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Digitalization in Romania in the Context of Economic Changes

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ABSTRACT

The digitalization of the economy has become a powerful driving force in recent decades, significantly impacting economic growth globally. This transformation has brought about several changes in how businesses operate, how people interact, and how business transactions occur. In this article, we aimed to explore the influence of the digitalization of the economy on economic growth and highlight the benefits of this evolution. In this approach, we started by analysing the dynamics of digitalization indicators. To demonstrate the role of digitization in economic growth, we used regression analysis considering GDP per Capita as the dependent variable and several variables considered in the DESI calculation as causal variables.

1. Introduction

The challenges generated by the COVID-19 crisis have imposed digitalization as a sustainable and profitable work solution for individuals and companies. Digitalization represents one of the most dynamic contemporary trends, determining the development and expansion of significant processes of change and restructuring in almost all economic sectors and society as a whole, generating both opportunities and risks for the evolution of society (Gouvea, Kapelianis, & Kassicieh, 2018). From the perspective of globalization, digitalization has allowed and encouraged the development of new scalable business models, reducing the costs of searching, identifying and trading resources, but also of market activities, by increasing access to information and using increasingly efficient technologies (Hagberg, Malin, & Egels-Zandén, 2016), the automation of tasks and occupations and the emergence of new specific industries.

On the other hand, digitalization implies innovation, a process in which research and applying research results are necessary prerequisites. The innovative processes, which affected all fields of activity, determined significant economic transformations and reconfigured some business models. Of note are the key technologies of the last two decades that have accelerated the digitalization process, making it ubiquitous in the lives of individual users, namely, the smartphone, widely introduced in 2007, artificial intelligence (AI) or blockchain technology (OECD, 2017).

Therefore, digitalization has gained its rightful place not only in scientific and political debates but also in the concerns of researchers and public authorities (Neacsa, 2020); understanding digital transformation and how it influences the economy is increasingly relevant for researchers and decision-makers. In today's era of advanced technology, digitalization plays a fundamental role in the transformation and evolution of the economy. The digitalization process refers to adopting and using digital technologies in various aspects of business and society to improve efficiency, innovation and competitiveness. This article analyzes the impact of digitalization in the context of economic changes and underlines its importance in the sustainable development of society.

Digitalization has brought several apparent advantages to the economy. We can summarize these advantages in four categories as follows:

1. Improved operational efficiency:

The digitalization of the economy allows businesses to optimize operational processes through automation and advanced technologies. By implementing digital solutions, companies can reduce costs, increase productivity and accelerate production and distribution processes. This increased operational efficiency contributes to economic growth by maximizing the use of resources and reducing waste.

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2. Innovation and technological development:

The digitalization of the economy has opened up new opportunities for innovation and technological development. Companies can use emerging technologies such as artificial intelligence, data analytics and the Internet of Things to leverage their products and services. This technological innovation stimulates economic growth by creating new industries, jobs and business opportunities.

3. Accessibility and globalization:

The digitalization of the economy removes geographical barriers and facilitates access to international markets. Through e-commerce and company platforms, they can reach the entire world and expand their business effectively. This digital globalization opens new markets and stimulates economic growth by creating export opportunities and foreign investment.

4. Growth of entrepreneurship and the digital economy:

The digitalization of the economy has created an enabling environment for developing entrepreneurship and the digital economy. Start-ups and small businesses can benefit from low market entry costs and access to digital resources like e-commerce and online marketing platforms. Thus, implementing the digital economy in entrepreneurship contributes to economic growth by creating new jobs and stimulating innovation.

2. Literature review

In the fourth industrial revolution (Industry 4.0) stage, technology and economic-social transformations based on digitalization and automation emphasize the interaction between machines and people. The digitalization of the economy has become a central theme in recent decades, having a significant impact on the way businesses and society as a whole operate. Thus, in recent years, many scientists and experts in economics have highlighted the importance of digitalization in economic development. Digitalization has been considered a key factor in increasing economies' productivity, innovation and competitiveness, significantly impacting various sectors, including manufacturing, financial services, e-commerce and healthcare. A study published in 2017 by the Organization for Economic Cooperation and Development (OECD) highlighted that digitalization can contribute to economic growth, job creation and efficiency in different countries (OECD, 2017). Also, a 2016 World Economic Forum (WEF) report pointed out that digitalization can boost innovation and productivity, positively impacting economic development (WEF, 2016).

This transition to a digital economy has generated many debates and studies on its impact on economic growth. According to Hoßfeld (Hoßfeld, 2017), through digitalization, homo economicus evolves into homo cyberneticus.

Many researchers believe digitalization significantly impacts the economy by promoting innovation, efficiency and productivity. They argue that new digital technologies can stimulate economic growth by creating new business opportunities, improving operational processes and digital infrastructure, and increasing competitiveness and exports. Scientific articles in this field reveal various analyses that support this positive view (Sima et.al., 2020).

Digitalization supports innovation and productivity:

Authors Saxenian, A. L., & Hsu, J. Y. J. argue that digital interactions within technical communities contribute to economic growth and innovation (2001). Brynjolfsson, E. and McAfee, A. (2014) argue that digital technologies and automation can improve productivity and economic performance.

Digitalization requires the conceptual transformation of the supply chain. Digitalization has led to the creation of smart products that can bring new competitive advantages to companies, adding innovative and connectivity components to the physical component of the classic product (Porter & Heppelmann, 2014; Byun, 2018).

