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Russian Digital Economy and Cybersecurity: An Overview of Recent Developments*

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Abstract

The main purpose of this research was to examine the key metrics of the Russian digital economy and influencing factors affecting the digital economy development in Russia during the period of 2010-2020. One-way ANOVA was conducted to compare the three indicators of e-government. Results from LSD statistics indicated that there was a significant difference between the telecommunications indexes and human capital. The correlation matrix of economic influencing factors in Russia in terms of ICT application revealed that there has been a balance between the various economic sectors. Results of the Kruskal–Wallis test demonstrated that there was a significant difference between Russian financial institutions in terms of cyber-attacks. Based on the refinery methods of factor analysis, Pearson's correlation coefficient, and multiple regression model, five variables GDP, GDP per capita, R&D expenditure, cyber security, and consumer price index were removed from the analysis, and the results showed that the human capital has a significant positive impact on the development of the digital economy in Russia. Despite the significant explanatory role of the human capital index, this study strongly recommended considering the other variables, both predictive and control variables, to explain the variance in the development of digital economy in Russia.

Keywords: Cyber Attacks, Digitalization, E-government, One-way ANOVA, Refinery Analysis, Russian Economy

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1. Introduction

Cyber-attacks have become increasingly common around the world in recent years. In particular, the ongoing unfortunate events between Russia and Ukraine have been aided with the use of technology (Ehiorobo et al., 2023). The number of cyberattacks carried out against Russian information systems in 2023 increased by 65% compared to the same period last year. This was stated by Russian Deputy Prime Minister Dmitry Chernyshenko on March 3 during a meeting with young scientists, inventors and technology entrepreneurs at the Eurasian Science and Education Center in Ufa. According to the Deputy Prime Minister, the collective West is now making serious efforts and concentrating its cyber skills to carry out cyber-attacks on domestic information systems and various Russian information products. Dmitry Chernyshenko also noted that there is a high probability that such cyber-attacks on Russian information systems will continue in the future (CISOCLUB, 2023). In 2021, the seventh SOC Forum[1] on Cybersecurity in Russia was held, organized by FSTEC[2], the FSB[3] and other departments. During the event, problems in the field of information security of public bodies were raised, which include: the lack of a reliable level of protection in public sites, poor staff training on safety issues, lack of cybersecurity specialists, and poor qualifications of IT administrators. In 2022, external threats to the country's cybersecurity emerged. Therefore, in May, Vladimir Putin signed the Decree No. 250 on additional information security measures. According to this cybersecurity document, from January 1, 2025, in Russia, state-owned companies and government

1. The practice of countering computer attacks and building information security monitoring centers
2. Official website of the Federal Service for Technical and Export Control
3. Federal Security Service of the Russian Federation

agencies are prohibited from using information protection tools made in unfriendly countries. In addition, every institution should set up an IT security office (Rostbk, 2023). The Russian government's approach to cybersecurity and information security is founded on a firm commitment to national interests. Although cybersecurity has become a buzzword for many policymakers, the term has not yet been officially adopted in Russia. There are numerous definitions of information and communication technology (ICT), but Russia prefers to focus on information security rather than cyber derivatives, owing to conceptual differences in security approaches rather than merely linguistic features (Stadnik, 2021). The modern lifestyle is heavily influenced by the concept and function of "digital", and the COVID-19 pandemic has accelerated this change while revealing the effects of digital assets and basic and advanced digital skills on socio-economic sustainability. As a result, the "digital economy" is expected to become a major driver of the future economy as an important part of a lifestyle. Russia has the sixth largest online population in the world and as of January 2022 there were 129.8 million internet users in Russia. (Statista; DataReportal, 2022; Tian & Liu, 2021; The European Commission, 2020a). According to Melkadze (2023), the share of monthly active Internet users in Russia is expected to reach 88.48% of the total population by 2027. This would mark an increase of 5.06 percentage points from 83.42% in 2022. In addition, against the background of negative dynamics in the overall economy, the share of the ICT industry in the total volume of construction work and services sold increased from 3.8% in the second quarter of 2022 to 4.1% in the third quarter. Russia's ICT exports are expected to reach $7.36 billion by 2026, and this annual increase was 2.8% from $6.22 billion in 2021 (ReportLinker, n.d.; TADVISER, 2023). It should be noted, however, that the Russian ICT industry provides a wide range of highly sophisticated digital tools and well-organized software solutions (Gritsenko et al., 2021). A review of international indices, such as the E-Government Development Index (EGDI), the ICT Development Index, and the Digital Economy Index, reveals that the Russian Federation has improved in this regard. According to Taylor (in Statista, 2022c), as of 2022, Denmark was the most digitally competitive country in the world, and the United States ranked second. The Aggregated Business Digitalization Index in Russia showed that among the indicators that constructed the index, the highest score was recorded for the use of data storage and transmission channels, and the lowest for human capital, which reflects the lack of the attention of the Employers towards the digital education of employees (Statista, 2021).

Introducing ICT as the core of the “digital technology”, Bukht and Heeks (2017) argue that the digital economy is an economic product solely or primarily driven by digital technologies and a business model based on digital services and goods. They also discuss the way in which the digital economy’s concepts and metrics are limited and divergent. Based on the definition proposed by the United Nations Conference on Trade and Development (UNCTAD, 2019, p. 2), the evolving digital economy is enhanced by data and closely linked to a significant number of the leading technologies, such as blockchain, data analysis, artificial intelligence (AI), 3D Printing, Internet of Things (IoT), automation and robotics, and cloud computing. Additionally, digital changes can profoundly affect economic and social processes, primarily economic growth, labor market, and service quality (The World Bank, 2018, p. 3). It should also be noted that the world is still at the early stage of a data-driven economy, despite a dramatic increase in the global Internet traffic as an indicator or representative for data flow. As defined by the Organization for Economic Cooperation and Development (OECD, 2021a), digital security is essential to trust-building in the digital age. Digital security aims to encourage the development of trust-building policies without impeding ICT capabilities in order to support innovation, growth, and competitiveness. Nowadays, governments, businesses, and consumers are greatly dependent on smart products. In 2019, 60% of member states to OECD, including Russia, were employing cloud computing services and 68% of people of these countries were registered as e-banking users. The market size of public cloud services in Russia is projected to reach almost 231 billion Russian rubles in 2025, increasing more than 2.5 times compared to 2020 (Statista, 2022a; OECD, 2021b, p. 5). This type of services and the Internet in general, are changing businesses, lifestyles, and public IT institutions and involve a variety of tools and applications such as data storage, servers, databases, networking, and software (Watanabe et al., 2018; Akamai, 2021; Investopedia, 2021). As mentioned earlier, the COVID-19 pandemic has accelerated digital development and increased human dependence on smart products because of the need to comply with the health protocols such as physical distancing (OECD, 2021b, 5; De et al., 2020). Therefore, Moscow has recently proposed a strong legal framework and set of rules to outline the future digital sovereignty. These rules involve data localization and import substitutions for IT products used by governmental organizations and critical institutions (Epifanova, 2020). This framework outlines the Russian State Duma's bill (The State Duma) on "Internet sovereignty", approved on April 4, 2019, according to which a national Internet traffic routing system will be developed to ensure the reliable operation of the Russian Internet in the event of large-scale breakdowns or external influences. It is hence necessary to propose security measures that ensure the stable and long-term operation of the Internet in Russia. It is noteworthy that the 2013 revelations of Snowden, a former CIA employee (Davies, 2019), the 2014 Western sanctions against Russia over the annexation of Crimea, and the 2016 NATO description of cyberspace for the US military action and national cyber strategy adopted in September 2018 to punish those who carry out cyber-attacks against them were among the most important reasons for Moscow's decision to become independent of foreign IT and focus on centralized government management in ICT. Accordingly, security is of particular importance as a cornerstone of digital transformation (Epifanova, 2020; Shahim, 2021). Russia's conflicts with the West, the independent strategies and programs of the hegemonic powers, the US and China, in the field of digital economy, the intense concentration of the digital economy in these two countries (UNCTAD, 2019, p. 2), and Russia's technological dependence on foreign technologies in this field further highlight the importance of the Russian Federation’s national program approach. In his December 2016 speech to the Federal Assembly, Putin announced the development of a digital economy program (Lowry, 2021, p. 53). In his speech at the St. Petersburg Economic Forum in June 2017, he called on everyone to face the challenges of digital transformation in Russia. In the presidential decree of May 2018, he also emphasized the importance of digital operating systems as a key driver of cross-sectoral digital transformation in the Russian economy (The World Bank, 2018, p. 85). Moreover, Dmitry Nikolaevich Chernyshenko, the Russian Deputy Prime Minister, stressed the need to develop project-oriented digital transformation strategies in the economic and social spheres at a summit of digital transformation leaders on May 28, 2021. The final version of these strategies should take into account both regional projects and local characteristics and be understandable not only to the authorities, but also to industry owners, traders, and citizens. In addition, these strategies have been decided to be implemented until 2024 (Russian Government, 2021c). However, in addition to supporting a model of economic digital transformation, it is necessary to establish a balance between protecting national security and consumer interests and supporting the growth of digital operating systems to achieve digital gains in all economic activities (Rossotto et al., 2018, p. 36). The Russian government hence seeks to design cyber polygons in various industries to protect government information systems or systems serving the current economic sectors. Most efforts in this regard are currently focused on energy, credit and finance, and infrastructure of government agencies (Russian Government, 2021b). Considering the opportunities and challenges of economic digitalization in Russia in terms of economic development and cybersecurity, this study aims to find answers to the following questions:

- What are the main features of the Russian digital economy?
- What are the functions and measures of the Russian digital economy regarding cybersecurity?
- What are the factors influencing the digital economy development of the Russian Federation?

