zhromažďuje sa miera reálneho rastu HDP členských štátov, aby sa odhalili úrovne hospodárskeho rozvoja. Index digitálnej ekonomiky a spoločnosti (DESI) sa používa na lepšie pochopenie ich digitálneho výkonu. Na základe analýzy sa očakáva, že členské štáty s vysokou digitálnou výkonnosťou budú na tom lepšie na trhu a odhaduje sa, že ich hospodársky rast bude rýchlejší. Predpokladá sa, že technologické činnosti zohrávajú kľúčovú úlohu v hospodárskej činnosti vrátane MSP v elektronickom obchode, mobilnom



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bankovníctve a IT infraštruktúrach. Výsledkom tejto štúdie je, že menej rozvinuté členské štáty s nízkou digitálnou výkonnosťou majú vyššiu rast HDP, pretože majú väčší priestor na zlepšenie. Rozhodujúci vplyv digitalizácie na tempo ekonomického rastu preto nemožno prezentovať očakávaným spôsobom.

Kľúčové slová: HDP, index digitálnej ekonomiky a spoločnosti, digitalizácia, Európska únia.

Introduction

Recent decades have proven the importance of the implementation of technological developments. After the rapid development of the internet, the digital revolution brought a new style of communication, trade, education, and business. The capitalisation of tech-oriented companies is growing daily, and their impact on the world economy is uncontradictable. The COVID-19 pandemic has once again proved the necessity of digital solutions for sustainable economic growth. Today, the digital economy blends in with global economies, and the European Union aims to represent digitalisation in the global market.

The impacts of digitalisation on economic growth can be correlated with its effects on businesses. For instance, implementing digital transformation and cross-border e-commerce activities creates a high chance for businesses to gain a competitive advantage in the market. Their services and products will improve rapidly through those transformations, and their markets will expand. The successful transformation to a Digital Single Market will bring many profits to workers and consumers. Demand for new jobs increases when businesses transform through more innovative solutions. Therefore, there are changes in creating jobs and the required skills of workers.

The EU considers digital developments a priority, and the Commission encourages member states to implement many actions. The actions taken towards the Digital Single Market are expected to be collaborative, aiming to achieve the European economy's digitalisation. As a result, efficiency, productivity, sustainability, economic development, and economic growth are expected to improve through these digitalisation actions in the European Union. Expected results may prove digital improvements benefit the region's economic development level. A group of countries with high digital performances are expected to match with more developed member states. Since the EU has a standard institutional structure with a single labour, capital, goods, and services market, it is easier to compare countries in the aspects of economic growth caused by high digital performances. Additionally, comparing member states will give precise results because of the region's unique governance model.

Previous studies agree that digitalisation performances should positively affect economic growth based on the linear correlation between Gross Domestic Product (GDP) per capita and International Telecommunications Union (ITU) databases. Still, digitalisation's impact on economic growth speed is not explored, and this study will discuss this topic.

1. Literature view

Text It is crucial to start this study with the definition of digital transformation, and there is no way better than to explain this by analysing the previous study written by Parviainen, Tihinen, Kääriäinen, and Teppola. In this study, digital transformation is described as changes in methods of working, roles, and business offerings generated by the use of digital technology in an organisation or the company's operating environment. While explaining digital transformation, the authors focus on barriers to digitalisation and potential ways to solve them in numerous sectors. They define the transformation through four levels of change: process level (introducing digital tools to increase efficiency), organisation level (improving the existing services & processes), business domain level (transforming value chains & structures), and society level. On this basis, the authors discuss the necessity of proper implementation of digital initiatives, for instance, investing in new technology and skill development of employees. They advocate for a customer-centric approach to digitisation and data analytics to gather insights through decision-making. They also emphasise the advantages of digitisation (e.g. the effects on efficiency and competitiveness) while recognising the hazards, such as cybersecurity threats. Ultimately, the authors highlight the significance of adjusting to the digital age to remain competitive and successful in business.¹

Similar to this study, Henriette, Feki, and Boughzala explore the elements that drive and constrain digital transformation in their study. They analyse these elements through organisational, technological, and cultural variables. The authors define the possible risks and constraints of digital transformation by including privacy issues and the digital divide. However, they mention that the primary advantages of digital transformation play a crucial role in a company's future development and point out the importance of achieving customer satisfaction with digital strategies.²

Text The report suggests a new paradigm for researching digital transformation, including four dimensions: strategic, organisational, technological, and human. According to the authors, this paradigm can assist firms in better understanding and implementing digital transformation plans. This paradigm and the recommendations of this study have similarities with the report conducted by Reis, Amorim, Melão, and Matos. The authors suggest a framework for the researchers to understand digital transformation's future better. The framework includes five research streams: analysing the impact of digital transformation on organisations, investigating the role of digital leadership in digital transformation, understanding the technical aspects of digital transformation, researching the impact of digital transformation on the workforce, and researching the ethical & social implications of digital transformation. As a conclusion of the report, the authors identify areas for further research in each of

¹ Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge: how to benefit from digitalization in practice. *International journal of information systems and project management*, 5(1), 63-77.