Digitalization can improve competitiveness and exports:

Bakari et al. (2022) found that digitalization and trade openness generate positive effects on economic growth, demonstrating the role of technology transfer and increased human expertise. Technological progress has also led to the growth of high-quality products with affordable prices, achieved by implementing manufacturing technologies based on automation and connectivity solutions, data and security. These efforts generate long-term effects, leading to increased business profitability (Weller, 2019).

On the other hand, some researchers are more skeptical about the impact of digitalization on economic growth. They bring up the concerns of automation and structural unemployment, increasing social inequality and the digital divide, exploitation of personal data and cyber security. It is important to note that there are also concerns about the negative effect of digitalization, such as the impact on the labour market and social inequalities. Some research has highlighted the risk that digitalization will lead to the polarization of the workforce and increased income inequality.

Büchner et al. (2022) address the negative aspects of digitalization, especially the impact on jobs and the unequal distribution of advantages economic. Acemoglu, D., & Autor, D. (2011) argue that digitalization can lead to increased wage inequality and discrepancies in access to well-paid job opportunities. The results of the studies so far (Autor, 2015; Ranzatti et al., 2019) show that digitalization is driving significant changes in the workforce. Some studies (J. Bejtkovský & Mulyaningsih, 2018; Kornelakis & Petrakaki, 2020) show that

digitalization does not have the potential to generate unemployment but will transform occupations and job profiles, which creates challenges for social policy.

Thus, new jobs have emerged that require new skills and abilities, which require changes in the educational profile of human capital (Sugandi & Kurniawan, 2018). By promoting collaborative consumption, the digital society generates new challenges for human behaviour, social and business practices, requiring the qualification of human resources for sustainable behaviour (Tao et al., 2019). Also, the evolution of technologies leads to the development of new employment models, namely, part-time, temporary, and on-demand (Kergroach, 2017). They offer the advantage of worker flexibility, which is especially desired by the young and the highly educated (Krzywdzinski, 2017). Also, women can benefit from the positive effects of digitalization, accessing specific fields more easily. On the other hand, people with a low level of education and who belong to disadvantaged social classes appear to be more exposed to risk and social insecurity (Agrawalet al. 2019). The development of communication technology in the digital economy imposes the need to ensure cyber security (Mishra, Alzoubi, Anwar, & Gill, 2022).

3. Current approaches to digitalization in Romania and in the European Union

Digitalization is a key factor in the context of economic changes in today's society. It refers to adopting and using digital technologies in various aspects of the economy and society to improve efficiency, stimulate innovation and create new opportunities. In order to analyze the dynamics of digitalization indicators at the level of the European Union, we considered the following data series:

- Digital Economy and Society Index (DESI);
- Households - level of internet access - the degree of access to the Internet at the household level;
- Broadband and connectivity – households - broadband internet connectivity at the household level;
- Broadband and connectivity – enterprises - broadband Internet connectivity at the level of companies;
- Individuals using the internet for interacting with public authorities;
- E-commerce, customer relation management (CRM) and secure transactions - the number of businesses with online sales;
- Integration of internal processes - the number of enterprises that have ERP software packages to share information between different functional areas.

These values are presented synthetically in Table 3.1 and in graphic form in Figures 3.1, 3.2, 3.3, 3.4, 3.5, 3.6 and 3.7. The data was extracted from Eurostat and the European Commission database, covering the period 2017-2022, with two exceptions.

Table 3.1. The evolution of digitalization indicators at the level of Romania and the European Union

	Digital Economy and Society Index (weighted score)		The degree of internet access at the household level (%)		Broadband internet connectivity at household level (%)		Broadband internet connectivity for companies (%)		People who use the Internet to interact with public authorities (%)		Businesses with online sales (%)		Businesses that have ERP software packages to share information between different functional areas (%)	
Year	UE	RO	UE	RO	UE	RO	UE	RO	UE	RO	UE	RO	UE	RO
2017	33.7159	19.3991	85.81	76.45	85.81	76.45	92.90	82.30	41.60	7.00	18.20	7.40	36.10	21.50
2018	35.9201	20.7227	87.94	80.89	87.94	80.89	92.90	84.50	43.31	7.38	16.90	6.50	-	-
2019	38.6443	22.3651	89.68	83.61	89.68	83.61	91.60	82.90	44.31	8.71	18.00	7.40	35.90	23.50
2020	41.6652	24.7263	91.30	86.24	91.30	86.24	93.30	86.80	47.68	10.05	18.70	18.90	-	-
2021	46.1997	27.4349	92.31	88.74	92.31	88.74	94.90	90.70	47.39	10.81	19.50	10.40	38.00	16.80
2022	52.2752	30.5849	92.48	89.41	92.48	89.41	94.90	97.20	-	-	20.60	10.90	-	-
Source:	European Commission, Digital Scoreboard		Eurostat - Digital economy and society (Online data code: ISOC_CI_IN_H)		Eurostat - Digital economy and society (Online data code: ISOC_BDE15B_H)		Eurostat - Digital economy and society (Online data code: ISOC_BDE15B_EN2)		Eurostat - Digital economy and society (Online data code: ISOC_BDE15EI)		Eurostat - Digital economy and society (Online data code: ISOC_BDE15DEC N2)		Eurostat - Digital economy and society (Online data code: ISOC_BDE15DIPN 2)	

For all indicators, Romania is below the European Union average, as can be easily seen by looking at the values in Table 3.1.