Referring to the studies of the European Commission (2022) framework, Zhang et al., (2022), Li and Liu, (2021), Pang et al., (2022), APEC Economic Policy Report (2019), and considering the availability of data, digital economy was measured. In addition, a data-driven analysis of key trends in e-government development was conducted based on the assessment of e-government development and e-participation indices introduced by the United Nations E-Government Development Index (EGDI) methodology.

2. Literature Review

In this part, the results of previous research and factors affecting the development of digital economy in Russia will be reviewed. Russian Federation approved its digital economy program in July 2017. With an annual budget of $ 1.8 billion, this program is decided to be implemented by 2025 in order to overcome the weaknesses that prevent Russia from joining the top ranks of global digital economy leaders. The main axes of this program are digital skills, education, research and development (R&D), investment in digital infrastructure, and cybersecurity. The Russian president approved the 2020-2030 national strategy for artificial intelligence development in 2019 (The World Bank, 2018, p. 2; World Bank Group, 2021, p. 9), and the Russian government submitted a draft law titled "Experimental Legal Regimes of Digital Innovation in the Russian Federation", consisting of four chapters and twenty articles, to the Russian State Duma on March 16, 2020. This law required the Russian Federation to develop and test digital innovations in eight areas, including medicine, transportation, learning, financial markets, telecommunication, architecture and construction, state and municipal services, and industry (Legislative Activity Support System, 2021). After the approval of this law on July 31, 2020, the Ministry of Economic Development of the Russian Federation was appointed to implement the national digital economy program of the Russian Federation (Ministry of Economic Development of the Russian Federation, 2021). Accordingly, certain projects such as "normative regulation of digital environment" and "unknown data management" are now underway by this ministry. The digital economy is nowadays considered not only an objective, but also a tool to provide a new quality of economic system growth and a source of social (human development: actualizing human capacities and implementing important social projects), ecological (sustainable development), and economic (innovative development) benefits (Yalmaev et al., 2020).

Several researchers have mentioned the initial conditions of the development of the digital economy in Russia and in different sectors of the economy. Shulus et al., (2019) found that the transition of modern Russia to the digital economy would take place by 2024 in three successive stages, including the development of an informational society, the formation of technology reserves, and the implementation of innovative digital technologies. Belokurova et al. (2020) also argue that the establishment of an e-government system, an informational society, and the digital economy is a prerequisite to the digital economy institutionalization in Russia. As discussed by Kargina and Rozanov (2023), the prerequisites for the development of digitization in Russia were reducing the cost of technologies and computing power, while increasing the availability of high-speed data transmission. However, regional inequalities in the implementation of digital technologies slow down the overall process and therefore need to be eliminated.

Malkhasyan and Savelyeva (2023), investigated the digitalization of the industrial complex of Russia. They concluded that the current state of domestic industry is far from digital production, and most companies use the labor force of hired workers, despite the use of high-tech equipment. Such a system puts a significant importance on the human factor, which increases the cost risk. They argued that the new digital production paradigm optimizes the process of controlling and accounting for production processes, thereby increasing labor productivity and manageability of the company; in addition, thanks to operational control, this paradigm allows to react in time to emerging changes.

Yurak et al. (2023), in their study on the degree of digitization of the oil and gas industry of Russia, found that in addition to positive trends towards digitization in this sector, there are still unsolved problems that hinder its transformation and the construction of digital platforms. The training of qualified personnel is one of the main issues highlighted in this study. The other important problem is observed in the industry's dependence on foreign technologies, equipment, software and investments, which is exacerbated by sanctions and other restrictions. Lowry (2021) examined Russia's digital economy program and concluded that the transition to the digital economy in Russia without the development of the domestic electronics industry can only be considered in the context of buying electronic equipment abroad, which is likely to lead to a reduction in the size of the digital economy in Russia, rather than its growth. However, it should be noted that Russia is a unique country in terms of contracting governmental interests, which are formed based on legal norms and social interests and are reflected in the process of economic digitalization. This contradiction not only serves as an obstacle to the establishment of the digital economy in Russia, but also reduces its competitiveness worldwide.

The findings of Popkova and Gulzat (2020) on digital economy contradictions in Russia indicated that since there is a relationship between the social consequence of the digital economy and its effects on cybersecurity, both technical components (causes of threats arising from the characteristics of digital technologies) and social components threatening different population groups should be taken into account when dealing with cyber threats. Zemtsov et al. (2019) studied the reduced risks posed by the mechanization of the economy and artificial intelligence after liberating the majority of the labor force in Russia and stated that adaptation to digital transformation is an important component of risk reduction and that less adapted high-risk areas are often located in less developed areas in southern Russia. Another study by Chazhaeva et al. (2020) about sustainable development of the digital economy and management of its subsequent threats revealed that the digital economy growth can be consistent with one of the following scenarios: 1- sustainable development (no fluctuations in GDP growth rates at constant prices: for example, in Indonesia and China); 2- unsustainable development and crisis (considerable fluctuations in GDP growth rates at constant prices: for example, in Venezuela and Russia): and 3- sustainable growth (the most favorable scenario to increase GDP growth at constant prices: for example, in Singapore and the US). Popkova and Sergi (2020) employed a new conceptual model and an algorithm to study the Russian digital economy in relation to the development of transport and logistics policies. They stated that since the digital economy is vital to Russia, block chain, big data, IoT, and AI should be enhanced by dedicating governmental, technological, and financial supports and emphasizing customer preferences. Watanabe et al. (2018) investigated a new paradox in the digital economy and found that the limitations of GDP statistics in measuring the digital economy achievements have turned into a major issue.

In another study about the concept of the digital economy in Asia, Li et al. (2020) argued that correction of traditional business trends, widespread technology innovation, governmental support policies for economic growth, and enhancement of digital entrepreneurship capacity are prerequisites for the realization of the digital economy in Asia. Addressing the positive effects of the digital economy on market performance and market friction, Chen (2020) analyzed the new challenges of the digital economy as well as the policies on competition, regulatory, IP protection, and consumer privacy designed to improve performance in this field. Shahim (2021) studied the reduced business risks associated with the application, ownership, and exploitation of digital technologies and stated that digital security risks have turned into a business challenge that needs to be managed in a balanced and continuous manner for the long-term and sustainable achievements. The findings of Benčič et al. (2020) about the establishment of the digital economy in developing and developed countries indicated that a favorable short-term scenario (from 2019 to 2024) is the integration of developed and developing countries to pave the way for their close interaction and cooperation in establishing digital infrastructure and incorporating digital technologies in the structure of businesses based on cluster mechanisms. This can lead to a 29% reduction in the digital competition gap between countries by 2024.

The factors affecting the development of the digital economy in Russia are presented in Table 1.

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Table 1. Factors Influencing the Development of the Digital Economy

Variable Resource	Cybersecurity	Workforce training and education	Human capital (qualified personnel)	GDP and per capita GDP	Sanction	R and D expenditure	Inflation (consumer price index)
Yurak et al, 2023		•	•		•		
Weiyu et al., 2022						•	
Zhang et al., 2022						•	
Anisimova et al., 2022		•					
Pang et al., 2022				•			
Aleksandrova et al., 2022				•			
Pratt, 2022							•
Shahim, 2021	•						
Chen, 2021			•	•			
Platunina & Ermolenko, 2021	•						
Puspaningtyas & Mukhlis, 2021							•
Abd Razak et al., 2021	•	•					
Gaufman, 2021	•						
Loh et al., 2021	•	•					
Russian Government, 2021a				•			
Plakhotnikova et al., 2020			•		•		
Yue et al., 2020		•		•		•	•
Novikova & Strogonova, 2020				•			
Pradhan et al., 2019				•			
World Bank, 2018		•					
Davies, 2019					•		
Morakanyane et al., 2017			•				
Oxford Economics, 2011		•					
Mohan, 2007							•

3. Research Methodology

In this study, the main indicators of the development of the digital economy in Russia were extracted based on the data book of Indicators of the digital economy (2021). Referring to the studies of the European Commission's Digital Economy and Society Index (2022), Zhang et al., (2022), Li and Liu, (2021), Pang et al., (2022), APEC Economic Policy Report (2019) and considering data availability, this paper presents the main indicators in four dimensions: innovation and growth, openness, infrastructure and integration. The weights and total scores of the dimensions of the digital economy development from 2013 to 2020 were then computed using a factor analysis using the principal component method. This research is descriptive from a statistical point of view and uses the one-way statistic ANOVA and Levene's test for homogeneity of variance to compare the three indicators of e-government in Russia. The Pearson correlation coefficient was used to determine the relationship between the four measures of e-government development index, e-participation index, losses suffered by customers, and recovery costs of the banking system, after checking and confirming the normal distribution of the variables with the Shapiro-Wilk test. In addition, the correlation matrix between the different economic sectors of Russia in relation to the use of ICT in 13 activities was calculated using the Pearson coefficient. The main advantage of statistical correlation analysis is that it evaluates the intensity of the relationship between variables based on the available real data. In other words, it calculates the degree of the sensitivity of one variable to another based on the trend of recent years. In the analysis of Russian financial institutions in terms of the number of cyberattacks, the Kruskal-Walls test by ranks was used. The investigation of factors affecting the development of the digital economy in Russia was carried out in two stages. In the first step, a linear correlation between the identified variables was tested. In the second step, the correlated variables were inserted into the regression equation model. The validity of the regression model was examined by performing and testing assumptions related to multicollinearity and residual distribution. The data were analyzed using the Excel program and SPSS statistical software version 26.