² Henriette, E., Feki, M., & Boughzala, I. (2015). The shape of digital transformation: a systematic literature review.

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these streams, which can assist companies in efficiently implementing digital transformation plans.³

A four-stage digital transformation approach for SMEs presented by Szopa and Cyplik is also an essential resource for the field. The first step is awareness, during which SMEs recognise the need for digital transformation and evaluate their present digital capabilities. The second step has been given as strategy creation, in which SMEs create a defined digital transformation plan connected with their company objectives. The third step is implementation, in which SMEs implement digital technology and procedures to achieve their digital transformation objectives. The fourth and final step is continuous improvement, in which SMEs monitor and assess their digital transformation activities. In addition, the authors emphasise the significance of leadership and employee involvement in digital transformation projects. They argue that leadership is critical for successful digital transformation strategies, and employee participation is required for effective implementation. Overall, the paper gives a pragmatistic strategy for SMEs to use for improving digital transformation strategies and shows ways to remain competitive and grow faster in the digital age.⁴

Furthermore, when we analyse the case study held by Chantias, Myers, and Hess, we get a clear demonstration of how the financial services provider overcame the challenges of digital transformation by establishing a separate digital unit within the organisation, implementing agile methodologies, and leveraging external partnerships to gain access to digital expertise.⁵ The authors present the necessity of strong leadership and organisational culture in enabling effective digital initiatives, which complements the studies we mentioned earlier. The paper delves into the complexity of building a digital proposal for pre-digital companies and emphasises the significance of approaching digital transformation fundamentally and contextually.⁶ They recommend that environmental, organisational, strategic, and managerial factors be deeply evaluated, and they have to be covered in formulating digital transformation strategies.⁷

One of the most important studies regarding the relationship between GDP growth and digitalisation is the report by Judith Scherer and Michael Mandel, which includes how digital technologies boost economic growth and productivity. The authors argue that digital technologies have been and will continue significantly contributing to

³ Reis, J., Amorim, M., Melão, N., & Matos, P. (2018). Digital transformation: a literature review and guidelines for future research. *Trends and Advances in Information Systems and Technologies: Volume 1* 6, 411-421.

⁴ Szopa, Ł., & Cyplik, P. (2020). The concept of building a digital transformation model for enterprises from the SME sector. *LogForum*, 16(4).

⁵ Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. V. (2013). Digital business strategy: toward a next generation of insights. *MIS quarterly*, 471-482.

⁶ Berman, S. J. (2012). Digital transformation: opportunities to create new business models. *Strategy & leadership*, 40(2), 16-24.

⁷ Chantias, S., Myers, M. D., & Hess, T. (2019). Digital transformation strategy making in pre-digital organizations: The case of a financial services provider. *The Journal of Strategic Information Systems*, 28(1), 17-33.

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economic growth. They point out several significant ways digital technologies foster economic expansion by creating new industries and jobs. They mention the importance of digitalisation technologies to enable specific new products and services that are not accessible without digitalisation. The significant rise in efficiency and reduced costs in a wide range of industries are also highlighted throughout the report.

Moreover, innovation and its effects on Small and Medium-sized Enterprises (SMEs) are presented. It is also pointed out that the advantages of digital technologies are imbalanced and that specific geographical locations and sectors are more suited than others to profit from them. As a result of the report, the authors advise governments to concentrate on ensuring that all areas and sectors have access to the facilities, personnel, and tools required to benefit from digital technology fully. They recommend that policymakers prioritise spending on digital skills and infrastructure to guarantee that all sectors of the economy can benefit from the new technologies.⁸ We can easily see the European Council's efforts regarding the recommendations above. One of the biggest obstacles behind the European Digital Single Market is the imbalanced nature of the digital developments in each member state. Therefore, the European Council tries to take action to create harmonised improvements all around Europe (the actions are going to be explained further in Chapter IV.).

The growing relevance of ICT in the global economy led to a growing interest in researching the link between ICT and economic growth, and this caused research to occur in regional studies. One of the critical research areas can be seen as Latin America when we look at the analysis made to explore the relationship between ICT and economic growth. On the one hand, Campos has focused on the association between ICT and economic growth using data from a panel of ten Latin American nations from 1990 to 2010. The author discovered a favourable association between ICT and regional economic growth. However, he found this correlation weak and suggested a different path to discover it further. The author specifically argued that IT investment influences regional economic growth, particularly in the early phases of development. Additionally, Campos evaluated that IT has a more significant influence on economic growth in nations with higher levels of human capital.⁹

On the other hand, the research by A. Aleksandrova and M. Khabib discovers the link between ICT and GDP growth using data from 41 nations, covering both developed and developing economies. The study presents that while ICT significantly influences productivity in developed and developing countries, it substantially impacts job creation and innovation in developed nations. The authors

⁸ Mandel, M., & Scherer, J. (2015). A Low-Cost and Flexible Approach for Tracking Jobs and Economic Activity Related to Innovative Technologies.