Figure 3.1 illustrates the evolution of DESI in Romania compared to the EU average. Although it registered an increasing evolution of DESI, in 2022, Romania is ranked last among the 27 EU member states.

This result is due to the lower relative annual growth than that of similar countries. This evolution shows that Romania needs to converge with the rest of the EU member states regarding digitalization. Romania needs to catch up in terms of the level of basic digital skills. On the other hand, Romania maintains a leading position regarding the proportion of female ICT specialists in the workforce and the number of graduates in the ICT field. Romania also scored well in connectivity, surpassing the EU average in using fixed broadband coverage services and very high-capacity fixed networks. However, Romania needs to improve its performance in terms of the integration of digital technologies and digital public services. The share of SMEs that have at least a basic level of digital intensity (22 %) and the percentage of businesses that exchange information electronically (17 %) is the lowest in the EU.

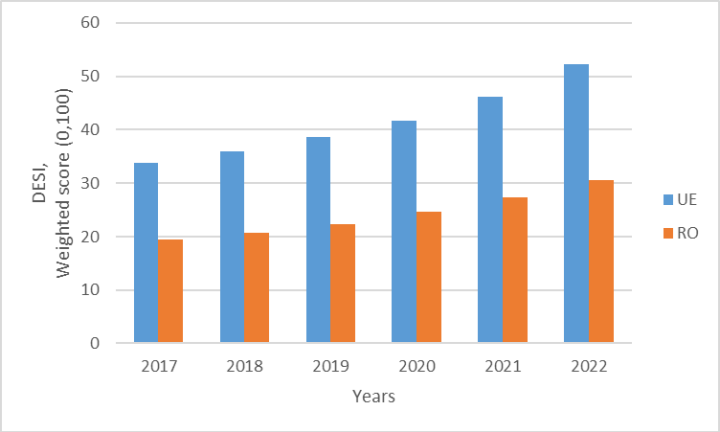

Figure 3.1. Evolution of the Digital Economy and Society Index (DESI) in Romania compared to the European Union (European Commission, Digital Scoreboard), Weighted score

Source: author's computation

Figure 3.2 depicts the evolution of the degree of access to the Internet at household level in Romania compared to the European. Regarding connectivity, in 2022, Romania ranks 15th out of 27 EU countries, below the EU average. Improving the overall rate of use of fixed broadband services is the biggest problem facing Romania in terms of connectivity. Thus, although broadband services register low costs and very high-capacity networks have a high degree of coverage, the degree of connectivity registers a stagnation caused mainly by the country's demographic imbalances and the low level of basic digital skills. Romania still maintains a significant digital gap between urban and rural environments in terms of high-capacity network coverage. In terms of mobile connectivity, despite a high degree of coverage of 4G technology of almost 100% and a continuous increase in the degree of coverage of 5G technology, Romania is below the EU average (Figure 3.3, 3.4).

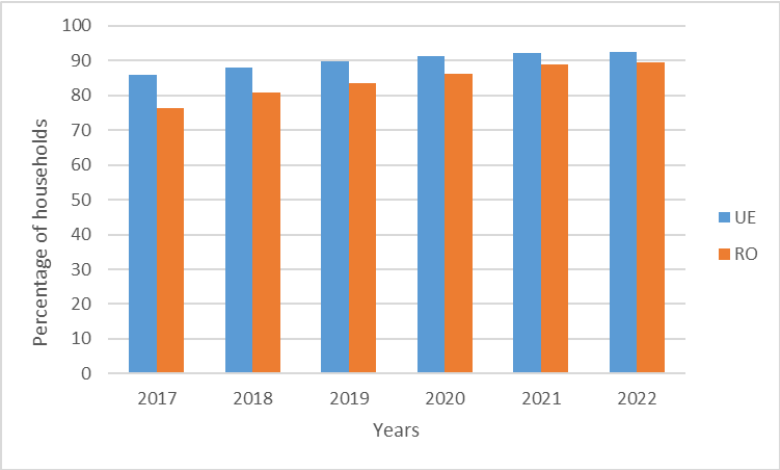

Figure 3.2. Evolution of the degree of access to the Internet at household level in Romania compared to the European Union, %

Source: author's computation

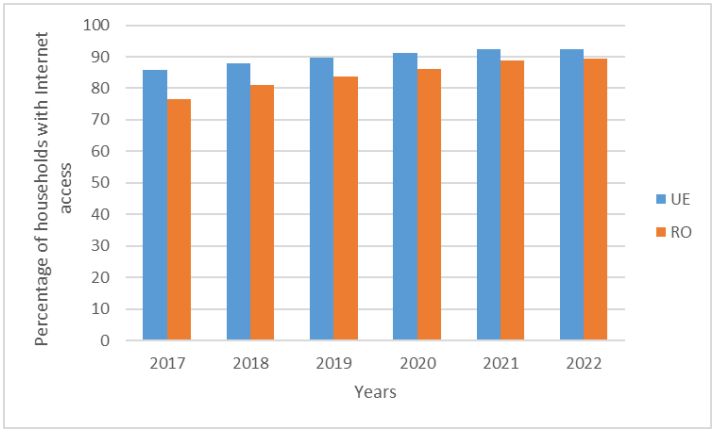

Figure 3.3. The evolution of broadband Internet connectivity at household level, in Romania compared to the European Union, %

