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Research paper

Digital Transformation As A Driving Force Behind Contemporary Economic and Social Change

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Abstract

The article explores the issue of gaining efficiency for the economy and society in the process of digital adaptation. The impact of digital technologies on labor productivity, competitiveness and social processes is analyzed. The purpose of the study is to identify the peculiarities of the global economy's adaptation and to substantiate the directions of ensuring the process of integrating digital technologies into public life in the global environment. A comprehensive methodological approach combining multiple linear regression is used to analyze the relationship between labor productivity, employment share and gross value added (GVA) in the digital sectors of a sample of 36 countries. The results of the regression analysis show that the model explains 41.4% of the variation in labor productivity in the digital economy and at the same time confirms the statistically significant impact of employment on its growth. It is established that the development of jobs in information and communication technologies is a key driver of digital transformation. The practical value of the study is to provide recommendations for the formation of public policy aimed at stimulating digital employment and inclusive technological development. The scientific novelty of the study is manifested in the identification of the relationship between digital adaptation and economic performance, in particular through the emphasis on the role of human capital in increasing labor productivity. The author proposes an integrated approach to assessing digital transformation, which takes into account both quantitative and qualitative aspects, including technological integration and social inclusion, which intensifies the formation of new strategies for sustainable development of countries in the context of global economic challenges.

Keywords: *Digital Economy; Digital Adaptation; Digital Rivalry; Productivity Transformation; Digital Infrastructure; Public Interest.*

1. Introduction

Global processes of economic and social development are characterized by intensive digital transformations that cover both production and social processes, leading to the emergence of new forms of economic interaction, business organization and modification of consumption and management models. Over the past decade, the pace of scientific and technological progress has accelerated at an unprecedented rate, especially in the information and communication sphere, which has led to a rapid increase in data, the digitalization of virtually all sectors of the global economy, and the transformation of social institutions (Bodó et al., 2024).

Of particular importance is the systematic study of asymmetries in digital adaptation, which are manifested in the uneven integration of digital solutions into various types of economic activity, the presence of barriers to digitalization in the social sphere, as well as the blurring of the conceptual framework and methodological approaches to measuring the degree of digital transformation. Therefore, the study of the digital adaptation of the economy and society aims not only to describe current trends, but also to create an analytical basis for the formation of a new digital development policy that will meet the challenges of our time and promote transformational changes in national economic systems towards digitalization and saturation with digital solutions (Ivanenko, 2024). It is for these reasons that we determine that the relevance of this study is due to the need to critically analyze the role of digital technologies in ensuring the long-term competitiveness of the national economy, improving management efficiency and creating conditions for inclusive innovation growth.

2. Literature Review

The development of the digital economy has stimulated numerous scientific studies that seek to conceptualize its essence, structure, and impact on social and economic processes. For example, Phan and Dinh (2023) and Rust Russo (2024) consider the digital economy itself as a system of social relations aimed at optimizing reproductive processes and stimulating the socio-economic development of states. The authors emphasize the importance of the social orientation of digital transformation, but do not detail the mechanisms of interaction between institutional agents of change and the effectiveness of such transformations. Further, Javaid et al. (2024) base their research vector on the fact that the digital economy is a form of a new model of human relations based on information and communication technologies, which corresponds to the paradigm of the fourth industrial revolution. This vision combines the technological and social dimensions of digital transformation. However, the papers do not provide a systematic analysis of the risks and threats that accompany this process, such as digital divide, cyberattacks, or privacy intrusion.

A group of scholars, Al-Zoubi (2024), Fox and Griffy-Brown (2024), describe the digital economy as a transformation of general-purpose technologies in the field of information and communication technologies, covering not only the economic but also the social sphere. It emphasizes the wide range of impact of digital tools, which is a significant addition to the known economic models. At the same time, the question of how to measure the effectiveness of such transformations in the context of state development remains open.

Already Chen and Xing (2025) emphasize the role of digital transformation in the creation of innovative products that incorporate advanced technologies. The authors rightly highlight the innovative potential of digital transformation, but the study does not specify how such technologies are transferred to the real sector of the economy and what are the barriers to the widespread adoption of innovations in society. Also noteworthy is the work of Makedon et al. (2024), which narrows the concept of the digital economy to the production and distribution of electronic goods and services. The approach has applied value for analyzing activities in the digital environment, but loses the complexity of understanding digital transformation, especially at the level of public administration and the formation of a digital society.

Well-known scientists Dahmer (2024), Polishchuk et al. (2025), in their publications focus on the key factors of the digital economy: Internet of Things, cloud computing, artificial intelligence, big data, 3D printing, blockchain, digital design. This entire list points to the technological core of digital transformation. At the same time, the social impact of these technologies, including changes in labor skills, digital mobility, and digital security, remain poorly understood. Separately, Westerman et al. (2020) emphasize the investment attractiveness of the digital economy, citing the high profitability of digital projects. These positions will substantiate public policy priorities, but require a critical analysis of the emergence of macroeconomic risks associated with digital assets.

It should be noted that approaches to studying the digital transformation of the economy vary significantly depending on the regional context and the degree of technological development. For example, Javaid et al. (2024) focus on industrial applications of artificial intelligence and robotization, but their research is limited to high-tech economies, which reduces the relevance of their conclusions for countries with insufficient digital infrastructure. Another critical aspect is the lack of assessment of the social and ethical risks associated with labor automation. Chen & Xing (2025) emphasize the role of the institutional environment in accelerating digitalization, but the authors do not take into account the problems of asymmetric access to technology in developing countries.