⁹ Campos, N. F. (2010). The impact of information and communication technologies on economic growth in Latin America in comparative perspective. In *Innovation and Economic Development*. Edward Elgar Publishing.

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recommend that developing economies prioritise infrastructure and human capital development to enable ICT investment.¹⁰

Furthermore, the Organization for Economic Cooperation and Development (OECD) published a "Measuring the Digital Economy" report. The report presents a methodology for assessing the digital economy and various issues that must be solved to evaluate the digital economy accurately. This report gives a guideline for researchers and policymakers to understand the dynamic between the global economy and digitalisation. The report notes several obstacles in evaluating the digital economy, including the quickly changing nature of digital technology, a lack of common definitions and standards, and difficulty determining the value of many digital goods and services.¹¹ This leaves traditional economic statistics behind because it is argued that they may not fully represent the value of the digital economy. To overcome the issues of evaluating digitalisation and its effects, the report suggests incorporating new data sources into traditional economic statistics, such as online scraping and data from digital platforms. It also highlights the importance of openness, transparency, and data access for efficient measurement.

Based on the many kinds of research on digitalisation, there is significant evidence regarding the influence of digitisation on productivity growth. Still, the impact of digitalisation may be overestimated, given that many digital services are challenging to quantify.¹² The influence of innovation cannot be presented as clearly as others in each industry. Evaluating the software and telecommunications industries in the area gives strong correlations. However, we should acknowledge that the influence of digitalisation on innovation may be restricted in specific industries in the global economy, such as manufacturing.

Employment is another critical factor that digital improvements affect, and the data for this issue is conflicting. While some studies claim that digitalisation has caused employment displacement in some areas, others claim it has provided new job prospects.¹³ We can give an example of the issues in employment by covering the effects of COVID-19. The study presented by Connor, Conboy, and Dennehy gives essential insights into the influence of the COVID-19 pandemic on information system development for remote employees, as well as the problems and possibilities caused by this unexpected shift to remote work. According to the authors, the transition to remote work has resulted in the fast growth of information systems and a growing dependence on cloud-based technology. However, they identified several obstacles, such as additional security measures, difficulty sustaining communication

¹⁰ Aleksandrova, A., & Khabib, M. D. (2022). The role of information and communication technologies in a country's GDP: A comparative analysis between developed and developing economies. *Economic and Political Studies*, 10(1), 44-59.

¹¹ OECD (2014), *Measuring the Digital Economy: A New Perspective*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264221796-en>.

¹² Ishnazarov, A., Kasimova, N., Tosheva, S., & Isaeva, A. (2021, December). ICT and Economic Growth: Evidence from Cross-Country Growth Modeling. In *The 5th International Conference on Future Networks & Distributed Systems* (pp. 668-671).

¹³ Biagi, F., & Falk, M. (2017). The impact of ICT and e-commerce on employment in Europe. *Journal of Policy Modeling*, 39(1), 1-18.

and collaboration in a distant setting, and more robust remote training/support. The essential outcome that needs to be taken from this research is for enterprises to promote the creation of adaptable and resilient information systems to better prepare for future catastrophes and faster growth.¹⁴

The next Chapter covers each issue mentioned in the previous studies and presents how the European Union takes action to overcome them. Since the methods and data sources are still unclear to give specific answers for the correlation between economic growth and levels of digitalisation, this study aims to focus not only on statistical measures but also on the background story behind the achievements towards the European Digital Single Market.

2. The EU'S path to the digital decade

The 21st century showed more profound developments due to digitalisation, starting with fast innovations globally. The European Union (EU) has been going through a significant change in varying ways during the last decades in the digital arena. The Commission's goals in the digital arena cover a wide range of reforms.¹⁵

In 2030 (Digital Compass), the Commission expects a digitally skilled population and highly skilled digital professionals. Also, the concrete targets set out for secure/sustainable digital infrastructures, digital transformation of businesses, and digitalisation of public services. This system will enable a more efficient EU-wide borderless digital market and connect member states at a higher level with end-to-end digital public services. This cooperation between member states is expected to increase the market share of the EU drastically. According to several studies, it is estimated that if the digital agenda can be implemented based on the standards set by the Commission, it will contribute a minimum of €415 billion to the EU GDP each year.¹⁶

The Commission works with programmes, bodies, projects, and monitoring tools to demolish each challenge through digitalisation. The European legislation covers the telecom sector, copyright law, digital service provision, personal data protection, geo-blocking, Big Data, Intellectual Property Rights Enforcement, etc. This set of standardisations enables the Union to control everyday actions.¹⁷

¹⁴ O Connor, M., Conboy, K., & Dennehy, D. (2022). COVID-19 affected remote workers: a temporal analysis of information system development during the pandemic. *Journal of Decision Systems*, 31(3), 207-233.