Source: author's computation

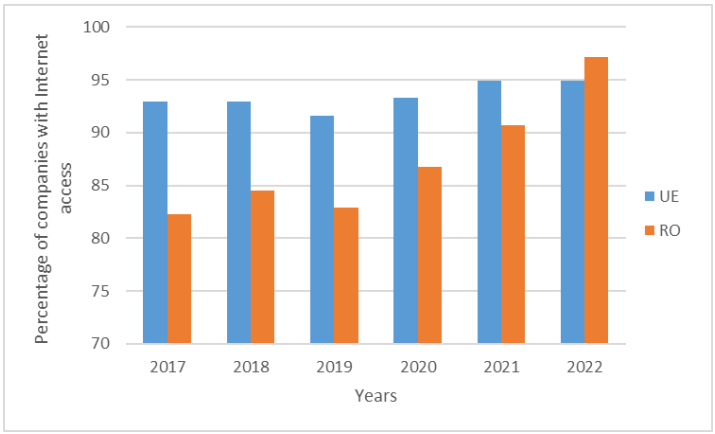

Figure 3.4. The evolution of broadband Internet connectivity at company level, in Romania compared to the European Union, %

Source: author's computation

Figure 3.5 illustrates the evolution of the number of people who use the Internet to interact with public authorities, in Romania compared to the European Union. Digitalization of public services remains a problem for Romania, which is far below the EU average in terms of all indicators. Thus, in terms of the availability of digital public services for citizens and businesses, Romania scores almost half compared to the EU average. Also, digital interaction between citizens and public authorities still needs to improve, only 17% of Internet users use e-government services.

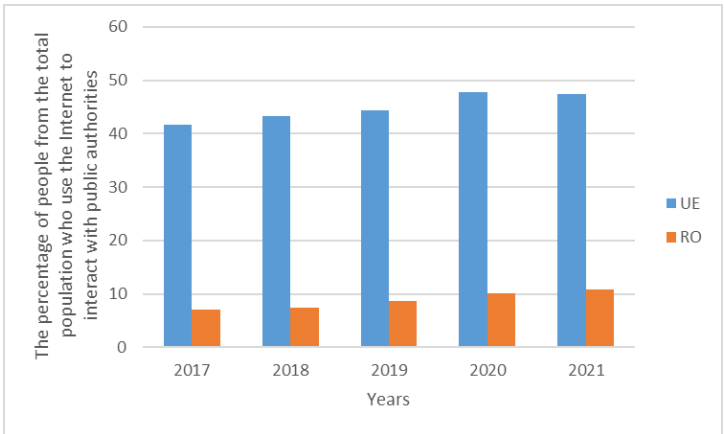

Figure 3.5. Evolution of the number of people who use the Internet to interact with public authorities, in Romania compared to the European Union, %

Source: author's computation

Figure 3.6 illustrates the evolution of the number of companies with online sales in Romania compared to the European Union. Romania records poor results in terms of the integration of digital technologies, being in

the last position among the EU member countries for this dimension in 2022, with a significant gap between Romania and the other countries. The share of SMEs with at least a basic level of digital intensity is less than half the EU average. Thus, only 12% of SMEs sell online. In terms of adopting advanced technologies, Romania is also far below the EU average. The situation is much worse for artificial intelligence, with only 1% of businesses implementing such technologies, compared to the EU average of 8%. The processing of large volumes of data also needs to be higher compared to the EU average.

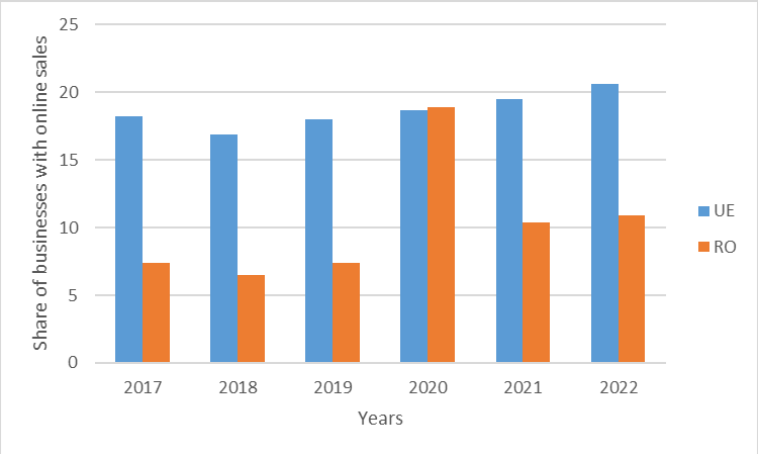

Figure 3.6. The evolution of the number of companies with online sales in Romania compared to the European Union, %

Source: author's computation

Figure 3.7 depicts the evolution of the number of companies that have ERP software packages to share information between different functional areas, in Romania compared to the European Union. In Romania, there has been no integrated economic policy approach to support the business environment for adopting specific Industry 4.0 technologies. Thus, it is necessary to articulate a national innovation ecosystem for the digitalization of enterprises.