The study by Suhendra et al. (2025), based on data from regions of Indonesia, empirically shows that low broadband coverage density and insufficient training of personnel in the public sector significantly weaken the productivity effects of digitalization; the authors directly point to platform fragmentation and the lack of unified integration standards as critical barriers to scaling. Similarly, Phan and Dinh (2023), analyzing Vietnamese enterprises, note a gap between the introduction of digital tools and organizational capacity, including a lack of data management and cybersecurity policies, which ultimately reduces the return on investment in ICT. Romero & Mammadov (2024) add an institutional dimension to their work on IT companies in small economies: regulatory instability and asymmetric access to finance exacerbate "digital inequality," causing uneven transformation effects even under identical technological conditions. Consistent with macro-level data from the World Bank (2024), the results show that the discourse is shifting from describing trends to critically analyzing the technical (data standards, network parameters, cybersecurity) and institutional (policies, financing, competencies) conditions for effective digital transformation in less developed regions.

We would like to present separately the works of Von Solms and Van Niekerk (2013) and Suhendra et al. (2025), which examine digitalization from the perspective of a virtual environment that complements reality. The researchers distinguish two approaches: the first as an economy built on IT, and the second as the use of digital technologies in production. Both approaches are relevant, but do not take into account the complexity of digital adaptation in the face of institutional inertia and social resistance to change. Finally, Suntsova (2024) defines the digital economy as a new IT-based economic management system that forms a new economic order. The authors offer a holistic vision of digitalization, but do not provide sufficient empirical evidence of the implementation of such approaches in transforming economies.

Thus, we can state that scientific thought on the digital economy and its adaptation in the context of transformations is characterized by a significant variation of approaches, ranging from technology-oriented to socio-economic. However, there is a noticeable lack of comprehensive studies that would systematically reveal the relationship between digital changes and structural shifts in society. The issues of inclusiveness of digital adaptation, assessment of its long-term consequences, social justice in the context of digital transformation and adaptation to crisis conditions remain problematic. These issues become the basis for further scientific study.

The aim of the study is to investigate the process of digital adaptation of the world economy and to substantiate the directions of ensuring the integration of digital technologies into public life in an unstable global environment.

3. Materials and Methods

This study uses a comprehensive methodological approach that combines quantitative and qualitative methods of analysis to assess the impact of digitalization on economic and social transformations and changes. The main tool for quantitative analysis was a multiple linear regression aimed at modeling the relationship between labor productivity in digital sectors of the economy, the share of people employed in these sectors, and gross value added. The data for the econometric model were collected based on statistical reports from a number of international organizations. The sample size of the study is 36 countries with different levels of digital development. The sample of 36 countries was selected based on the principle of representativeness in terms of digital development, employment structure, and the share of ICT in GDP, reflecting both developed economies (EU, US, South Korea) and developing countries (India, Vietnam, Poland, Ukraine). This approach allows us to identify global patterns of the impact of digitalization on labor productivity, without being limited to individual models of economic growth.

The variables included: the number of people employed in digital sectors (% of total employment), GVA (% of GDP), and labor productivity (calculated as the ratio of GVA to the number of people employed). The regression model was estimated using multiple regression analysis. To ensure the validity of the model, the residuals were tested for normality of distribution (Shapiro-Wilk test).

4. Results

4.1. The role of digitalization in shaping adaptation processes in the national economy and society

Profound economic transformations give rise to the ability of society and the economy to adapt to digital changes, which are not just technological innovations but fundamental drivers of social and economic development. The rapid introduction of digital technologies has resulted not only in increased labor productivity, but also in a significant increase in the competitiveness of enterprises, optimization of production costs, the emergence of new employment segments, and a gradual reduction in poverty and social inequality. The processes of automation, informatization and digitalization in the context of modern economic transformations are not mutually exclusive stages, but logically connected sequential components of the comprehensive digital adaptation of the economy and society (Figure 1).
The digital adaptation of the economy, as part of this process, is based on a set of factors that can be divided into three key groups. First, there is a set of preconditions that form the basis of the digital space, i.e., the so-called "three pillars" of the digital economy: non-digital factors (institutional environment, infrastructure, level of education), digital factors (Internet access, IT personnel, legal support), and the digital sector of the economy itself, which includes industries that create or operate digital products.

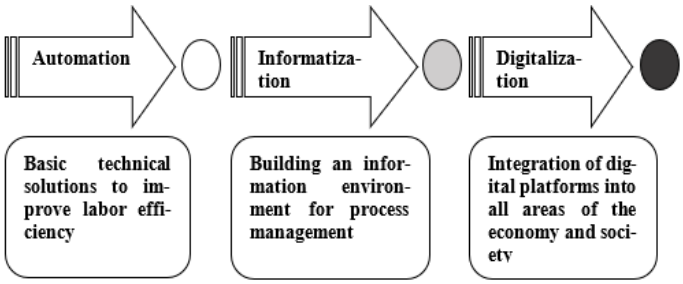

Fig. 1: Stages of Digital Adaptation of the Economy and Society in the Context of Modern Transformations.