4. Research Findings

4. 1. Digital Economy in Russia

The Russian National Digital Economy Project, which began on October 1, 2018, and ended on December 31, 2024, pursued the following three fundamental objectives (Russian Government, 2021a):

1. Increasing the domestic expenditures for the digital economy development from all sources (in terms of GDP share) at least by three times, compared to 2017.

2. Providing infrastructure for the fast transfer, processing, and storage of large amounts of data in a way that they would be available to all organizations and families.

3. Encouraging government agencies and organizations and local governments to mainly use governmental software applications.

Various projects, financially supported by the Federal budgets and other resources, have been planned on regulatory, digital environment, digital government, human resources, information security, technologies, and infrastructure in order to achieve the above-mentioned objectives. There are more than 30 key criteria and methodologies for monitoring and evaluating the size and influence of the digital economy; these criteria and methodologies fall into four categories depending on the measurement goal: infrastructure, empowering society, innovation and technology adoption, and jobs and growth.

Based on the European Commission's Digital Economy and Society Index (2020b), the digital economy is, in fact, a structure consisting of five dimensions, each of which has its own indicators and measures. These dimensions are connectivity, human capital, use of internet services, integration of digital technology, and digital public services. Table 2 indicates the status quo of the digital economy in Russia based on the dimensions of DESI. The scores on these indicators were normalized on a scale of 0 to 100, with higher scores indicating better status and position of a country. For example, Japan (74.5), the US (65.7), Iceland (75.4), Switzerland (86.1), and South Korea (85.3) are the top other countries of the world in terms of connectivity, human capital, use of internet services, integration of digital technology, and digital public services, respectively.

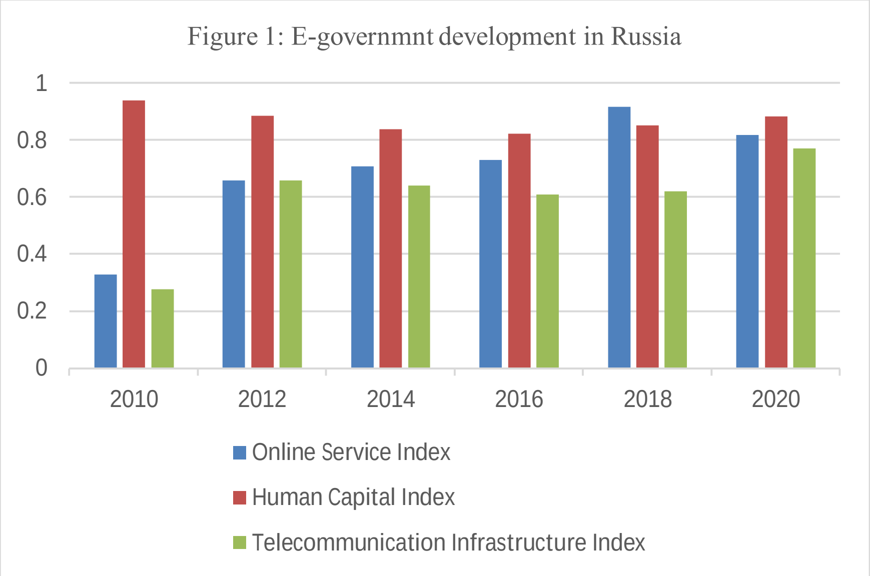
Table 2. Indicators of the Digital Economy in Russia

Total index	Connectivity	Human capital	Use of internet services	Integration of digital technology	Digital public services
38.7	45.8	37.2	47.8	27.8	60.5

Source: The European Commission's Digital Economy and Society Index, 2020b

The E-Government Development Index (EGDI) is a measure of e-government that consists of the weighted mean of normalized scores of three important dimensions of government, i.e. the Telecommunication Infrastructure Index (TII), the Human Capital Index (HCI), and the Online Service Index (OSI). The EGDI is employed to rank the UN member states in terms of e-government development. The first one, i.e. TII, consists of four indicators: the estimated number of Internet users per 100 people, the number of mobile phone subscribers per 100 people, the number of active subscribers of mobile-broadband internet services, and the number of users of fixed-broadband internet services per 100 people. The indicators of the HCI are the adult literacy rate, the gross ratio of primary, secondary, and tertiary enrollment, expected years of schooling, and mean years of schooling. Finally, the OSI is measured by the national portal, the e-services portal, the e-participation portal, and the websites of various ministries (United Nations E-government Survey, 2022; United Nations E-government Survey, 2020).

As a complement to the EGDI, the E-Participation Index (EPI) is another index in this regard, which emphasizes the governments' use of online services to provide conditions for "electronic information sharing", "electronic consulting", and "electronic decision making". The EPI score ranges between 0 (worst status) and 1 (best status) (World Bank, 2021; United Nations E-government Survey, 2022). Figure 1 illustrates the status of e-government development in Russia over the past decade based on its indicators. The three indicators of e-government development were compared over this period using one-way ANOVA. To this end, the homogeneity of variance was checked and confirmed by Levene's test (Table 3). The results of one-way ANOVA showed that there was a significant difference between the indicators over the studied period. The difference between the indicators was then examined using the Least Significant Difference statistics (LSD).



Source: Authors' Compilation from the UN Raw Data, 2021

Table 3. Levene's Test for the Homogeneity of Variance

	Levene Statistic	df1	df2	Sig.
Based on Mean	1.451	2	15	.265
Based on Median	1.044	2	15	.376
Based on Median and with adjusted df	1.044	2	10.214	.387
Based on trimmed mean	1.263	2	15	.311

Source: Authors' Compilation from SPSS 26

As illustrated in Table 3, as the homogeneity of variance was confirmed at the 0.05 level of significance, one-way ANOVA was used to compare the three indicators (human capital Index, online services Index, and telecommunication Infrastructure Index). According to Table 4, the F-value (0.022) was statistically significant ($p \leq 0.05$), that is to say, there was a significant difference between at least two of the studied indicators. The results of LSD used for this purpose are presented below.

Table 4. One-way ANOVA

Var	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.231	2	.116	4.970	.022
Within Groups	.349	15	.023		
Total	.580	17			

Source: Authors' Compilation from SPSS 26

According to the findings of Table 5, there was a significant difference between the telecommunications infrastructure indexes (TII) and human capital Index (HCI), so the average human capital index is better than that of telecommunications. In addition there was no significant difference between the indicators of online services index and human capital index, as well as online services and telecommunications indices.

Table 5. Multiple Comparisons between Indicators

(I) Var	(J) Var	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
OSI	HCI	-.17620333	.08802849	.064	-.3638316	.0114250
	TII	.09760667	.08802849	.285	-.0900216	.2852350
HCI	OSI	.17620333	.08802849	.064	-.0114250	.3638316
	TII	.27381000*	.08802849	.007	.0861817	.4614383
TII	OSI	-.09760667	.08802849	.285	-.2852350	.0900216
	HCI	-.27381000*	.08802849	.007	-.4614383	-.0861817

*The mean difference is significant at the 0.05 level.

Source: Authors' Compilation from SPSS 26

The Pearson correlation coefficient was employed to find the correlation between EGDI and EPI, after checking and confirming the normal distribution of variables by the Shapiro–Wilk test. Table 6 indicates a significant positive correlation between two indicators in the studied period, with a significant level of 1% and high intensity of dependence (0.981).

Table 6. Correlation between EGDI and EPI

		E-Government Index	E-Participation Index
E-Government Index	Pearson Correlation	1	.981**
	Sig. (2-tailed)		.001
	N	6	6
E-Participation Index	Pearson Correlation	.981**	1
	Sig. (2-tailed)	.001	
	N	6	6

** Correlation is significant at the 0.01 level (2-tailed)

Source: Authors' Compilation from SPSS 21

It can be generally stated that Russia ranks among the top countries in terms of EGDI in 2022 (ranked 42nd among the UN 196 member states), with a score of 0.816 (OSI+HCI+TII/3) (0.75>). Figures 2-4 compare the components of e-government development in Russia with the mean status in post-Soviet countries (except for Moldavia due to lack of access to data), upper-middle income countries (55 countries, including Russia) (The World Bank, 2023)), and high-income countries with a very high EDDI score (44 countries) in 2020. As shown in the following figures, the e-government development score of the Russian Federation is above the mean score of post-soviet countries and significantly more than the mean of upper-middle income countries. However, according to Figure 4, Russia's score is significantly lower than the third group countries', except in terms of HCI. This difference is more statistically significant in TII.