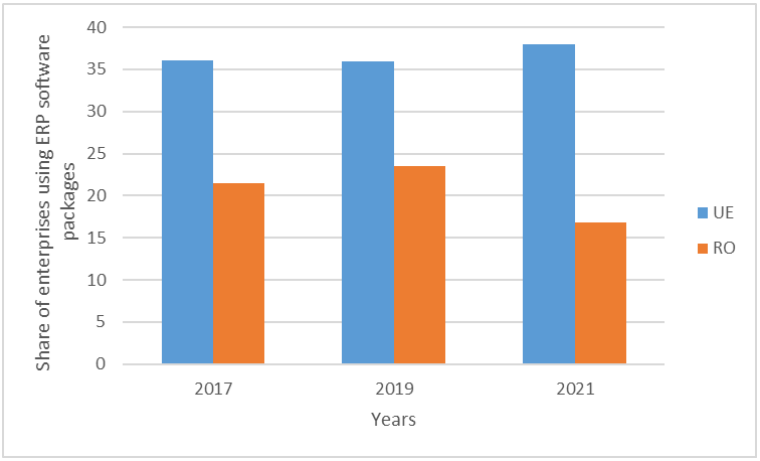

Figure 3.7. The evolution of the number of companies that have ERP software packages to share information between different functional areas, in Romania compared to the European Union, %

Source: author's computation

The highest discrepancy occurs in the case of people who use the Internet to interact with public authorities. In this case, their percentage in Romania is below 25% of the EU average percentage. The closest values are observed for the degree of Internet access at the household level and broadband Internet connectivity, both at the household level and at the company level. This picture confirms the opinions in the specialized literature (Andrei et al., 2022) that the digitalization of Europe is still uneven. Thus, in terms of digital intensity, there are still differences, both between European countries and between different sectors of activity. The trend of progress, however, on all levels, is also obvious.

4. Analysis of digitalization indicators in Romania compared to the European Union

Analysis of the influence of digitalization of the economy on GDP in Romania

According to studies by the McKinsey Group, the Internet strongly influences economic growth rates in large and developed economies, accounting for an average of 3.4% of GDP in developed economies, which

account for 70% of global GDP (Manyika & Roxburgh, 2011). The same source shows that if Internet consumption and spending were considered a sector, its share of GDP would be greater than the energy or agriculture industries. Thus, the total contribution of the Internet to global GDP is more significant than the GDP of Spain or Canada and is growing faster than the GDP of Brazil. Ongoing research suggests that digitalization has led to increased GDP. There is, however, considerable variation between countries, including those at relatively similar stages of development, leaving tremendous room for further growth related to digitalization and the Internet.

This situation led us to analyze the extent to which the digitalization of the economy influences Romania's Gross Domestic Product (GDP). We used the GDP per Capita because this is a macroeconomic indicator used by economists to analyze the prosperity of a country based on its economic growth.

To carry out the analysis, we took into account the following elements:

- The economic situation of the country, expressed by GDP per Capita, at market prices (GDPpCap);
- The degree of digitalization of the national economy, expressed by DESI, weighted score (DESI;
- Share of companies with online sales in the total number of companies in Romania, % (E_comm_Ent);
- Share of companies using DSL or other fixed broadband connection at the level of companies in Romania, % (Bd_Con_Ent);
- Share of households using DSL or other fixed broadband connection at the level of households in Romania, % (Bd_Con_Hous);
- Frequency of internet use at individual level in Romania, % (IntU_Frecv_Ind);
- Individuals ordering goods or services online, individuals (Aq_On_Ind);
- Enterprises who have ERP software package to share information between different functional areas, % (ERP_Ent).

The data were taken from EUROSTAT.

In Table 3.1, we presented the evolution of the analyzed indicators for 2017-2022 because, in the case of DESI in 2017, the calculation methodology was changed. For this reason, we did not use this indicator in the modelling. Regarding GDP and the share of businesses with broadband internet connectivity, the respective indicators have registered continuous increases, the average values being close to those of 2017-2018.

The Gross Domestic Product in Romania registered a continuous growth after 2011. As seen in figure 4.1, this growth had a slower pace in 2011-2016. From 2016 until 2019, the GDP growth rate increased. The COVID crisis is highlighted in the case of this significant macroeconomic indicator by a decrease at the level of 2020. Subsequently, the upward trend has returned.

According to an analysis performed by Harvard University researchers (https://atlas.cid.harvard.edu/), Romania is among the top 15 countries in the world in terms of the estimated growth rate of GDP/capita until 2030. According to this study, the GDP per capita growth rate will be around 3.5% per year, the 12th fastest in the world. The evolution of this indicator in the period 2020-2030 will be influenced by several factors, among which the most important are the increase in economic complexity and the decrease in the population in Romania.

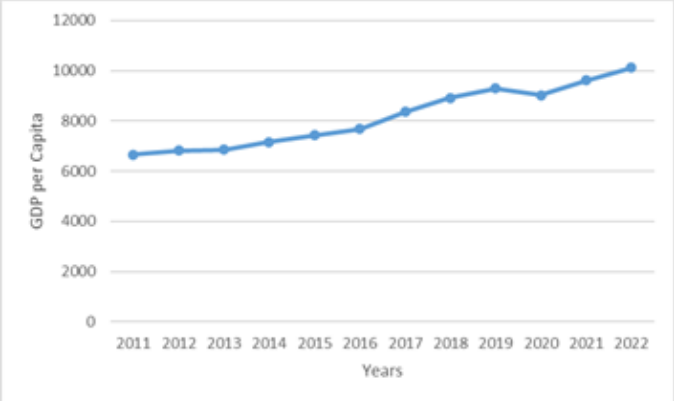

Figure 4.1. The evolution of the GDP at the market price in Romania, euro

Source: author's computation based on Eurostat data, SDG_08_10

GDP growth after 2011 was based on the contribution of industry and services. In terms of uses, general government expenditure, changes in inventories and net exports positively influenced GDP. Thus, the individual consumption of households and the collective consumption of the public administration decreased. Net exports fell more sharply. The growth rate of gross fixed capital formation had a negative effect. In this context, attracting foreign capital remains a key issue.