Source: based on Malynovska et al. (2025).

The combination of these elements determines the system's potential for high-quality digital transformation and reflects its readiness to adapt to modern challenges (Bradač Hojnik & Huđek, 2023). Secondly, authors define the fundamental role of integrating digital technologies into the practice of functioning of economic and social institutions, both at the level of public administration and in the business environment, as well as in the daily lives of citizens. This means the formation of a digital public sector, where administrative services are provided online; a digital business that uses automation, data analytics, and e-commerce; and a digital citizen-consumer who has digital skills and uses digital ecosystems. The third aspect is the new dependence of economic and social effects on digitalization, which is manifested in changing the dynamics of economic growth, transforming the labor market, increasing employment in high-tech sectors, improving the quality of public services, and increasing the well-being of the population (Díaz Triñanes, 2024). One of the fundamental trends that has led to modern changes has been the globalization of digital solutions, which, due to the high mobility of innovative technologies, have become widespread in the world (Figure 2).

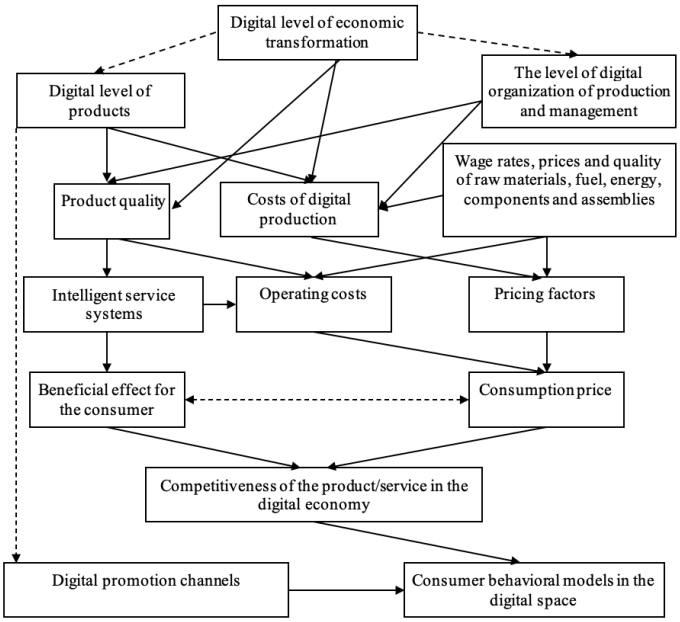

Fig. 2: Level Model of Digital Penetration in the Changing Economy and Structure of Production and Consumption.

Source: own development of the author.

Another feature of the current stage of digital adaptation is the growing role of scientific and technological progress, which directly affects the dynamics of economic development and stimulates the creation of new business models, digital platforms and ways of organizing work. In the context of this influence, the tendency to accumulate and process large amounts of information contributes to the digital transformation of economic activity (Brynjolfsson & McAfee, 2021).

Empirical studies confirm that digital transformation can be a powerful tool for reducing poverty, but its effect varies significantly depending on the level of development of digital infrastructure and institutional capacity of the state. According to the World Bank (2024), a 10% increase in mobile internet penetration correlates with a 1.2% increase in GDP per capita, which in turn contributes to a reduction in the proportion of households living below the poverty line. Similarly, OECD reports (2023) demonstrate the positive impact of digital financial services and e-government on the accessibility of services in remote regions, especially in Central and Eastern European countries. At the same time, UNCTAD (2023) warns that uneven digital integration exacerbates social divides, as automation can displace low-skilled workers. In countries with weak digital skills and low ICT infrastructure accessibility, the positive impact of transformation is limited to large cities and does not extend to peripheral areas.

The expansion of information-oriented activities and the active participation of citizens in the production and distribution of digital content have contributed to the exponential growth of data on a global scale. Thus, according to the CELIOS rating (2024), the total amount of digital data in the world will reach 175 zettabytes by the end of 2025 (Figure 3).

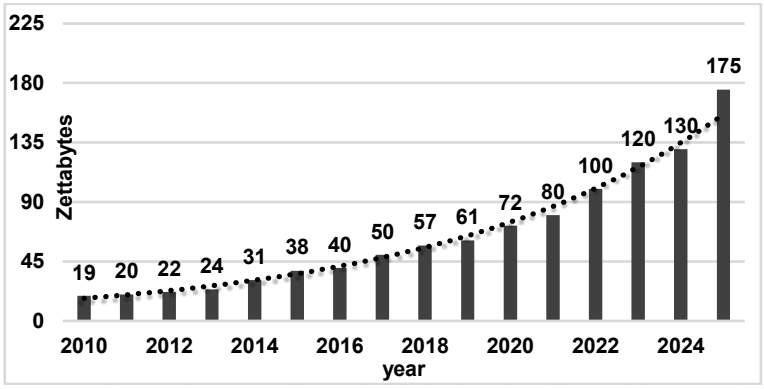

Fig. 3: Global Digital Data Growth Dynamics as an Indicator of Digital Adaptation of the World Economy (2010-2025, Zettabytes).

Source: based on CELIOS (2024).