Figure 2. Comparison of Components of E-government in Russian & Post-Soviet Countries

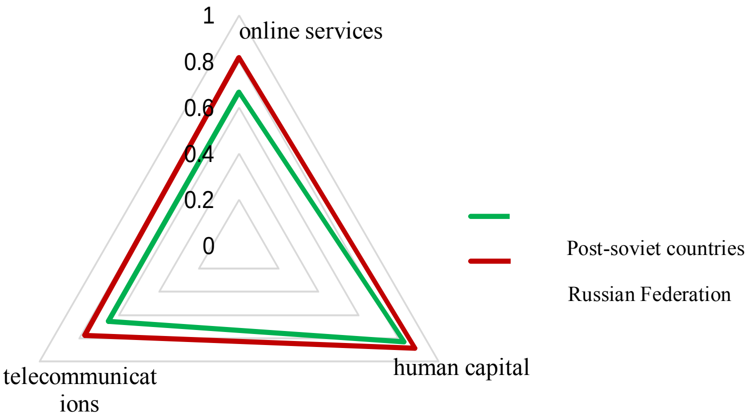


Figure 3. Comparison of Components of E-government in Russian & Upper-middle Income Countries

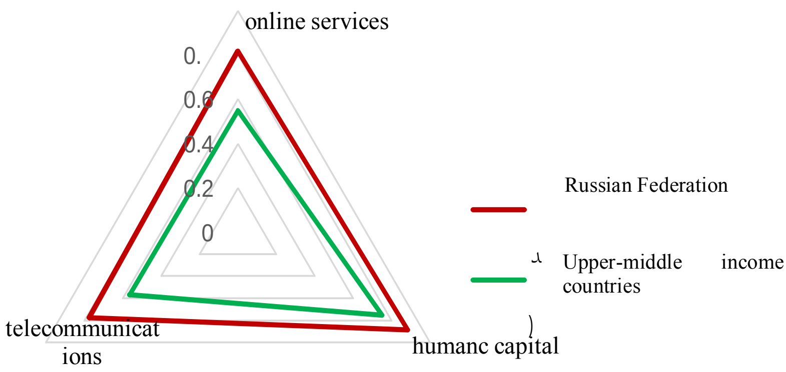
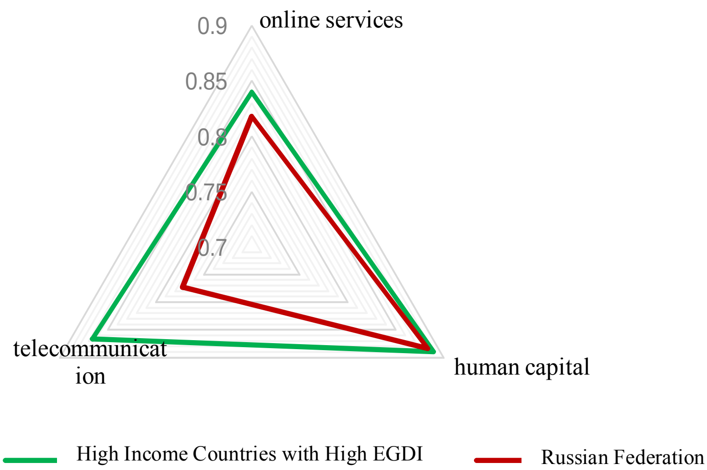


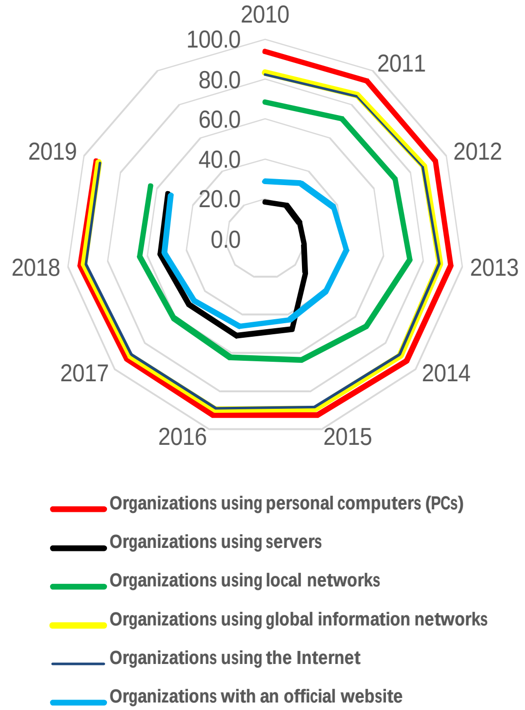
Figure 4. Comparison of Components of E-government in Russian & High Income Countries



Source: Authors' Compilation from Excel

Figure 5 also illustrates the status quo of using ICT (0-100%) in Russian organizations in the period 2010-2019. The data indicate that the use of personal computers, the Internet, and global information networks has always had coverage of about 90%. The use of servers and websites also shows a significant growth compared to 2019, but there is still a gap between the status quo and the desirable status. However, the use of local area networks by organizations has declined by about 5%, which can be attributed to the development of other infrastructure.

Figure 5: Statis quo of ICT use in Russian organizations in the period 2010-2019



Resource: Authors' Compilation from Excel (Data Accessed from the Federal State Statistics Service of the Russian Federation, 2021)

Table 7 provides a matrix of correlation between Russia's various economic activities regarding the use of ICT. Because of the ratio scale of the variables, the Shapiro–Wilk test was employed to examine the distribution of variables before Pearson's correlation test. Results indicated that all variables followed a normal distribution pattern, except for Variable X_8 (real estate, rental, and services). This variable was also normalized to be used for analysis. The results of the Pearson's correlation test demonstrated that there was a significant positive correlation ($p < 0.05$) between economic activities and all variables, except for the colored ones (16 items), regarding the use of ICT in the studied period. However, there was no significant correlation between the real estate, rental, and service sector, and other sectors. Since there was a high correlation between different economic activities in this regard, it can be stated that there has been a balance and coordination between the various economic sectors in Russia considering the use of ICT over the studied period.

Table 7: Correlation Matrix

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}
X_1	1												
X_2	.952**	1											
X_3	.898**	.964**	1										
X_4	.932**	.818**	.753**	1									
X_5	.866**	.851**	.892**	.776**	1								
X_6	.963**	.954**	.950**	.875**	.936**	1							
X_7	.879**	.951**	.977**	.744*	.867**	.904**	1						
X_8	.395	.349	.374	.451	.434	.323	.517	1					
X_9	.947**	.954**	.961**	.862**	.882**	.946**	.970**	.509	1				
X_{10}	.622	.784**	.748*	.459	.430	.613	.761*	.067	.691*	1			
X_{11}	.932**	.952**	.982**	.823**	.938**	.976**	.960**	.417	.979**	.649*	1		
X_{12}	.887**	.943**	.991**	.725*	.918**	.947**	.964**	.398	.947**	.672*	.980**	1	
X_{13}	.940**	.941**	.964**	.839**	.894**	.956**	.955**	.444	.992**	.663*	.986**	.959**	1

*The 0.05 level of significance
**The 0.01 level of significance
Source: Authors' Compilation from SPSS 26 (Data Accessed from Federal State Statistics Service of the Russian Federation, 2021)

X1: Mine
X2: Factory industries
X3: Production and distribution of electricity, water, and gas
X4: Construction
X5: Wholesale and retail, repair of motor vehicles and motorcycles, household goods, and personal items
X6: Hotels and restaurants
X7: Financial and insurance activities
X8: Real estate, rental, and services
X9: General management and military operations, social insurance
X10: Higher professional education and training of specialized personnel
X11: Health care and social services
X12: Recreational, entertainment, cultural, and sports activities
X13: Other activities

4. 2. Cybersecurity

According to the Presidential Decree No. 646 (Security Council of the Russian Federation, 2016) of December 5, 2016, the Information Security Doctrine of the Russian Federation was adopted in order to ensure Russia's national security in the area of intelligence. Article 10 of this doctrine indicates that IT can cause new information threats although it plays a major role in the economic development and better functioning of government and social institutions (The Ministry of Foreign Affair of the Russian Federation, 2021). Information security is an issue with national and transnational dimensions; at the international level, it involves issues such as the observance of the norms, rules, and principles of governments in the ICT environment, international cooperation to prevent the use of ICT for hostile military-political purposes, and improvement of public-private partnerships to ensure the protection of critical information infrastructure (Russian International Affairs Council, 2020).

In addition to triggering economic development and improved functioning of governments and public institutions, the development of IT applications in various fields can also pose information threats (Li, 2019). The term “cyber warfare” refers to the use of cyber weapons and other tools and systems in cyberspace as a strategy of defense and attack aiming at causing harm, death, and destruction or affecting international actors. Cyber warfare is another mode of conflict in the long history of military technology, forcing new operational and tactical concepts that allow one country, with the help of computer engineers or hackers, to attack other countries and launch attacks. Accordingly, the main features ensuring information security in Russia are the defense of sovereignty over the information space, the use of intelligence in confrontation with military objectives, further control over informational content, expansion of international cooperation in information security, and development of a military definition that guarantees information security and analyzes the provision of this security under Russian laws (Bokil, 2023; Górka, 2022; Tabachnik & Topor, 2020; Li, 2019).