5. Data processing and interpretation of results

Methodology

We sought to obtain a regression model to analyse the regression function and its parameters and assess the degree to which the variables considered as influence affect economic growth. Data processing was carried out using SPSS.

Analysis of the model

Table 5.1 summarizes the descriptive statistics of the variables considered when defining the model.

Table 5.1 Descriptive Statistics

Variable	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	Kurtosis
GDPpCap	6860	10110	8443.00	1116.234	1245978.889	-.045	-1.429
E_comm_Ent	5.5	18.9	8.800	3.9376	15.504	2.204	5.313
Bd_Con_Ent	74.5	97.2	83.740	6.5685	43.145	.829	.864
Bd_Con_Hous	58.07	89.41	76.4060	11.39957	129.950	-.505	-1.153
IntU_Frecv_Ind	45.38	84.05	64.3900	14.03547	196.994	.044	-1.517
Aq_On_Ind	15.1865	51.4553	28.615080	13.3503758	178.233	.761	-1.085
ERP_Ent	16.80	23.50	20.9800	1.87012	3.497	-1.187	2.054

Source: author's computation

Table 5.2 shows the correlation matrix of the analyzed variables. It is found that the highest value of the correlation coefficient is recorded in the cases of GDP per Capita – Bd_Con_Hous, GDP per Capita – Bd_Con_Hous and GDP per Capita – IntU_Frecv_Ind, where a value above 0.9 is obtained, which demonstrates a robust correlation. A powerful correlation, supported by a correlation coefficient value of 0.898, is also found in the case of the pair GDP per Capita – Online purchases at the individual level. Instead, in the case of the GDP per Capita – ERP_Ent pair, the correlation coefficient value of -0.203 shows a very low correlation between the two variables and of the opposite sign. In all other cases, the correlations are direct, showing that the indicators vary in the same direction.

Table 5.2 Corelations Matrix

	GDPpCap	E_comm_Ent	Bd_Con_Ent	Bd_Con_Hous	IntU_Frecv_Ind	Aq_On_Ind	ERP_Ent
GDPpCap	1.000	.501	.918	.972	.984	.898	-.203
E_comm_Ent	.501	1.000	.542	.592	.612	.747	.201
Bd_Con_Ent	.918	.542	1.000	.890	.931	.930	-.426
Bd_Con_Hous	.972	.592	.890	1.000	.980	.879	-.032
IntU_Frecv_Ind	.984	.612	.931	.980	1.000	.944	-.177
Aq_On_Ind	.898	.747	.930	.879	.944	1.000	-.303
ERP_Ent	-.203	.201	-.426	-.032	-.177	-.303	1.000

Source: author's computation

When constructing the regression model, we opted for a linear multifactorial model using the backward SPSS procedure. This method provides the correct statistical model, trying, in turn, all possible models, including all variables, from which it eliminates, one by one, those that are not relevant, that is, those that show multicollinearity, that is, they are correlated with other variables from the model.

Thus, four models were evaluated. Model 1 considered as causal variables all the six initially considered variables, respectively, E_comm_Ent, Bd_Con_Ent, Bd_Con_Hous, IntU_Frecv_Ind, Aq_On_Ind and ERP_Ent. Model 2 was developed by removing the Share of businesses with broadband Internet connectivity. Model 3 was developed, also drawing IntU_Frecv. Model 4 was elaborated, and ERP_Ent was removed.

Table 5.3 Model Summary[e]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.995[a]	.990	.969	196.737	.990	47.787	6	3	.005	
2	.995[b]	.990	.977	170.702	.000	.011	1	3	.922	
3	.995[c]	.989	.981	154.331	.000	.087	1	4	.783	
4	.993[d]	.986	.979	159.996	-.003	1.449	1	5	.283	1.780

a. Predictors: (Constant), ERP_Ent, Bd_Con_Hous, E_comm_Ent, Aq_On_Ind, IntU_Frecv_Ind

b. Predictors: (Constant), ERP_Ent, Bd_Con_Hous, E_comm_Ent, Aq_On_Ind, IntU_Frecv_Ind

c. Predictors: (Constant), ERP_Ent, Bd_Con_Hous, E_comm_Ent, Aq_On_Ind

d. Predictors: (Constant), Bd_Con_Hous, E_comm_Ent, Aq_On_Ind

e. Dependent Variable: GDPpCap

Source: author's computation

Analyzing the values summarized in tables 5.3 and 5.4, we find that, taking into account a 95% level of the degree of confidence of the results, all four models can be accepted because the value of the coefficient of significance (Sig.) is 0.000, value less than 0.05.