¹⁵ Elmassah, S., & Hassanein, E. A. (2022). Digitalization and subjective wellbeing in Europe. *Digital Policy, Regulation and Governance*, 24(1), 52-73.

¹⁶ EUROPEAN COMMISSION, (2015). A Digital Single Market Strategy for Europe.COM/2015/0192 final. Retrieved from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52015DC0192>

¹⁷ Dudukalov, E. V., & Ushakov, D. (2020). Innovative development as a factor of european union economy digitalization. *International Journal of Organizational Innovation*, 13(2), 200-210.

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However, the most significant changes occur when member states actively participate in programmes/projects such as Digital Skills & Jobs. By mobilising member states, companies, social partners, and NGOs, digital skills have reached regional and local levels with projects under the Digital Skills and Jobs Coalition, such as digital public libraries, creating community digital classes, and educating job seekers in web development.¹⁸

Moreover, the EU considers e-commerce a key to economic growth because it provides new markets abroad for companies and gives a variety of options for customers. By that, companies will be able to benefit from economies of scale. Most importantly, SMEs will take advantage of competitiveness with fewer costs and a more efficient and productive environment. Some member states have a significant role in e-commerce activities, such as Czechia taking part with Ireland, Denmark, Belgium, and Sweden. In the meantime, companies still face many challenges adapting to cross-border activities. High delivery costs, language differences, legal problems, and disputes are the most common factors that hesitate over cross-border e-commerce in the EU.

Furthermore, the European Commission maintains the monitoring role based on the evolution of the services and technologies and the internet's openness in each member state. The European Structural and Investment Funds (ESIF) is a crucial incentive supporting the Commission's actions. In the 2014-2021 period, the ESIF provided 6 billion euros to implement national broadband plans in member states, and it will continue to help regarding the very high capacity networks in the upcoming years. In February 2021, the Recovery and Resilience Facility (RRF) was adopted with a budget of €723.8 billion. It aims to recover from the COVID-19 pandemic faster in member states by providing support in economic and social aspects.¹⁹ One of the most significant pillars under this regulation is green transition and digital transformation. Also, the RRF Regulation requires that each member state designates at least 20% of the allocation received for its RRP to foster the digital transition and/or address the resulting challenges. The leading countries that take steps to support digital transformation with this allocation were reported as Austria and Germany. More than 50% of their total spending was reported as being digital-related. In addition to those countries, Ireland, Lithuania, and Luxembourg have had more than 30% of expenditures to achieve digital targets.²⁰

Besides, consumption of digital goods and services increases when citizens have basic usage skills, which automatically yields a profit to economies. Since the COVID-19 pandemic has proven that we must develop our digital skills even more,

¹⁸ Horobet, A., Mnoghghitnei, I., Zlatea, E. M. L., & Belascu, L. (2022). The interplay between digitalization, education, and financial development: A european case study. *Journal of Risk and Financial Management*, 15(3), 135.

¹⁹ Cone, L., Brøgger, K., Berghmans, M., Decuypere, M., Förschler, A., Grimaldi, E., ... & Vanermen, L. (2022). Pandemic Acceleration: Covid-19 and the emergency digitalization of European education. *European Educational Research Journal*, 21(5), 845-868.

²⁰ Recovery and Resilience Facility. (2021). European Commission. https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en

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the importance of human capital in digitalisation has been rising. It is essential to mention that digital skills' social outcomes are affirmative with the economic benefits.²¹ Therefore, the social investment paradigm should be harmonised with digital skills policies.²² The EU frames digital skills by highlighting two facts. Firstly, digital skills are necessary for faster economic growth, European competitiveness, and better jobs. Secondly, they are imperative for the EU society in case a citizen wants to have better living standards and be able to participate in modern society.²³

However, the different levels of digitalisation formed in the Union have also changed rapidly and unpredictably depending on states' interests and according to the field's developments. Digital improvement enables more efficiency in the market, but simultaneously, it creates critical inequalities in European society. The multi-speed nature of the EU is continuous when it comes to digital performances as well. Due to the different speeds of digital improvement in member states, imbalanced competition still exists in the European Digital Single Market. The six founding members (Germany, France, Belgium, Italy, the Netherlands, Luxemburg) have been the source of crucial economic support to the rest of the Union since the beginning of the Union, and they are also Europe's largest economies. Besides, the development levels inside the Union have always been imbalanced. The differences can be observed distinctly if we consider Eastern European member states and Scandinavian member states. The situation is similar in member states' digital performances (Figure 1.). Therefore, the European Commission is concerned about the future of the European Single Market with the lack of common reforms in the digital arena.²⁴

There appears to be a need for the European Union regulations for each member state to harmonise the potential of digitalisation successfully. These regulations are expected to change the balance in the Union if they can be implemented correctly by less developed member states. The impact of these changes can be clarified with the help of this study. Additionally, the results may contribute to and complement previous studies in the field.