However, beyond information warfare, the Russian military definition of "cyber warfare" also involves computer network operations, electronic warfare, and intelligence and psychological operations (Tabachnik & Topor, 2020). Similar to economic and business digitalization that increases the costs of information security, cybersecurity is also effective in developing the digital economy and securing rapid digital changes. The information security cost is influenced by many factors, the most important of which is cyber threats (Platunina & Ermolenko, 2021; Mahalina & Mahalin, 2020; Konopleva et al., 2019); such threats aim to penetrate a country's information system in order to steal data and money or obtain confidential information to engage in espionage processes, information warfare, or other purposes that have potentially negative consequences for government, society, business, and people (Lobach & Smirnova, 2019; Voskanyan, 2018). According to a report of the Russian RG.RU Gazette (Linnik, 2021), the Deputy Chairman of the Board of Sberbank of Russia has estimated that Russia's economy is likely to lose about 6 trillion rubles by early 2022 due to cybercrimes. He has also warned about the economic and human losses of cyber-attacks. Studies indicate that the growth of cybercrime is one of the main threats to the sustainable operation of national payment and liquidation infrastructures as well as financial and credit systems in Russia and the member states to the Eurasian Economic Union

(Pishchik & Alekseev, 2021). In addition, the economic loss caused by cybercrime in Russia (in dollars) shows an 80% increase from 2018 to 2020, from $ 28 billion to $ 50.4 billion, and it is predicted to undergo a 150% increase to $ 126 billion by 2022 (Rusakova & Golovan, 2021).

The raw data contained in an article by Shkodinskij et al. (2021) were employed to investigate the relationship between the number of cyber-attacks on Russian financial institutions and the type of financial institutions during the period 2016-2020. Since the data normal distribution and homogeneity of variance were not established, the Kruskal–Wallis test by ranks was used for statistical analysis (Table 8). Results indicate that there was a significant difference between Russian financial institutions in the number of cyber-attacks, as banks, and financial institutions other than banks, ranked higher in this regard (Table 9). The Central Bank of the Russian Federation was also the target of the fewest cyber-attacks during the same period.

Table 8. Kruskal–Wallis Test[a,b]

	Number of cyber-attacks
Kruskal-Wallis H	14.698
Df	3
Asymp. Sig.	.002

a. Kruskal Wallis Test

b. Grouping Variable: Type of financial institutions

Resource: Authors’ compilation from SPSS 26

Table 9. Ranking (Number of Cyber-attacks)

Type of financial institution	N	Mean Rank
-Central Bank of Russian Federation	3	2.00
-Systemically important banks	5	6.00
-Other banks	5	15.20
-Financial institutions other than banks	5	11.80
-Total	18	

Source: Authors' Compilation from SPSS 26

The Pearson's correlation test also showed that there was a significant positive correlation between the losses incurred by customers of banking and non-banking financial institutions (million rubles), and the banking systems recovery and operation cost after a cyber-attack during the period 2016-2020, at a significant level of 1% (Table 10). In other words, the increasing cyber-attacks significantly increased the system recovery costs. The findings of Mingaleva (2019) showed that the retrieval cost of websites in the Russian credit and financial sector is on the rise following the cyber-attacks.

Table 10. Pearson's Correlation Test

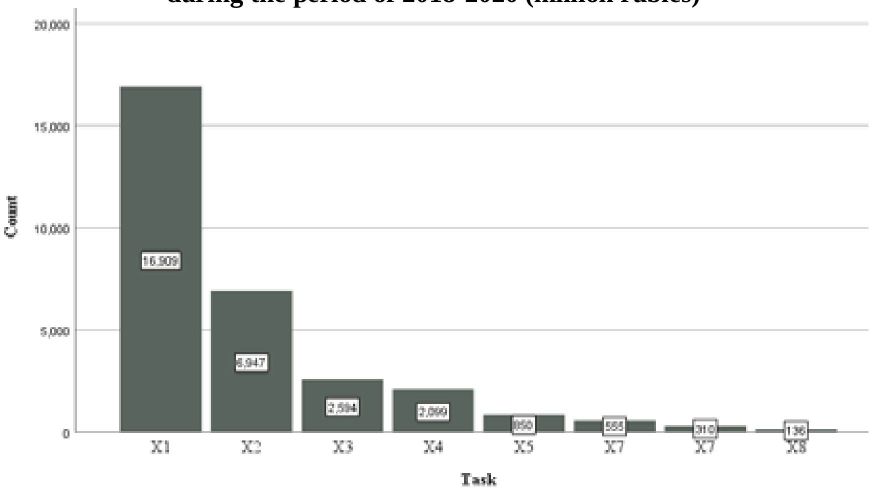
		Losses to customers	Banking system recovery cost
Losses to customers	Pearson Correlation	1	.999**
	Sig. (2-tailed)		.000
	N	5	5
Banking system recovery cost	Pearson Correlation	.999**	1
	Sig. (2-tailed)	.000	
	N	5	5

Source: Authors' Compilation from SPSS 26

The global market for cybersecurity services has been constantly growing, as it is projected to experience a 68% growth and reach $

231.94 billion by 2022, while it was $ 137.85 billion in 2017 (Voskanyan, 2018). Figure 6 illustrates the major goals for which Russia has planned and in which Russia has invested from 2018 to 2020. The data indicate that more than half (55.6%) of the 30,400 million rubles spent on the following eight axes is dedicated to ensuring the stability and functional security of information systems and technologies.

Figure 6. The most expensive tasks in the "Information Security" section during the period of 2018-2020 (million rubles)



Source: Authors' Compilation from SPSS 26 (Data Accessed from Konopleva et al, 2019)

The tasks X1 through X8 in the figure above mean that:

X1: Ensuring the stability and security of the functioning of information systems and technologies

X2: Ensuring the protection of the rights and legitimate interests of business in the digital economy

X3: Creation of technical tools to ensure safe information interaction of citizens in the digital economy

X4: Ensuring controllability and reliability of the Russian segment of the Internet

X5: Providing organizational and legal protection of state interests in the digital economy

X6: Ensuring the stability and safety of the functioning of the unified telecommunication network of the Russian Federation

X7: Ensuring technological independence and security of the functioning of hardware and data processing infrastructure

X8: Ensuring the legal regime of machine-to-machine communication for cyber-physical systems

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It is important to investigate the relationship of the digital economy and cybersecurity with gross domestic production (GDP). Based on the Russian cybersecurity budget (in rubles) in the period 2018-2020 (Konopleva et al, 2019) and the World Bank data on Russia's current GDP (World Bank data sheet, 2021), the cybersecurity share of GDP was 0.007 in 2018, 0.01 in 2019, and 0.01% in 2020. In terms of the digital economy, as stated by the Russian government (Russian Government, 2021a), although GDP is one of the determinants of digital economy development, it seems that the effects of the digital economy on economic growth will appear with a considerable time lag. Certain macroeconomic and digital economy indicators of Russia over the past decade based on the latest available data are presented in tables 11 and 13. The results indicate that military and digital economy expenses still account for a major share of GDP, although the Russian economy has shrunk in recent years. The Pearson's correlation test also revealed that there was a significant negative and strong correlation (-0.670) between the Russia's GDP growth rate and military expenditure during the period 2010-2021 (Table 12). In other words, as GDP has fallen, military spending has increased. Nitsevich et al. (2019) criticize this situation, arguing that the Russian Government, facing a low GDP, still has to spend a thousand billion rubles on defense and security, while failing to meet its citizens' needs in food, clothing, and medicines. Moreover, the status quo of the Russian economy is not satisfactory due to non-competitive production, a drop in the price of oil and other export raw materials, and Western anti-Russian sanctions.

Table 11. Macroeconomic Indicators of the Russian Economy

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GDP growth rate	4.5	4.3	4.02	1.75	0.73	-1.97	0.19	1.82	2.8	2.2	-2.66	4.74
GDP per capita growth rate	4.45	4.21	3.84	1.53	-1.04	-2.18	0.01	1.70	2.81	2.24	-2.46	5.1
Military expenses (share of GDP)	3.58	3.43	3.68	3.85	4.11	4.87	5.42	4.24	3.69	3.83	4.26	4.08

Source: World Bank Data Sheet, 2023

Table 12. Pearson's Correlation Test

		GDP growth rate	Military expenses (% of GDP)
	Pearson Correlation	1	-.670*
	Sig. (2-tailed)		.017
GDP growth rate	N	12	12
	Pearson Correlation	-.670*	1
Military expenses	Sig. (2-tailed)	.017	
(% of GDP)	N	12	12

Source: Authors' Compilation from SPSS 26

Table 13. Digital Economy Spending to GDP in Russia 2017-2021

	2017	2018	2019	2020	2021
Gross domestic expenditure on digital economy development	3.6	3.6	3.7	3.8	3.7
Household expenditures on digital technologies use	1.3	1.3	1.5	1.7	1.5
Internal costs of organizations on digital technologies	1.9	1.9	2.2	2.1	2.2

Source: Statista Research Department (2022b)

4. 2. 1. Digital Economy Development

To examine the explanatory role of the influencing variables on the digital economy development, this paper needs to measure the digital economy development of the Russian Federation. First, the main indicators were extracted based on the data book of Digital Economy Indicators in the Russian Federation (2021) (Table 14). Second, referring to the studies of the European Commission's Digital Economy and Society Index (2022), Zhang et al., (2022), Li and Liu, (2021), Pang et al., (2022), APEC Economic Policy Report (2019), and considering the availability of data, this paper contains the main indicators (Table 15) in four dimensions: innovation and growth, openness, infrastructure, and integration. Some measures of central tendency and dispersion of indications are presented in Table 15.