Table 5.4 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11097693.314	6	1849615.552	47.787	.005[b]
	Residual	116116.686	3	38705.562		
	Total	11213810.000	9			
2	Regression	11097253.895	5	2219450.779	76.168	.000[c]
	Residual	116556.105	4	29139.026		
	Total	11213810.000	9			
3	Regression	11094720.192	4	2773680.048	116.453	.000[d]
	Residual	119089.808	5	23817.962		
	Total	11213810.000	9			
4	Regression	11060217.759	3	3686739.253	144.021	.000[e]
	Residual	153592.241	6	25598.707		
	Total	11213810.000	9	1849615.552	47.787	
a. Dependent Variable: GDPpCap						
b. Predictors: (Constant), ERP_Ent, Bd_Con_Hous, E_comm_Ent, Bd_Con_Ent, Aq_On_Ind, IntU_Frecv_Ind						
c. Predictors: (Constant), ERP_Ent, Bd_Con_Hous, E_comm_Ent, Aq_On_Ind, IntU_Frecv_Ind						
d. Predictors: (Constant), ERP_Ent, Bd_Con_Hous, E_comm_Ent, Aq_On_Ind						
e. Predictors: (Constant), Bd_Con_Hous, E_comm_Ent, Aq_On_Ind						

Source: author's computation

Table 5.5 presents a synthetic analysis of the regression coefficients obtained in the case of the three analysed models.

Table 5.5 Analysis of regression model coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1834.181	5451.690		.336	.759	-15515.529	19183.891		
	E_comm_Ent	-160.977	120.934	-.568	-1.331	.275	-545.841	223.888	.019	52.725
	Bd_Con_Ent	-6.975	65.462	-.041	-.107	.922	-215.304	201.354	.023	42.991
	Bd_Con_Hous	68.479	88.767	.699	.771	.497	-214.017	350.976	.004	238.095
	IntU_Frecv_Ind	-29.682	107.385	-.373	-.276	.800	-371.431	312.066	.002	528.218
	Aq_On_Ind	96.864	93.737	1.159	1.033	.377	-201.450	395.178	.003	364.151
	ERP_Ent	119.959	196.154	.201	.612	.584	-504.289	744.207	.032	31.289
2	(Constant)	1288.030	1610.976		.800	.469	-3184.756	5760.815		
	E_comm_Ent	-163.136	103.446	-.575	-1.577	.190	-450.347	124.075	.020	51.245
	Bd_Con_Hous	61.824	54.727	.631	1.130	.322	-90.123	213.771	.008	120.213
	IntU_Frecv_Ind	-26.068	88.403	-.328	-.295	.783	-271.514	219.378	.002	475.506
	Aq_On_Ind	96.116	81.104	1.150	1.185	.302	-129.064	321.296	.003	362.107
	ERP_Ent	133.221	131.544	.223	1.013	.368	-232.003	498.444	.054	18.691
3	(Constant)	1647.937	950.609		1.734	.144	-795.681	4091.554		
	E_comm_Ent	-138.046	53.192	-.487	-2.595	.049	-274.781	-1.312	.060	16.576
	Bd_Con_Hous	47.381	22.073	.484	2.147	.085	-9.359	104.122	.042	23.924
	Aq_On_Ind	74.471	31.184	.891	2.388	.063	-5.689	154.631	.015	65.490
	ERP_Ent	107.658	89.449	.180	1.204	.283	-122.277	337.593	.095	10.574
4	(Constant)	2576.506	575.750		4.475	.004	1167.697	3985.316		
	E_comm_Ent	-78.745	20.778	-.278	-3.790	.009	-129.587	-27.902	.425	2.353
	Bd_Con_Hous	71.277	9.999	.728	7.129	.000	46.811	95.744	.219	4.568
	Aq_On_Ind	38.910	10.339	.465	3.763	.009	13.612	64.209	.149	6.698
a. Dependent Variable: GDPpCap										

Source: author's computation

Of interest in the analysis and regarding the coefficients, the values of the level of significance (Sig.). Thus, it is observed that they are significant only in the case of model 4; only in this case are they located below the threshold of 0.05.

Thus, in the case of Romania, the accepted model can be written in the form below:

$$GDPpCap = 2576.506 - 78.745 * E\_comm\_Ent + 71.277 * Bd\_Con\_Hous + 38.910 * Aq\_On\_Ind \quad (5.1)$$

The interpretation of this model is as follows: when E_comm_Ent (independent factor) increases by one unit, GDP per Capita (dependent variable) decreases on average by 78,745 units in conditions where the other elements would remain constant; when Bd_Con_Hous increases by one division, GDP per Capita increases by a par of 71,277 units, under situations in which the other factors would remain stable, and when Aq_On_Ind increases by one unit, GDP per Capita increases by an average of 38,910 units, under conditions in which different factors would remain constant. The explanation of the decrease in GDP due to the increase in the share of companies that implement online sales solutions could be related to the increase in investment expenses. On the other hand, the increase in GDP due to the growth in the share of households that use internet services and the number of people who make online purchases could be linked to the role of consumption in GDP.

Another important aspect of the analysis is the analysis of partial correlations. Thus, the cases that consider ERP_Ent, Bd_Con_Ent or IntU_Frecv_Ind are removed from the model because they strongly correlate. The variance inflation factor values also support the above interpretation, denoted VIF, calculated as the inverse of the tolerance. This factor appears multiplicatively in defining the variance of the estimated coefficients (it can be said that it is measured how many times the variance of the coefficients is overestimated due to multicollinearity about the situation when there would be no collinearity). The interpretation is derived from that of tolerance: a VIF value greater than 10 denotes collinearity.