²¹ Zolkover, A., Petrunenko, I., Iastremska, O., Stashkevych, O., & Mehdizade, M. M. (2022). Benefits and risks of digital business transformation: the example of Eastern Europe countries. *Journal of Eastern European and Central Asian Research (JEECAR)*, 9(2), 344-356.

²² Esping-Andersen, G. (2002). *A new European social model for the twenty-first century. The new knowledge economy in Europe: a strategy for international competitiveness and social cohesion*, Cheltenham, Edward Elgar, 54-94.

²³ Europa, 2020. *Digital Skills & Jobs*. <https://ec.europa.eu/digital-single-market/en/policies/digitalskills>

²⁴ Boikova, T., Zeverte-Rivza, S., Rivza, P., & Rivza, B. (2021a). The determinants and effects of competitiveness: The role of digitalization in the european economies. *Sustainability (Basel, Switzerland)*, 13(21), 11689. doi:10.3390/su132111689

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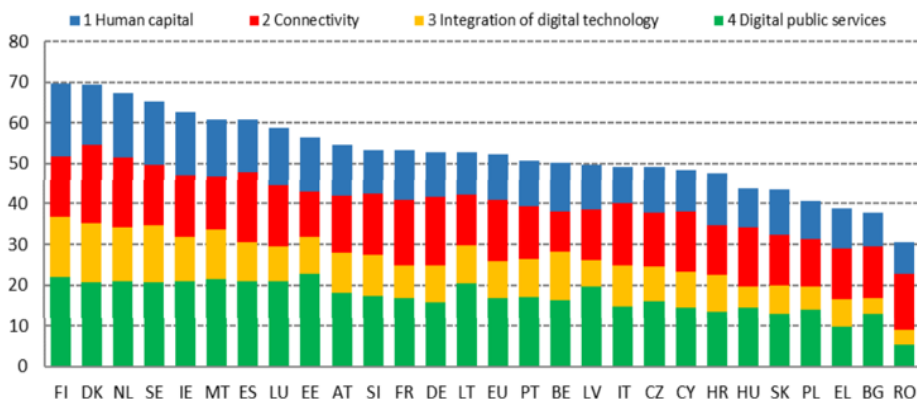


Figure 1. Digital Economy and Society Index, 2022

Source: DESI 2022, European Commission

3. Methodology

Since the study does not have a primary dataset, the main sources are online quantitative reports. Firstly, the economic development of member states is measured with one of the most common economic indicators: the real GDP growth rate published by Eurostat every year. Secondly, the digitalisation levels of member states are examined based on the Digital Economy and Society Index that the European Commission monitors.

Starting from 2014, the European Commission has been keeping an eye on the digital performances of each member state through the Digital Economy and Society Index (DESI)

reports. DESI has a crucial role in the field because it helps researchers analyse the countries lacking technological adaptation, underdeveloped infrastructure, and outdated technologies. It gives the Commission better insight into specific areas in certain member states.

Therefore, the indicators of each thematic Chapter should be explained further. DESI includes four main thematic chapters: Human Capital, Connectivity, Integration of Digital Technology, and Digital Public Services. Firstly, Human Capital covers many indicators related to individuals' digital and software skills and the number of ICT specialists, ICT graduates, and enterprises providing ICT training. Secondly, Connectivity focuses on metrics such as overall fixed broadband take-up, fast broadband coverage, VHCN coverage, 5G readiness, broadband price index, etc.

Furthermore, SMEs with at least a basic level of digital intensity, electronic information sharing, social media, big data, cloud, artificial intelligence (AI), ICT for environmental sustainability, e-commerce turnover, and selling online cross-border

are the indicators under the Integration of Digital Technologies chapter. Finally, the Digital Public Services chapter serves the data with the help of its indicators listed: e-government users, pre-filled forms, open data, and digital public services for citizens and businesses. All these four thematic chapters, with their detailed indicators, give us a solid foundation to compare and correlate with other data sources. It is considered that these indicators can be compared with the GDP growth rate to evaluate the objectives of this study.²⁵

The census of this study covers around 447.7 million inhabitants with 27 Member States of the EU. The study focuses on the DESI reports published from 2018 to 2022, and Eurostat reports for GDP in 2018-2022. It is essential to mention that the EU average scores in DESI 2018 and DESI 2019 still include the United Kingdom because each report presents the data collected from the previous year.

To extend this study, many descriptive statistic methods can measure the connection between economic growth and digitalisation. These complementary methods can be based on many other data sources as well, such as the OECD data sources (e.g. Science, Technology, and Innovation Scoreboard), Digital Evolution Index, World Development Index (WDI), Digital Density Index (DDI), Networked Readiness Index (NRI), etc. In light of the database findings, suitable descriptive statistics should be measured and presented. Correlation, regression, and cluster analyses are suitable for further study evaluation.