In particular, systematic work with data, which is transforming into a strategic resource of the digital economy, is becoming increasingly important; cloud computing is spreading intensively, providing flexible access to infrastructure resources; and high-speed data transmission is becoming increasingly important, which is a critical condition for the effective functioning of digital services. In this context, the introduction of the Internet of Things (IoT) technology, which is an integral digital ecosystem, is also gaining relevance (Mandych & Kovalenko, 2024). It is obvious that within the framework of overall technological progress, certain digital tools and technologies have a much higher transformational potential. In this regard, in 2022, experts from the European Commission (2022) proposed an original methodology for classifying leading digital trends based on the following criteria: the degree of implementation (assessed on a scale from 0 to 5), the level of innovation (determined by the number of patents and scientific developments), and the degree of public interest (determined by the frequency of mentions in search engine queries). Let us highlight the three most mature technological areas that, in our opinion, demonstrate both a high level of practical application and a significant amount of investment. These include:

- enhanced digital connectivity, which includes fifth and sixth generation mobile communication technologies (5G/6G), as well as satellite internet;
- Applied artificial intelligence, including machine learning, natural language processing, computer vision, and robotic systems;
- cloud and edge computing, the relevance of which is growing due to the explosive increase in the number of IoT devices and the need for prompt processing of distributed data at the place of their generation (Table 1).

Table 1: Key Technological Trends (Based on the Example of 2024)

Technology	Level of implementation	Innovation	Public interest	Volume of investments (2024, billion USD)
Advanced connectivity	5	0,70	0,40	185
Applied AI	5	0,95	0,50	200
Cloud and edge computing	4	0,25	0,10	160
Web3 (Web 3)	2	0,10	0,65	130
Trust architectures and digital identity	3	0,08	0,12	45
Immersive reality technologies	2	0,25	0,18	40
Industrializing machine learning	2	0,30	0,06	8
Next-generation software	2	0,05	0,05	3
Quantum technologies	1	0,05	0,03	5

Source: based on Makedon et al. (2025), van Dijck et al. (2025), Zavidna et al. (2025)

Digital transformation relies on the synergy of three key technological components—artificial intelligence (AI), the Internet of Things (IoT), and fifth and sixth generation wireless networks (5G/6G)—which together form the technological foundation of cyber-physical systems. Artificial intelligence functions as the central element of analytical information processing, providing automated pattern recognition in large-scale data sets, adaptive decision-making, and autonomous model learning. The implementation of deep learning algorithms, neural network architectures, and natural language processing (NLP) technologies in production and management processes enables the development of intelligent systems for predictive demand analytics, dynamic pricing, energy resource management, and logistics chain optimization.

The Internet of Things, accordingly, aggregates primary data through geographically distributed sensor networks that integrate industrial assets, transportation systems, household devices, and energy infrastructures. Technological implementation is achieved through the use

of MQTT, CoAP, Zigbee, and LoRaWAN protocols, which guarantee energy-efficient real-time data transmission. Information processing takes place at the edge computing level, which minimizes time delays, optimizes the load on centralized server capacities, and enhances information security. Fifth and sixth generation telecommunications technologies (5G/6G) form the basic communications infrastructure for the functioning of intelligent digital services, providing extremely high data transmission channel bandwidth (up to 20 Gbit/s), ultra-low signal delay (less than 1 ms), and the ability to support connections to up to one million devices per unit area (km²). It is these technical characteristics that create the necessary conditions for the implementation of autonomous transport platforms, telemedicine services, remote monitoring of production processes, and the concept of "smart" cities.

4.2. Study of digital competition and its impact on the global economy and public interests

Possession of technological leadership in the development, implementation and scaling of digital innovations for countries of the world creates a condition not only to strengthen their competitiveness, but also to claim dominance in the new configurational structure of the world economy, where digital advantage is becoming the main criterion for economic power and dominance of the society model. This is quite clearly manifested in the strategic confrontation between the United States of America and the People's Republic of China (PRC), for which securing a leading position in the global digital ecosystem has become a national policy priority. It is in this context that the concept of digital sovereignty becomes particularly important, as it reflects the ability of the state to pursue an independent and strategically oriented policy in the digital space, which implies the availability of its own technological infrastructure, data control, and a secure information environment (Metelenko et al., 2019). Although in practice the achievement of full digital sovereignty remains a controversial issue due to the deep globalization of technological chains and the transnational nature of digital platforms, this concept is increasingly appearing in economic discourse as a key element of managing transformations in the digital age.

The latest statistical estimates for 2024 confirm that the United States and China continue to lead the digital economy in terms of absolute volumes, infrastructure scale, and institutional influence on the global technology ecosystem. According to the IMD World Competitiveness Center (2024), these two countries continue to control about 88% of the total market capitalization of the world's 70 largest digital platforms, which indicates the concentration of innovation and financial potential in a narrow circle of countries. At the same time, the United States retains global leadership in terms of the value of the digital sector, which in 2024 is estimated at more than USD 18.4 trillion, while China shows steady growth, reaching USD 8.2 trillion. This allows it to maintain its second place in the global digital ranking (Figure 4).