Table 14. Main Indicators of Russia's Digital Economy Development (2013-2020)

Dimension	Indicator	Source of data
Innovation and growth	Gross domestic expenditure on R&D in 'Information and telecommunication systems' priority S&T area as a percentage of the gross domestic expenditure on R&D	Indicators of the digital economy, 2021
	ICT-related publications by Russian authors indexed in Scopus: as a percentage of the world total number of ICT-related publications	Indicators of the digital economy, 2021
	ICT-related patent applications filed by Russian residents: as a percentage of the world total ICT-related patent applications	Indicators of the digital economy, 2021
	Innovative goods and services as a percentage of total sales in the ICT sector	Indicators of the digital economy, 2021
	ICT sector's gross value added as a percentage of GDP	Indicators of the digital economy, 2021
	Content and media sector's gross value added as a percentage of GDP	Indicators of the digital economy, 2021

Continue the table 14…

Dimension	Indicator	Source of data
Openness	Export-to-import ratio: ICT services, percentage	Indicators of the digital economy, 2021
	Export-to-import ratio: ICT goods, percentage	Indicators of the digital economy, 2021
	High-technology exports (% of manufactured exports)	Indicators of the digital economy, 2021; World Bank (2023)
Infrastructure	Fixed broadband subscriptions per 100 inhabitants	Indicators of the digital economy, 2021; World Bank, 2023
	Mobile broadband subscriptions per 100 inhabitants	Indicators of the digital economy, 2021; World Bank, 2023
	Households with Internet access as a percentage of all households	Indicators of the digital economy, 2021
	Individuals who have ever used the Internet as a percentage of individuals aged 15–74	Indicators of the digital economy, 2021
	Individuals who have used the Internet daily or almost every day as a percentage of individuals aged 15–74	Indicators of the digital economy, 2021
Integration	Enterprises in business enterprise sector (as a percentage of total number thereof) that use broadband access	Indicators of the digital economy, 2021
	Enterprises in business enterprise sector (as a percentage of total number thereof) that use cloud computing services	Indicators of the digital economy, 2021
	Enterprises in financial sector (as a percentage of total number thereof) that use broadband access	Indicators of the digital economy, 2021
	Enterprises in financial sector (as a percentage of total number thereof) that use cloud computing services	Indicators of the digital economy, 2021
	Institutions in social sphere (as a percentage of the total number thereof) that use broadband access	Indicators of the digital economy, 2021
	Institutions in social sphere (as a percentage of the total number thereof) that use cloud computing services	Indicators of the digital economy, 2021

Table 15. Descriptive Statistics of Digital Economy Development Indicators (2013 – 2020)

Indicator	Scale	Mean	Std.D	Max	Min
Enterprises in financial sector (as a percentage of total number thereof) that use broadband access	Ratio	91.44	1.76	93.80	89.30
Content and media sector's gross value added as a percentage of GDP	Ratio	0.35	0.01	0.39	0.33
Enterprises in business enterprise sector (as a percentage of total number thereof) that use broadband access	Ratio	82.17	2.75	86	78.90
ICT sector's gross value added as a percentage of GDP	Ratio	2.84	0.11	3.10	2.74
Gross domestic expenditure on R&D in 'Information and telecommunication systems' priority S&T area as a percentage of the gross domestic expenditure on R&D	Ratio	8	0.32	8.5	7.4
Institutions in social sphere (as a percentage of the total number thereof) that use broadband access	Ratio	80.32	3.81	85.30	74.60
Households with Internet access as a percentage of all households	Ratio	74.22	4.19	80	67.20
Individuals who have ever used the Internet as a percentage of individuals aged 15–74	Ratio	81.60	6.91	89.6	71
ICT-related patent applications filed by Russian residents: as a percentage of the world total ICT-related patent applications	Ratio	0.35	0.04	0.41	0.30
Fixed broadband subscriptions per 100 inhabitants	Interval	19.78	2.49	23	16.5
Gross domestic expenditure on digital economy development from all sources as a percentage of GDP	Ratio	2.04	0.31	2.5	1.7
Individuals who have used the Internet daily or almost every day as a percentage of individuals aged 15–74	Ratio	61.38	10.30	76.7	48
Export-to-import ratio: ICT services, percentage	Ratio	83.13	15.70	104.70	65.70
High-technology exports (% of manufactured exports)	Ratio	12.50	2.36	15.95	9.13
Mobile broadband subscriptions per 100 inhabitants	Interval	78.22	14.84	99.80	59.80
Innovative goods and services as a percentage of total sales in the ICT sector	Ratio	6.41	1.22	8	5.10
Institutions in social sphere (as a percentage of the total number thereof) that use cloud computing services	Ratio	20.01	5.81	27	11.30
Export-to-import ratio: ICT goods, percentage	Ratio	11.65	3.60	17.70	7.5

Continue the table 15…

Indicator	Scale	Mean	Std.D	Max	Min
Enterprises in business enterprise sector (as a percentage of total number thereof) that use cloud computing services	Ratio	20.35	6.59	29.10	11
ICT-related publications by Russian authors indexed in Scopus: as a percentage of the world total number of ICT-related publications	Ratio	2.3	0.80	3.48	1.07
Enterprises in financial sector (as a percentage of total number thereof) that use cloud computing services	Ratio	23.78	10.34	38.50	11.80

Source: Authors, Calculation from Digital Economy Indicators in the Russian Federation, 2021

4. 2. 1. 1. Factor Analysis

Factor analysis using the principal components method was used to calculate the weights and total scores of the dimensions of the digital economy development from 2013 to 2020. We build a comprehensive assessment index system based on the concept and characteristics of the digital economy from four dimensions: innovation and growth, openness, infrastructure, and integration. Dimension scores were calculated using related indicators, and through the technique of factor analysis, the data of the above four dimensions were standardized and then processed to lessen the dimension to attain the comprehensive development index of digital economy development. As explained by Shrestha (2021), factor analysis is particularly suitable to extract few factors from the large number of related variables to a more manageable number, prior to using them in other analysis such as multiple regression or multivariate analysis of variance. In this line, this study uses factor analysis to determine the correlations and weights of four constructs and applies SPSS26.0 software to perform a Pearson correlation test, KMO and Bartletts sphericity test on the four constructs to determine whether the data selected in this study are suitable for factor analysis. According to the results of the

Pearson correlation test, the four selected dimensions are significantly correlated and meet the requirements of factor analysis. In addition, the KMO statistic is 0.636. The Bartletts sphericity test indicates that the hypothesis of independence of each variable is not true (P-value=0.00001), indicating that the factor analysis method can be used to weight the dimensions. According to the results indicated in Table 16 and Table 17, four dimensions were loaded on one factor as latent variable (Eigenvalue >1 and communalities extraction > 0.5). This factor as a latent variable was called digital economy development, which explained 91% of the variance of the dimensions as explicit variables.

Table 16. Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.659	91.472	91.472	3.659	91.472	91.472
2	.258	6.449	97.921			
3	.073	1.830	99.751			
4	.010	.249	100.000			

Extraction Method: Principal Component Analysis.
KMO=0.636, p-value=0.00001

Source: Authors’ Compilation from SPSS 26

Table 17. Component Matrix[a]

	Component 1	Communalities extraction
Integration	.971	.943
Infrastructure	.928	.861
Openness	.967	.935
Innovation and Growth	.959	.920

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

Source: Authors’ Compilation from SPSS 26

4. 2. 1. 2. Correlation between Digital Economy Development (IV) and Explaining Variables

In this section, the six variables GDP, GDP per capita, R&D expenditure, cyber security, human capital index and consumer price index (as a measure of inflation) were selected as influencing factors affecting the digital economy development based on the literature review summarized in Table 1. Before conducting the Regression analysis, the relationships among dependent and independent variables were examined. The distribution of the variables was investigated before the analysis through the Shapiro–Wilk normal distribution test (it has low sensitivity to sample size and is suitable for samples with small size).

Pearson's correlation test showed a positive correlation between digital economy development and human capital index and consumer price index, and a negative correlation between digital economy development and cybersecurity during the period 2013-2020. There was no significant correlation between the digital economy development and the three variables GDP, GDP per capita and expenditure on research and development (Table 18).

Table 18. Correlations

		Digital Economy Development	GDP per capita	GDP	R and D expenditure	Human Capital (index)	Cyber security	Consumer price index
Digital Economy Development	Pearson Correlation	1	-.487	-.471	-.189	.994**	-.900**	.920**
	Sig. (2-tailed)		.221	.239	.655	.000	.002	.001
	N	8	8	8	8	7	8	8

**. Correlation is significant at the 0.01 level (2-tailed).
Source: Authors' Compilation from SPSS 26

In the next step, the above correlated variables, including human capital, cybersecurity, and consumer price index were inserted into the regression equation model.