4. Results

Since the organisation's beginning, the EU has been diverse and differentiated. Out of 27 Member States, 19 countries belong to the Eurozone. The Schengen space (26 members) comprises the EU and non-EU, just like the single market, which has broader coverage (30 countries, including the EEA members). Finally, 21 countries are inside both NATO and the EU.²⁶ Therefore, like in every other area, countries' digital performances are diverse inside the EU. This multi-speed scheme of the Union can be seen clearly from DESI reports and GDP growth rates.

²⁵ Batool, S., Gill, S. A., Javaid, S., & Khan, A. J. (2021). Good governance via E-Governance: moving towards digitalization for a digital economy. *Review of Applied Management and Social Sciences*, 4(4), 823-836.

²⁶ Multi-speed Concept is in the European Union's DNA - GLOBSEC. (2020, May 26). GLOBSEC. <https://www.globsec.org/publications/multi-speed-concept-is-in-the-european-unions-dna/> Accessed: 2020, October 27

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COUNTRY	Real GDP growth rate (%) ²⁸					DESI Rank				
	2018	2019	2020	2021	2022	2018	2019	2020	2021	2022
European Union - 27 countries (from 2020)	2.1	1.8	-5.6	5.7	3.4	:	:	14 (52.6%)	15 (50.7%)	15 (52.28%)
Belgium	1.8	2.3	-5.4	6.3	3.2	8	9	8	12	17
Bulgaria	2.7	4.0	-4.0	7.6	3.4	27	29	28	27	27
Czechia	3.2	3.0	-5.5	3.6	2.4	18	19	17	19	20
Denmark	2.0	1.5	-2.4	6.8	2.7	1	4	3	1	2
Germany	1.0	1.1	-3.8	3.2	1.8	14	12	11	11	13
Estonia	3.8	4.0	-1.0	7.2	-0.5	9	8	7	7	9
Ireland	8.5	5.3	6.6	15.1	9.4	6	7	6	5	5
Greece	1.7	1.9	-9.0	8.4	5.9	28	27	27	26	26
Spain	2.3	2.0	-11.2	6.4	5.8	10	11	10	9	7
France	1.9	1.8	-7.5	6.4	2.5	19	16	15	16	12

Croatia	2.8	3.4	-8.5	13.1	6.2	23	21	20	20	22
Italy	0.9	0.5	-9.0	8.3	3.7	26	25	25	21	19
Cyprus	5.6	5.5	-4.4	6.6	5.6	22	23	24	22	21
Latvia	4.0	2.6	-2.3	4.3	2.8	20	18	18	18	18
Lithuania	4.0	4.6	0.0	6.0	1.9	13	15	13	14	14
Luxembourg	1.2	2.9	-0.9	7.2	1.4	5	6	9	8	8
Hungary	5.4	4.9	-4.5	7.2	4.6	24	24	21	24	23
Malta	7.4	7.1	-8.1	12.3	6.9	12	10	5	6	6
Netherlands	2.4	2.0	-3.9	6.2	4.3	4	3	4	4	3
Austria	2.4	1.5	-6.5	4.6	4.8	11	13	12	10	10
Poland	5.9	4.5	-2.0	6.9	5.1	25	26	23	25	25
Portugal	2.8	2.7	-8.3	5.7	6.8	17	20	19	17	16
Romania	6.0	3.9	-3.7	5.8	4.7	29	28	26	28	28
Slovenia	4.5	3.5	-4.2	8.2	2.5	16	17	16	13	11
Slovakia	4.0	2.5	-3.3	4.9	1.7	21	22	22	23	24
Finland	1.1	1.2	-2.4	3.2	1.6	3	1	1	2	1
Sweden	2.0	2.0	-2.2	6.1	2.8	2	2	2	3	4
United Kingdom	1.3	1.4	:	:	:	7	5	:	:	:

¹ Multi-speed Concept is in the European Union's DNA - GLOBSEC. (2020, May 26). GLOBSEC. <https://www.globsec.org/publications/multi-speed-concept-is-in-the-european-unions-dna/> Accessed: 2020, October 27

¹ The idea of the empirical strategy of this table is based on the study "Economic growth in the conditions of digitalization in the EU countries" written by Vyshnevskiy, O., Stashkevych, I., Shubna, O., and Barkova, S. in 2020.

¹ Time frequency: Annual

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Unit of measure: Chain linked volumes, percentage change on previous period, per capita

National accounts indicator (ESA 2010): Gross domestic product at market prices

Source: This table is compiled by the author based on the data from Eurostat and DESI reports.

According to DESI reports, the leading countries in digitalisation are Sweden, Finland, Denmark, and the Netherlands in all years. In the case of low performers, the results also include almost the same countries each year. The countries with low performance are Romania, Bulgaria, Croatia, Greece, Poland, and Italy. Most importantly, Eastern European and Balkan member states have many challenges through digitalisation. The lack of institutions and resources to develop themselves towards ICTs is one of the biggest problems in these regions. These countries cannot step up for digital integration with other member states.