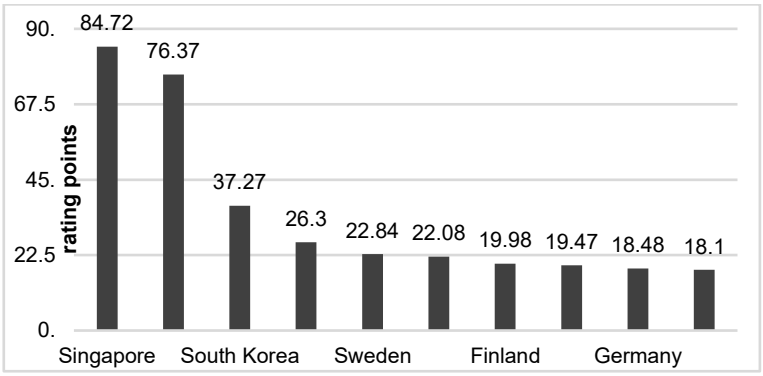

Fig. 4: Comparative Characteristics of the Size of Digital Markets by Rating Points, 2024

Source: based on World Bank (2024).

The growing gap betweenthe digital economies of the United States and China and the rest of the world is particularly telling. For example, Germany, which traditionally ranks third, had a digital economy of $3.1 trillion in 2024. THIS IS A SIGNIFICANT INCREASE. The countries with digital sectors exceeding the USD 1 trillion mark include Japan (USD 1.6 trillion), the United Kingdom (USD 1.4 trillion), and France (USD 1.1 trillion), which demonstrates a significant concentration of digital capacities within a limited number of countries with a high level of economic development (World Bank, 2024).

At the same time, according to the Statista database (2025), in 2024, China finally established itself as the largest domestic digital market in the world, which was the result of a systemic investment policy aimed at developing fifth-generation (5G) infrastructure, mass deployment of IoT systems, and modernization of fiber-optic networks. Over the past five years, China has focused its efforts on creating a complete digital production chain, from microelectronics to end platforms, which has led to the achievement of not only scale but also technological autonomy in a number of segments. According to Huawei Technologies & IDC (2024), in 2024, out of the ten most visited digital platforms in the world, four were headquartered in the United States, four in China, and one was created by Chinese developers, which shows the actual bipolarity of the global digital space, which determines the nature of economic adaptation in the twenty-first century (Figure 5).

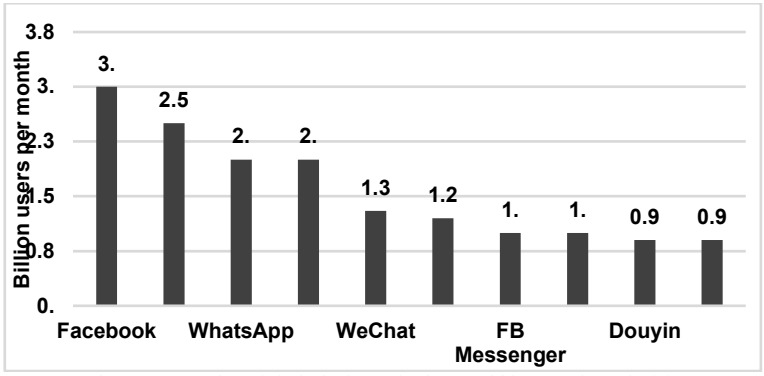

Fig. 5: The Most Popular Digital Platforms in the World by Number of Visits, 2024.

Source: based on data from Huawei Technologies & IDC (2024).

Global processes of digital adaptation demonstrate a significant level of dependence on the innovative activity of the private sector, which, in the context of a developed financial infrastructure and a favorable institutional environment, ensures high dynamics of digital development. This approach is vividly illustrated by the US economy, where the digital sector is an important driver of growth: in 2023, the amount of venture capital raised for technology projects amounted to $153.1 billion. Although lower than the peak in 2021, it still indicates significant investor interest in innovative business models. In 2024, the United States retained its leadership in the number of unicorns – private companies with a capitalization of more than USD 1 billion. This indicates the effective effect of the synergy of the domestic market, flexible financing mechanisms, and entrepreneurial culture (Figure 6) (CELIOS, 2024).

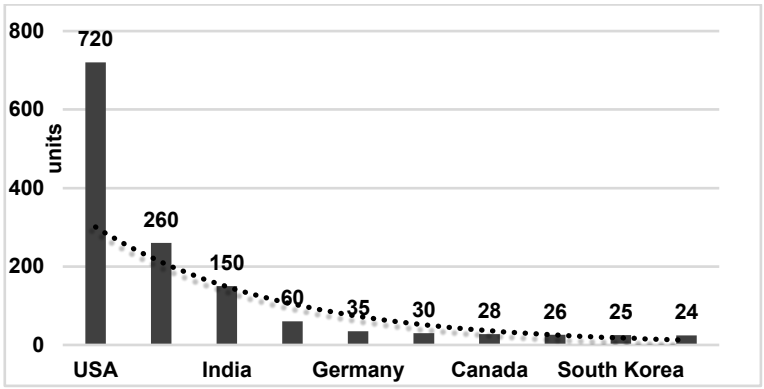

Fig. 6: Geographical Distribution of Unicorn Companies In 2024 as An Indicator of Digital Business Activity.

Source: based on CELIOS data (2024).