4. 2. 1. 3. Multiple Regression Analysis

When running a multiple regression, several assumptions must be checked to ensure that the data agree in order for the analysis to be reliable and valid. The primary result showed that there was multicollinearity (VIF scores were above 10) in the data and the value of the residuals is not independent (Durbin-Watson = 2.53). Therefore, the two variables consumer price index and cybersecurity were excluded from the analysis and a bivariate regression was conducted using human capital index as an explanatory variable.

The regression results of OLS are illustrated in Table 19 and Table 20. The findings indicate that the analysis of variance statistic is statistically significant and therefore the human capital of the Russian Federation can effectively promote the digital economy development at a significant level of 1%. In other words, 82% of the variation in the dependent variable could be explained by the human capital index.

Table 19. ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.	R Square	Adjusted R Square
1	Regression	5.934	1	5.934	33.417	.001[b]	.848	.822
	Residual	1.066	6	.178				
	Total	7.000	7					

a. Dependent Variable: Digital Economy Development

b. Predictors: (Constant), Human Capital

Source: Authors' Compilation from SPSS 26

Table 20. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.188	.152		-1.232	.264
	Human Capital	.812	.140	.921	5.781	.001

Dependent variable: Digital Economy Development

Source: Authors' Compilation from SPSS 26

5. Conclusion

According to strategic documents of the Russian Federation, opportunities resulting from the digital economy are considered a key factor that ensures economic growth and national sovereignty and stimulates production in all areas of social and economic activities. However, digital security is an essential part of trust-building in the digital age, since uncontrolled digitization of the economy can greatly increase its vulnerability to cyber threats (Shermet, 2019; OECD, 2021b, p. 5). Therefore, the active participation of the government, research and educational organizations, and enterprises is necessary for the development of the digital economy and the minimization of its possible risks in Russia (Gurlev, 2020). Effective solutions to combat cybercrime and increase cybersecurity in Russia include the development of cyber insurance, improvement of digital literacy of employees and activists of businesses as well as the general public, improvement of professional training, and adaptation to digital transformation (Chazhaeva et al., 2020; Prihod'ko & Bel'kova, 2021; Mamedov, 2021 Shepelin, 2017). The study findings regarding e-government development in Russia, as an important component of the digital economy, revealed that there was a significant difference between the telecommunications infrastructure index (TII) and human capital index (HCI); as a result, the average human capital index is better than that of telecommunications. The e-government development score of the Russian Federation was above the mean score of post-soviet countries and significantly more than the mean of upper-middle income countries. However, Russia's score is significantly lower than that of high-income countries with a very high EGDI score, except in terms of HCI. This difference is more statistically significant in TII. In other words, Russia is far ahead of high-income countries in terms of telecommunications infrastructure. As noted by the Russian government (2021a,b), and the World Bank (2018, 2), investments in digital infrastructure have been identified as one of the main axes of Russia's national digital economy project, which began on October 1, 2018. Regarding the human capital index of EGDI, the result of this research is not in line with Taylor (in Statista, 2022c). He found that Russia had the highest score for the use of data storage and transmission channels and the lowest for human capital, reflecting the lack of attention paid by employers to digital training of workers. Regarding the above result, it should also be noted that Taylor used the Aggregated Business Digitalization Index.

The Pearson's correlation test demonstrated that there was a significant positive correlation between EGDI and EPI in the studied period (($p \leq 0.05$), with a high intensity of dependence. In other words, any increase or decrease in the process of e-government development can increase or decrease e-participation and vice versa. The matrix of correlation between various economic activities in Russia in terms of ICT application also suggested the high intensity of dependence between different economic sectors. In fact, it can be stated that there has been a balance and coordination between the various economic sectors in Russia considering the use of ICT over the studied period.

The results of the Kruskal–Wallis test by ranks demonstrated that there was a significant difference between Russian financial institutions in the number of cyber-attacks, as banks and non-bank financial institutions ranked higher in this regard. The Central Bank of the Russian Federation was also the target of the fewest cyber-attacks in the same period. The Pearson's correlation test indicated that the increasing cyber-attacks substantially increased the system recovery costs, as more than half (55.6%) of the 30,400 million rubles spent on the eight axes of information security is dedicated to ensuring the stability and functional security of information systems and technologies. The findings also indicated that military and digital economy expenses, still account for a major share of GDP, although the Russian economy has shrunk in recent years. However, it is necessary to take into account the short-, medium, and long-term effects of digital economy development on economic growth. The Russian government states that although GDP is one of the determinant factors of digital economy development, it seems that the effects of the digital economy on economic growth will appear with a considerable time lag (Russian Government, 2021a). Finally, it can be stated that Russia's plans for the development of digital approaches to the economy, along with hefty expenses to ensure cybersecurity, can turn it into a top country in the world in this regard.

In sum, based on the refinery methods of factor analysis, Pearson's correlation coefficient and multiple regression analysis, five variables GDP, GDP per capita, R&D expenditure, cyber security and consumer price index (as a measure of inflation) were removed from the analysis and finally the connection between the digital economy development as a dependent variable and the human capital index was examined using a bivariate regression statistic. Several researchers have studied the relationship between the development of human capital and the digital economy development in Russia, which can be mentioned as follows: Ruzakova et al. (2023) (Human capital and digitalization in the Arctic); Malkhasyan and Savelyeva (2023) (labor productivity); Yurak et al. (2023) (training of qualified personnel); Zavyalova et al. (2022) (the key components of digitization of human resources management in the Russian market); Yashina et al. (2022) (Finance Digital with a focus on Human Capital in Russia); Zemtsov (2022) (Digital Transformation and Skills through Entrepreneurship in 83 Russian regions to learn); Treadwell (as cited in World Bank, 2018) (boosting digital skills and requires a highly-trained workforce).

Findings indicate that human capital has a significant positive impact on the development of the digital economy in Russia and, as noted by Gulyaeva et al. (2023), becomes the leading and intensive factor in the development of the digital economy. Human capital in the digital industry sector of Russia can be stimulated by promoting structural improvement, higher education and training of highly qualified personnel, since every technological breakthrough requires a highly-trained workforce (Anisimova et al., 2022; Orzkhanova et al., 2021; Abd Razak et al., 2021; Loh et al., 2021; Yue et al., 2020; World bank, 2018). However, despite the significant explanatory role of the human capital index, this study strongly recommended considering the other variables, both predictive and control, to explain the variance in the development of the digital economy. Therefore, the results in this section must be interpreted cautiously and conservatively.

References

Abd Razak, S. N., Mohamad Noor, W. N. B., & Mat Jusoh, Y. H. (2021). Embracing Digital Economy: Drivers, Barriers and Factors Affecting Digital Transformation of Accounting Professionals. *International Journal of Advanced Research in Economics and Finance*, *3*(3), 63-71. http://myjms.mohe.gov.my/index.php/ijaref

Akamai. (2021). Cloud Computing Services. https://www.akamai.com/us/en/resources/cloud-computing-services.jsp

Aleksandrova, A., Truntsevsky, Y., & Polutova, M. (2022). Digitalization and Its Impact on Economic Growth. *Brazilian Journal of Political Economy*, *42*(2), 424-441. https://www.scielo.br/j/rep/a/K5CLs3KfvVxKPJVSgwhzCbG/?lang=en#

Anisimova, T., Sabirova, F., Shatunova, O., Bochkareva, T., & Vasilev, V. (2022). The Quality of Training Staff for the Digital Economy of Russia within the Framework of STEAM Education: Problems and Solutions in the Context of Distance Learning. *Education Sciences, 12*, 87. https://doi.org/10.3390/educsci12020087

APEC Economic Policy Report. (2019). Measuring the Digital Economy. https://www.apec.org/publications/2019/12/2019-apec-economic-policy-report

Belokurova, E. V., Pizikov, S. V., Petrenko, E. S., & Koshebayeva, G. K. (2020). The Institutional Model of Building the Digital Economy in Modern Russia. In E. Popkova & B. Sergi (Eds.), *Digital Economy: Complexity and Variety vs. Rationality* (Vol. 87) (pp. 64-70). ISC 2019. Lecture Notes in Networks and Systems. Springer, Cham. https://doi.org/10.1007/978-3-030-29586-8_8

Benčič, S., Kitsay, Y. A., Karbekova, A. B., & Giyazov A. (2020). Specifics of Building the Digital Economy in Developed and Developing Countries. In E. Popkova & B. Sergi (Eds.), *Digital Economy: Complexity and Variety vs. Rationality* (Vol. 87). ISC 2019. Lecture Notes in Networks and Systems. Springer, Cham. https://doi.org/10.1007/978-3-030-29586-8_5

Bokil, R. (2023). Cyber Warfare: Taking War to Cyberspace and its Implications for International Humanitarian Law. *International Journal for Multidisciplinary Research, 5*(1), 1-12. https://www.ijfmr.com/papers/2023/1/1494.pdf

Bukht, R., & Heeks, R. (2017). Defining, Conceptualising and Measuring the Digital Economy. Development Informatics (Working Paper No. 68). https://ssrn.com/abstract=3431732

Chazhaeva, M. M., Serebryakova, A. A., Tashkulova, G. K., & Atabekova, N. K. (2020). Sustainable Development of the Digital Economy on the Basis of Managing Social and Technological Threats. In E. Popkova & B. Sergi (Eds.), *Digital Economy: Complexity and Variety vs. Rationality* (Vol. 87). ISC 2019. Lecture Notes in Networks and Systems. Springer, Cham. https://doi.org/10.1007/978-3-030-29586-8_6