In 2019, Lithuania, Poland, Hungary, Croatia, Bulgaria, Estonia, Romania, and Cyprus had the highest positions in GDP growth. Unlike in the aspect of digitalisation, these countries perform well when it comes to economic growth. Even if their development level is lower than that of Finland, Denmark, etc., their economic growth is faster than those developed countries. Although the expected results were set for the opposite outcome, the leaders of DESI (Finland, Denmark, Sweden, and the Netherlands) do not match the leaders of GDP growth because their GDP growth rates are around 1-2% each year in usual times. The correlation between economic growth and digitalisation cannot be proven based on this analysis. However, the benefits of digitalisation should not be underestimated, and further research with more data may give better results in this field.

According to the analysis I worked on, we can conclude that 2020 is not the best year to evaluate economic growth because of the devastating impact of the pandemic on the world economy. In addition, Brexit badly affected the European economy in the same year. However, its impact on Ireland's GDP growth rate in 2020 was positive. When many member states suffered from the drastic effect of COVID-19 and had negative GDP growth rates, Ireland's growth rate was recorded as 4.7%. Some of the reasons behind this level of economic growth might be continuous successful performances in digitalisation, but the main reason is the increasing trade flows due to Brexit.

Besides, we can surprisingly see a robust negative correlation based on the scatter plot between the GDP growth, and DESI ranks in 2022.²⁷ This significant negative relationship presents that countries with lower DESI ranks have higher GDP growth. (Figure 2.) However, the causation is unclear, and it is unclear whether one variable causes the other based on this analysis. Also, the absence of statistical evidence on the positive impact of digitalisation on economic growth did not allow us

²⁷Number of observations = 28 Spearman's rho = -0.198867144 Test of H0: GDP rank and DESI rank are independent. Prob > |t| = 0.0015

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to confirm the hypothesis of this study. "The high performance in digitalisation will result in faster economic growth" was the expected conclusion. However, the opposite correlation is presented when we create the scatter plot and run Spearman's rank correlation coefficient. This unexpected result might be the omitted data under this model. In short, a model that aims to explain the impact of digitalisation on economic development through DESI rank has an absence for complementing the hypothesis.

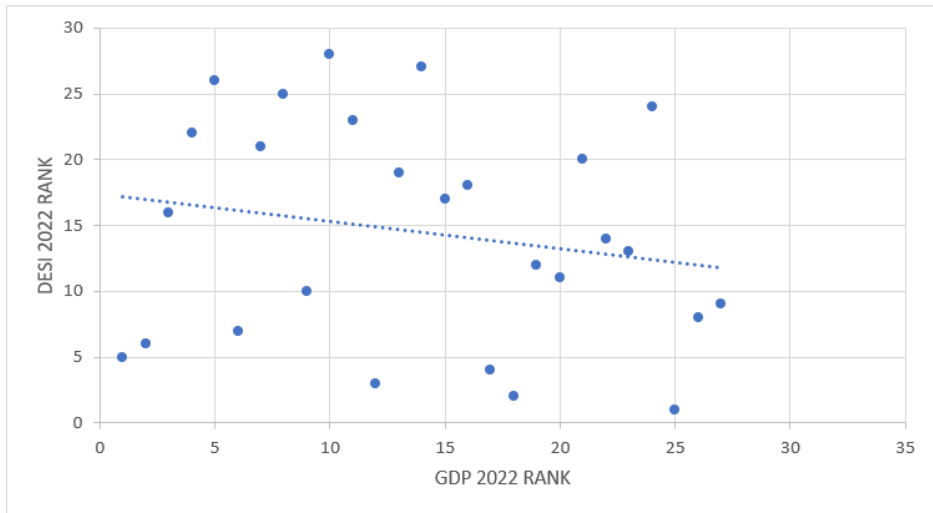


Figure 2. Scatter plot between the rank of DESI 2022 and the rank of member states based on their real GDP growth rate in 2022

Source: This graph is compiled by the author.

Additionally, the evolution of DESI dimensions (digital public services, integration of digital technology, connectivity, and human capital) will give a better understanding of the improvements in digitalisation in the EU (Figure 3.). These dimensions are not improving at the same level over time. For instance, digital public services (purple) increase rapidly and continuously when developments in human capital (blue) do not meet the Commission targets. This also shows that many member states prefer to focus on the changes in connectivity and digital public services.