Exchange financing continues to be a fundamental component of digital adaptation, in particular through the NASDAQ and NYSE stock exchanges, which are located in New York and provide US IT companies with priority access to additional financial resources compared to global competitors. Thus, according to 2024 data, 59 of the world's 100 largest technology companies by market capitalization are headquartered in the United States, which indicates the country's deep integration into the global digital economy. American companies also dominate the management of digital information flows, including data processing, storage, and transmission. Digital TNC giants such as: AWS, Microsoft Azure and Google Cloud, provide more than 60% of the global cloud services market, while China's Alibaba Cloud and Tencent Cloud together controlled only about 8% in the first quarter of 2024. At the same time, the digital access infrastructure in the United States remains extremely developed: more than 99% of the population has access to broadband, 4G coverage covers almost the entire territory, and the adoption rate of 5G networks exceeds 70% (Interactive Advertising Bureau, 2025).

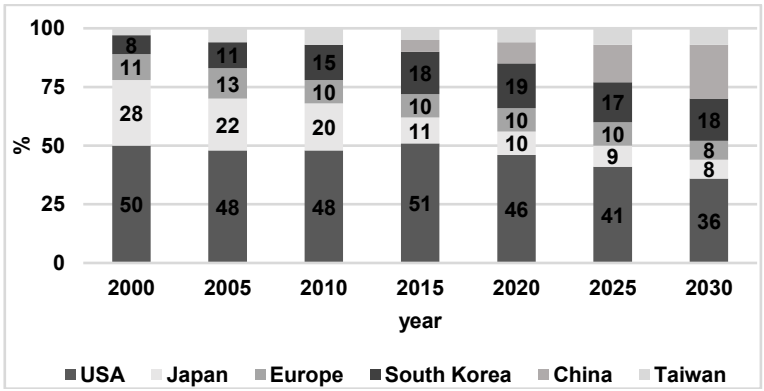

Fig. 7: Dynamics of Shares of the Global Microchip Design Market by Place of Registration of Companies' Headquarters in 2020-2030 (Forecast) in the Context of Digital Competition.

Source: based on data.

Digital transformation is also reflected in the high level of digitalization of public services: The United States ranks 7th in the world in terms of e-government usage (94.6%) and 9th in terms of openness of government data (82.4%) (World Bank, 2024). Semiconductor technologies, which determine technological autonomy and competitiveness in the digital economy, remain a progressive component of the country's digital exports (Figure 7).

However, even with such high performance, the US national industry is facing increased competition from China and South Korea. The share of US production capacity in the global volume decreased from 37% in 1990 to 12% in 2022, and by 2030, the US share in microchip design is projected to further decline to 36%, while the share of China (excluding Taiwan) may increase to 23% and South Korea to 19%. Despite the leading position of the United States in many areas of the digital economy, some segments are showing a decline in competitive advantage. In particular, authors are talking about new generation telecommunication technologies (5G and 6G), where leading positions are gradually being taken over by companies from China, South Korea, and the European Union, which enjoy government support. Thus, the digital adaptation of the economy and social shifts at the current stage of economic transformation is creating new contours of global competition. In the context of digital rivalry, technological leadership, control over digital platforms, and infrastructure superiority are becoming key factors of economic power. All of these processes affect not only economic models but also social values, raising issues of digital sovereignty, data security, and inequality (Organization for Economic Co-operation and Development, 2023). Table 2 summarizes the basic factors of digital competition, highlighting their impact on the global economy and public interests.

Table 2: Results of Digital Rivalry and Its Impact on the Global Economy and Public Interests

Rivalry factor	Technological leadership	Impact on global platforms	Infrastructure advantage	Socio-economic impact
Innovation dynamics	Dominance in the development of advanced technologies	Control over key digital ecosystems	Developed network infrastructure	Increased economic inequality
Digital autonomy	Creation of own technological standards	Restriction of access to global platforms	Autonomous communication and data systems	Growing issues of digital sovereignty
Concentration of resources	Financing of venture capital and exchange mechanisms	Monopolization of digital markets	Large-scale investments in 5G and IoT	Formation of a bipolar economic order
Competitiveness	Transition to next-generation technologies (6G)	Distribution of influence between several players	Localization of microchip production	Changing models of economic dominance
Security and regulation	Data protection and cybersecurity	Regulation of transnational platforms	Standardization of digital infrastructure	Balance between privacy and public distribution

Source: author's own development.

Thus, digital adaptation processes are shaping a new trend in global development, where technological leadership and control over digital ecosystems determine the economic and geopolitical weight of a nation and country. The concentration of resources in a narrow circle of global players increases inequality, making it difficult for less developed regions to access technology (Romero & Mammadov, 2024).

Thus, the results of the analysis of global digital competition shift the research from a macro-level comparison of technological strategies to quantitative modeling of their impact on national economies. The identified disparities between the rates of digital adaptation in developed and transition countries indicate the need to build formalized models capable of reflecting the relationship between the level of digital infrastructure, human capital, and the effective use of innovative technologies. It is analytical logic that determines the next stage of research—the construction of mathematical models for quantitative assessment of the impact of digital determinants on labor productivity, structural flexibility, and economic stability.

4. 3. Modeling the transformation of the digital economy and its impact on social economic behavior

The digital economy is not only a new form of business, but also a factor that significantly changes social economic behavior through the transformation of labor practices, consumer patterns, and management strategies. One of the key indicators of the level of digital transformation is labor productivity in sectors based on the use of information and communication technologies, as well as in the areas of digital content creation and media. It is labor productivity that allows us to quantify the efficiency of digital production, the flexibility of organizational models, and the ability of national economies to adapt to the new requirements of the digital environment. In 2024, the modeling of the dynamics of the digital economy is based on expanded statistical parameters covering the number of employed persons, gross value added (GVA) in the digital sector, and average labor productivity. Comparison of these indicators between countries allows us to determine not only the level of technological development but also the depth of institutional changes that affect the behavior of economic agents (Table 3).