Regarding the verification of the hypothesis of homoscedasticity, we performed it by graphically representing the residuals against the independent variable (fig. 5.2). Analyzing Figure 5.2; it can be seen that a specific model does not appear in the graphic representation, which supports the assertion of the presence of the phenomenon of heteroskedasticity. So, in other words, the hypothesis of homoscedasticity is not confirmed. The phenomenon of heteroskedasticity can be due, in the present case, to the reduced number of elements processed or to the transformation of the data.

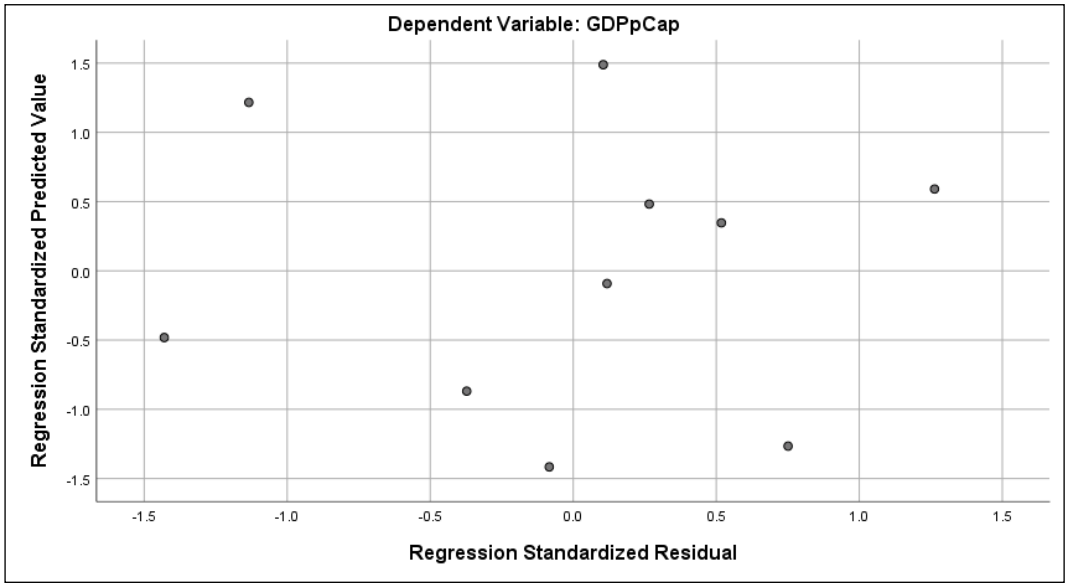

Figure 5.1. The scatter of the standardized residual by the standardized estimated value

Source: author's computation

Another important test that SPSS performs in regression analysis is the Durbin-Watson test (or DW test), used to find the autocorrelation of the first-order residuals of a regression model. We notice that the software automatically performed the DW test only for model 4, which is considered acceptable (tab. 5.3). If the errors are not correlated, then the value of DW will be around 2. In the analyzed case, this indicator has a value of 1.78, and as a result, we can accept that there is no serial correlation of the errors.

We concluded that we could not validate the model (3.1), and the regression model's assumptions needed to be fully confirmed. This means it is necessary to identify other causal variables that explain the variation in GDP per capita in the context of the digital economy.

6. Conclusions

Digitalization enables process automation, cost reduction and productivity development, increasing efficiency in various economic sectors. Also, the digitalization of the economy stimulates innovation and technological development. By adopting digital technologies, companies can create new innovative products and services, generating economic growth by creating new business opportunities and increasing competitiveness. Another important aspect is the impact of digitalization on the labour market. On the one hand, digitalization can lead to the automation of some jobs, which can harm employment. On the other hand, digitalization can create new employment opportunities in the technological and digital fields, thus contributing to economic growth.

Concluding the results of the analysis, we can state the following: Analysing the effects of digitalization on GDP per Capita in Romania, we observed that it is directly influenced by the broadband internet connectivity at the household level, the number of individuals ordering goods or services online, and the share of companies with online sales in the total number of companies, according to model 4 presented in relation 5.1. Econometrically, this model has a certain degree of acceptability in the analysis, given that the value of the significance coefficient (Sig.) is below the threshold of 0.05.

The digitalization of the economy has a significant impact on economic growth. It can stimulate economic efficiency, innovation and technological development and influence the labour market. However, it is essential to consider social and regulatory aspects to ensure that the benefits of digitalization are equitably distributed and that potential adverse effects are minimized.

Considering these results, it is necessary to continue the analysis to identify other variables that describe the digitalization phenomenon and can influence the characteristics of the national economy, especially if we consider that this phenomenon is on the rise. These results provide a solid basis for understanding the impact of digitalization of the economy on economic growth. They can serve as a starting point for further research in this area.

The digitalization of the economy has a significant impact on economic growth, bringing benefits such as established operational efficiency, technological innovation and development, accessibility and globalization, and the growth of entrepreneurship and the digital economy. To make the most of these advantages, governments and companies must invest in digital infrastructure, education and cyber security. By adopting and promoting the digitalization of the economy, we can build a more sustainable and prosperous economic future. However, addressing the challenges associated with digitalization, such as cyber security, is essential to ensure sustainable and prosperous economic growth in the digital age. By adopting and adapting to technological change, economies can reap the benefits of digitalization and thrive in an ever-evolving economic environment.

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