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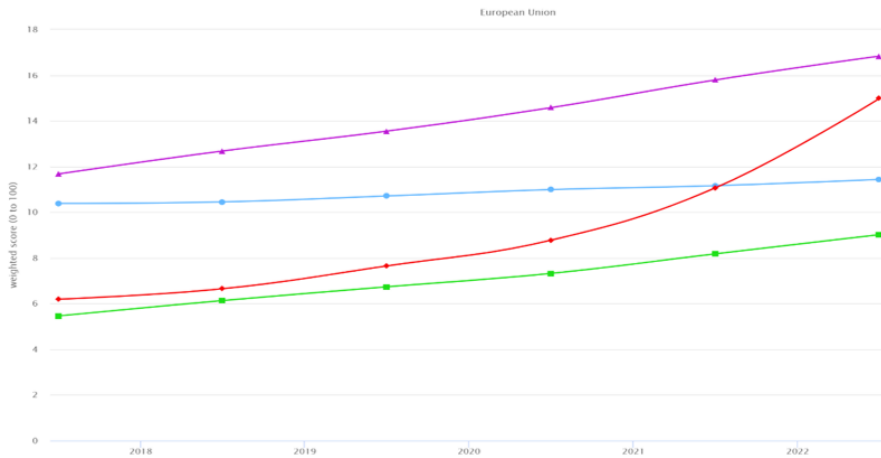


Figure 3. The Evolution of DESI Dimensions in the EU between 2016-2022.²⁸

Source: European Commission, 2022.

Estonia is one of the best examples of slowly but surely implementing digital practices for its citizens. Estonia successfully implemented the best practices compared to other member states during the last decade. In digital public services, almost every institution and citizen uses digital platforms. For instance, Estonia is the first country to offer electronic voting in a national election. Also, entrepreneurs can directly start up a company online if they open an Estonian online bank account.²⁹ Besides its impact on businesses, the environmental impact of Estonian digitalisation practices is dramatic with its 99% paperless state services.

However, as a founding member of the EU, Italy has an unexpected performance in digitalisation. In each DESI report, Italy ranked around fifth to last, and before the pandemic, the country put minimum effort into boosting digitalisation. Today, the necessity of digital solutions is acknowledged, and a substantial digital acceleration has been forced on the country. The most crucial change suggested is in businesses and their strategy for digital innovation. The digital gap in Italy is concerning since most companies are family-owned, and the country has one of the most minor shares of ICT graduates in the EU.³⁰ With its large public debt, Italy has not been able to achieve digital transformation yet. The steps taken after the pandemic are usually

²⁸ Purple: Digital Public Services, Green: Integration of Digital Technology, Red: Connectivity, Blue: Human Capital.

²⁹ What Estonia can teach us about digital transformation -. (2018, March 26). Clouddirect.net. <https://www.clouddirect.net/what-estonia-can-teach-us-about-digital-transformation/>

³⁰ Za, V. (2021, March 21). Pandemic leaves digital laggard Italy scrambling to catch up. U.S. <https://www.reuters.com/article/uk-health-coronavirus-italy-digital-insi-idUSKBN2BD0B6>

crisis-driven. Therefore, sustainable digital expansion is not expected soon in the country.³¹

Despite that, the rapid improvements in Malta, Ireland, and Slovenia should not be avoided. These countries are expected to catch up soon with the Scandinavian countries. Under some thematic chapters, certain member states improve their performances faster than others. For instance, even if Bulgaria is the most minor performer in the Union, it increased more quickly under the human capital dimension than many other member states in the last three years.

In short, member states do not have the same speed of economic growth, and most of the member states cannot reach common targets in digitalisation. The collected data analysis did not support this study's objectives and expected outcome. Therefore, the correlation between economic growth and digitalisation cannot be presented clearly in this study. However, this study opens the opportunity for more extended research in this area.

Conclusion

This study complemented the previous studies based on the field by analysing the European Union's actions toward digitalisation and its effect on economic activity. The study has suggested that the importance of understanding the current situation in digitalisation is because of its future impacts on the European Single Market and the global market. According to the study results, it was assumed that successful performances in digitalisation would increase the market share of the EU drastically.

However, the impacts of digitalisation on economic growth cannot be presented with any positive evidence when we compare the databases of this study. The main conclusion of DESI reports is that the EU Single Market is not yet capable of performing at the same speed as the en bloc, and the barriers to the harmonised European Digital Single Market remain. Together with the differences in the development levels, member states with high and low digital performances are similar each year. Member states with higher GDP growth rates (Lithuania, Poland, Hungary, Croatia, etc.) have lower digitalisation performances than many other member states. Therefore, there is no significant positive correlation between the GDP growth rate and the DESI ranks.

It is recommended that the importance of local authorities in adapting projects and programmes should not be noticed to achieve faster digital improvements. The European Commission must attach particular importance to these authorities and use monitoring tools to guide digital reforms in local areas. In the end, the multi-speed nature of the European Union may harm the improvement of digitalisation by causing slower progress. Still, on the other hand, it enables a multi-dynamic digital market where companies are motivated to be a part of the competition.

³¹ Kamolov, S., & Stepnov, I. (2020). Sustainability through digitalization: European strategy. Paper presented at the , 208 03048. doi:10.1051/e3sconf/202020803048 Retrieved from <https://go.exlibris.link/XMLW4C15>

Even though the correlation between economic growth and digitalisation was absent in this study, further research may determine the positive economic effects of digital actions.

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