Table 3: Ranking of Countries by the Development of Digital Technologies and Labor Productivity in Digital Sectors of the Economy in 2024

Country	Number of employed, %, by the end of the year	GROSS DOMESTIC PRODUCT, %.	Labor productivity	Place in the ranking
Australia	3,4	0,9	4,2	14
Austria	2,7	0,7	4,1	16
Belgium	2,4	0,6	4,0	18
Brazil	1,3	0,4	3,4	26
United Kingdom	3,7	1,3	5,2	7
Hungary	4,1	0,8	6,2	3
Germany	3,2	0,9	5,3	6
Greece	1,4	0,5	3,3	28
Denmark	3,0	1,5	4,3	13
India	1,0	0,2	6,0	5
Ireland	4,0	1,2	6,8	1
Iceland	3,6	2,1	4,5	11
Spain	2,4	0,8	3,6	22
Italy	2,6	0,5	3,8	20
Canada	3,2	1,2	4,0	17
Latvia	3,5	0,6	5,0	8

Lithuania	2,2	0,5	3,9	19
Luxembourg	4,2	0,7	7,0	2
Mexico	2,3	0,3	3,3	27
Netherlands	3,0	0,7	4,8	10
New Zealand	2,8	1,3	3,7	21
Norway	2,6	1,4	3,5	24
Poland	2,4	0,7	3,8	23
Portugal	1,8	0,5	3,4	25
South Korea	3,8	1,9	10,0	4
Slovakia	3,2	0,6	4,6	12
Slovenia	3,2	0,9	4,4	15
USA	3,0	1,3	5,8	5
Turkey	1,1	0,3	3,0	29
Finland	4,2	1,1	6,0	9
France	2,8	0,9	4,8	11
Czech Republic	3,4	0,6	5,8	6
Switzerland	5,0	0,8	6,8	3
Sweden	3,5	1,4	6,0	2
Estonia	4,8	1,1	5,6	7
Japan	3,3	0,9	6,2	4

Source: based on data from the Digital Cooperation Organization (2024).

Based on the data in Table 4, authors use a multiple linear regression econometric model to estimate the strength of the impact of the number of people employed in the digital sectors of the economy and gross value added (GVA) on labor productivity in the digital sectors of countries around the world.

$$Yi = \beta_0 + \beta_1 \times X_{1i} + \beta_2 \times X_{2i} + \varepsilon_i \quad (1)$$

Where:
Y_i – labor productivity in the digital sector,
$X_1$is the share of people employed in the digital economy (%),
$X_2$is the share of gross value added (%),
$\beta_0$is a constant (free term),
$\beta_{(1)}, \beta_2$are regression coefficients,
$\varepsilon_i$is a random error.

Table 4: Results of Model Estimation

Parameter	Estimation (β)	Standard error	t-statistic	P-value	Confidence interval (95%)
const	1.9585	0.636	3.079	0.004	[0.664, 3.253]
Employment	0.8909	0.235	3.791	0.001	[0.413, 1.369]
ValueAdded	0.2893	0.515	0.562	0.578	[-0.758, 1.337]

Source: calculated by the authors.

The modeling results show that the model explains 41.4% of the variation in labor productivity due to changes in the share of employment and GVA, as evidenced by the coefficient of determination ($R^2 = 0.414$), while the high statistical significance of the model is confirmed by the value of the F-statistic (11.67, $p < 0.001$), which indicates its reliability for assessing digital economic processes. In particular, the employment coefficient ($\beta_1 = 0.8909$, $p = 0.001$) was statistically significant at the 1% level, suggesting that a 1% increase in the share of people employed in digital sectors is associated with a 0.89 unit increase in labor productivity, with GVA remaining constant, emphasizing the importance of human capital in the digital economy. At the same time, the GVA coefficient ($\beta_2 = 0.2893$, $p = 0.578$) did not reach the level of statistical significance, which may indicate the limited ability of this indicator to reflect innovation activity or technology efficiency in digital sectors.

The statistical insignificance of the gross value added (GVA) coefficient in the constructed regression model demonstrates the inadequacy of conventional macroeconomic metrics to adequately reflect the true impact of digital innovation. A similar trend is observed in the work of Suhendra et al. (2025), where it is emphasized that aggregate GVA indicators do not cover the intangible effects of digital transformation, in particular productivity gains due to process automation, intensification of information exchange, reduction of transaction costs, and acceleration of management decision-making procedures. In the context of the digital economy, a significant share of the generated value migrates to the sphere of intangible assets: software products, algorithmic artificial intelligence solutions, and information databases, which are not directly reflected in the structure of gross value added.

Research by Romero and Mammadov (2024) also confirms that in countries with a high intensity of digitalization, official macroeconomic statistics record the innovation effect with a time lag of at least 2-3 years. Therefore, the low statistical significance of the GVA variable in the presented model can be explained by the existence of time lags between technological investments and their economic returns.

The applied regression model confirmed the hypothesis that employment growth in digital sectors, in particular in information and communication technologies, is crucial for increasing labor productivity, which emphasizes the need for targeted investment in training and job creation in this area to ensure the competitiveness of the economy. At the same time, the absence of a statistically significant impact of gross value added may be due to its aggregate nature, which does not fully reflect the qualitative aspects of digital innovation, such as the intensity of the use of artificial intelligence or 5G technologies, which requires a more precise methodology for assessing the economic contribution of digital sectors. It is determined that for an effective digital transformation, it is necessary to combine human capital development strategies with innovative approaches to assessing the economic impact, taking into account not only quantitative but also qualitative parameters, such as technological integration and digital inclusion, in order to have a sustainable trend of economic growth and social progress in the global digital environment.

5. Discussion

The scientific results of the study show an indisputable link between the level of digital employment and labor productivity in the digital-based industries. These findings are supported by Brynjolfsson and McAfee (2021), who emphasized that digital tools alone do not provide a lasting effect without the simultaneous development of human capital. Our work adds empirical support to this claim: using the econometric model is built, authors prove a statistically significant impact of the number of employees in digital sectors on productivity. Comparing our findings with Chen and Xing (2025), who focus on the innovative potential of the digital economy, it should be noted that the study goes further and analyzes real-world manifestations of economic behavior. It has been established that digital transformation not only intensifies innovation, but also causes changes in the organization of work: the role of flexible employment is growing, remote work formats are spreading, the platform economy and all digital ecosystems are being formed.

According to Javaid et al. (2024), Al Zoubi (2024), close attention is paid to the social impacts of digitalization, in particular its potential to increase access to services and social inclusion. Authors have confirmed these assumptions empirically, when digital technologies in the public administration and social sphere contribute to reducing administrative barriers, reducing regional inequality, and optimizing costs. At the same time, two key factors are needed to realize these benefits: the digital competencies of the population and the readiness of state institutions to modernize.

The studies by Westerman et al. (2020), Von Solms and Van Niekerk (2013) draw attention to the need for tangible changes in management practices, but their focus is mainly limited to the corporate level. The findings in this article complement this view by analyzing the impact of digital changes at the macroeconomic and interstate levels. Based on this statement, digital transformation can be interpreted as a factor of strategic adaptation at the global level, and not just as an internal organizational change.

Another element of the study was the study of the phenomenon of digital rivalry, which, according to research by Fox and Griffy-Brown (2024) and the OECD report, 2023, is characterized as a new form of geoeconomic competition. A comparison of the digital models of the United States and China has revealed the structural bipolarity of the modern digital space. The first model is liberal and market-based, based on the dominance of the private sector, while the second is state-controlled, focused on infrastructure dominance. This conclusion complements the study by Makedon et al. (2025), which examines the impact of digital infrastructure on the strategic independence of countries.

The most significant scientific contribution of this research is the proposed integrated approach to assessing the effectiveness of digital transformation. Unlike partial studies that are limited to technological parameters, as pointed out by Polishchuk et al. (2025), authors took into account a comprehensive set of indicators: from macroeconomic indicators to employment, productivity, structural flexibility, and social inclusion. In addition, the study makes an important contribution to understanding how digital technologies are changing the very nature of economic behavior.

Summarizing the results, it is appropriate to identify vectors for future scientific research capable of deepening the conceptual understanding of digital transformation as a multifaceted phenomenon. First, it seems relevant to quantify the digital sovereignty of a state—to develop a system of indicators that integrate the degree of national localization of critical information and technology infrastructure, the level of data security, and the degree of technological independence from global digital platforms. Second, the issue of digital inclusion in developing countries requires more detailed study, in particular, modeling the impact of digital service accessibility on social mobility indicators and employment parameters. Third, a scientifically promising direction is the study of cyber-physical risks in the structure of national economies, which involves the synthesis of econometric tools with information security methodology. The development of these research trajectories will enable the establishment of a comprehensive methodology for digital resilience.

6. Conclusion

The results of the study show that digitalization is a catalyst for the processes of adapting the model of the national economy and society to the realities of global progress. The study has shown that the process of digital adaptation includes not only technical modernization, but also changes in management systems, social interactions, and the organization of public services. Based on the analysis of concepts and statistics on technological development, it is proved that the greatest transformational potential in the digital economy is centered around three key areas: 1) the development of superfast networks (5G/6G), 2) the use of applied artificial intelligence, and 3) cloud computing.

Studies of global digital competition have shown that the United States and China remain the leading centers of digital power, and they not only dominate the international market in terms of capitalization and the scale of digital infrastructure, but also actively shape the policy of technological sovereignty, influencing the rules of the digital space. This trend has become a source of a new type of geo-economic polarization, with advanced countries strengthening their leadership, while less developed countries risk being on the periphery of technological development. The study confirmed that the determinants of digital influence in the modern world are technological leadership, institutional autonomy, access to financial resources, and infrastructure superiority.

The econometric modeling model highlighted the impact of a number of basic factors of digitalization of the economy and society of countries on labor productivity in digital industries. The findings confirmed that human capital is the engine of enhanced digital transformation. In particular, the share of workers employed in digital areas has a significant impact on productivity, unlike the gross value added indicator, which did not show significance, indicating the need to move from analyzing general macroeconomic indicators to assessing the quality of innovation, the level of digital competencies and the adaptability of public institutions.

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