Chen, B. (2021). Analysis on the Influencing Factors of Digital Economy Development in Chinese Cities. Proceedings of Asia-Pacific Conference on Image Processing, Electronics and Computers (pp. 916–920). https://doi.org/10.1145/3452446.3452666

Chen, Y. (2020). Improving Market Performance in the Digital Economy. *China Economic Review,* 62, 101482. https://doi.org/10.1016/j.chieco.2020.101482

CISOCLUB. (2023, Mar. 3). The Russian Cabinet Reported a 65% Increase in the Number of Cyber-Attacks on Russian Information Systems. https://cisoclub.ru/v-rossijskom-kabmine-soobshhili-o-roste-na-65-kolichestva-kiberatak-na-rossijskie-informaczionnye-sistemy/

DataReportal. (2022, Feb. 15). Digital 2022: The Russian Federation. https://datareportal.com/reports/digital-2022-russian-federation

Davies, D. (2019, Sep. 19). Edward Snowden Speaks Out: 'I Haven't and I Won't' Cooperate with Russia. *NPR*. https://www.npr.org/2019/09/19/761918152/exiled-nsa-contractor-edward-snowden-i-haven-t-and-i-won-t-cooperate-with-russia

De, R., Pandey, N., & Pal, A. (2020). Impact of Digital Surge during Covid-19 Pandemic: A Viewpoint on Research and Practice. *International Journal of Information Management*, 55, 102171. https://doi.org/10.1016/j.ijinfomgt.2020.102171

Ehiorobo, E., Pournouri, S., Ghazaani, S. J., Toms, J. M. (2023). Profiling Cyber Attackers by Classification Techniques; A Case Study on Russian Hackers. In H. Jahankhani, (Ed.), *Cybersecurity in the Age of Smart Societies* (pp. 171-201). Springer, Cham: https://doi.org/10.1007/978-3-031-20160-8_11

Epifanova, A. (2020). Digital Sovereignty on Paper: Russia's Ambitious Laws Conflict with Its Tech Dependence. *Wilson Center*. https://www.wilsoncenter.org/blog-post/digital-sovereignty-paper-russias-ambitious-laws-conflict-its-tech-dependence

European Commission. (2020a). Digital Economy and Society Index. https://digital-strategy.ec.europa.eu/en/policies/desi

European Commission. (2020b). International Digital Economy and Society Index. https://doi.org/10.2759/757411

European Commission. (2022). Digital Economy and Society Index/ Methodological Note. https://digital-strategy.ec.europa.eu/en/library/ digital-economy-and-society-index-desi-2022

Federal State Statistics Service of the Russian Federation. (2021 Jul. 23). Informacionnoe obshchestvo. Monitoring razvitiya informacionnogo obshchestva v Rossijskoj Federacii [Information society. Monitoring the development of the information society in the Russian Federation] [Excel data sheet]. https://rosstat.gov.ru/folder/14478#

Gaufman, E. (2021). Cybercrime and Punishment: Security, Information War, and the Future of Runet. In D. Gritsenko, M. Kopotev & M. Wijermars. (Eds.), *The Palgrave Handbook of Digital Russia Studies*. https://link.springer.com/book/10.1007/978-3-030-42855-6

Górka, M. (2022). A Definitional Framework for Cyber Warfare. *The Ukrainian Aspect. Polish Political Science Yearbook*, *51*, 1-14. https://doi.org/10.15804/ ppsy202272

Gritsenko, D., Kopotev, M., & Wijermars, M. (2021). Digital Russia Studies: An Introduction. In D. Gritsenko, M. Kopotev & M. Wijermars (Eds.), *The Palgrave Handbook of Digital Russia Studies* (pp. 1-12). https://www.palgrave.com/gp/book/97830304 28549

Gulyaeva, T. I., Kalinicheva, E. Y., Buraeva, E. V., & Sidorenko, O. V. (2023). Human Resource Development with Respect to Digital Challenges in Agriculture. In V.I. Trukhachev (Ed.), *Unlocking Digital Transformation of Agricultural Enterprises. Innovation, Technology, and Knowledge Management* (pp. 291-298). Springer, Cham. https://doi.org/10.1007/978-3-031-13913-0_30

Gurlev, I. V. (2020). Cifrovizaciya ekonomiki Rossii i problemy robotizacii [Digitalization of the Russian economy and problems of robotics]. *Bulletin of Eurasian Science*, *4*(12), 1-12. https://doi.org/ 10.1007/978-3-030-42855-6_7

Indicators of the digital economy: 2021: statistical collection / G. I. Abdrakhmanova, K. O. Vishnevsky, L. M. Gokhberg and others; National research University "Higher School of Economics". – M.: NRU HSE, 2021. https://www.hse.ru/primarydata/ice2021/

Investopedia. (2021). Cloud Computing. https://www.investopedia.com/terms/c/cloud-computing.asp

Kargina, L., & Rozanov, A. (2023). Digital Economy and its Impact on Russian Economic and Regional Development. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4344562

Konopleva, Y. U. A., Korystov, V. A., & Teslenko, D. V. (2019). Kiberbezorasnost' kak faktor razvitiya cifrovoj ekonomiki [Cyber security as a factor in the development of the digital economy]. *Bulletin of the North Caucasian Federal University*, *4*(73), 49-55. https://dspace.ncfu.ru/bitstream/20.500.12258/9291/1/49-55.pdf

Legislative Activity Support System. (2021). O vnesenii proekta federal'nogo zakona "Ob eksperimental'nyh pravovyh rezhimah V sfere cifrovyh innovacij v Rossijskoj Federacii" [About Introduction of the Draft Federal Law "About Experimental Legal Regimes in the Field of Digital Innovations in the Russian Federation"]. https://sozd.duma.gov.ru/bill/922869-7

Li. H. (2019). Kiberbezopasnost' v Rossii v svete Doktriny informacionnoj bezopasnosti RF 2016 goda [Cybersecurity in Russia in the Light of the Information Security Doctrine of the Russian Federation 2016]. *World of Russian-speaking Countries*, 10.24411/2658-7866-2019-10002 UDK 32. https://cyberleninka.ru/article/n/kiberbezopasnost-v-rossii-v-svete-doktriny-informatsionnoy-bezopasnosti-rf-2016-goda

Li, K., Kim, D. J., Lang, K, R., Kauffman, R. J., & Naldi, M. (2020). How Should We Understand the Digital Economy in Asia? Critical Assessment and Research Agenda. *Electronic Commerce Research and Applications*, 44, 101004, 1-16. https://doi.org/10.1016/ j.elerap.2020.101004

Li, Z., Liu Y. (2021). Research on the Spatial Distribution Pattern and Influencing Factors of Digital Economy Development in China. *IEEE Access*, 9, 63094-63106, DOI: 10.1109/ ACCESS. 2021.3075249.

Linnik, M. (2021, Jul. 07). Sberbank ocenil poteri rossijskoj ekonomiki ot kiberatak [Sberbank estimated the losses of the Russian economy from cyber attacks]. *Rossiyskaya Newspaper RG.RU*. https://rg.ru/ 2021/07/07/sberbank-ocenil-poteri-rossijskoj-ekonomiki-ot-kiberatak.html

Lobach, D. V., & Smirnova E. A. (2019). Sostoyanie kiberbezopasnosti v Rossii na sovremennom etape cifrovoj transformacii obshchestva i stanovlenie nacional'noj sistemy protivodejstviya kiberugrozam, Territoriya novyh vozmozhnostej [The State of Cybersecurity in Russia at the Present Stage of the Digital Transformation of Society and the Formation of a National System for Counteracting Cyberthreats, Territory of New Opportunities. *Bulletin of Vladivostok State University of Economics and Service*, *11*(4), 23–32. https://dx.doi.org/10.24866/VVSU/2073-3984/2019-4/023-032

Loh, Y. X., Abdul Hamid, N. A., Seah, Ch. S., Yo, J. J., Law, Y. Ch., Tan, S. Y., Chung, H. L., Liew, Y. L., & Chong, Ch. (2021). The Factors and Challenges Affecting Digital Economy in Malaysia. CoMBInES - *Conference Proceeding on Management, Business, Innovation, Education and Social Sciences, 1*(1), 1843-1849. https://journal.uib.ac.id/index.php/combines/article/view/4725

Lowry, A. (2021). Russia's Digital Economy Program: An Effective Strategy for Digital Transformation? In D. Gritsenko, M. Kopotev & M. Wijermars (Eds.), *The Palgrave Handbook of Digital Russia Studies*. (pp.53-77). https://doi.org/10.1007/978-3-030-42855-6_4

Mahalina, O. M., & Mahalin V. N. (2020). Cifrovizaciya biznesa uvelichivaet zatraty na informacionnuyu bezopasnost' [Business Digitalization Increases the Cost of Information Security]. *Control*, *8*(1), 134-140. https://doi.org/10.26425/2309-3633-2020-1-134-140

Malkhasyan, G., & Savelyeva, O. (2023). Digitalization of Industry as Tool for Increasing Production Efficiency: Best Practices and New Solutions. In A. Beskopylny, M. Shamtsyan, & V. Artiukh (Eds.), *XV International Scientific Conference "INTERAGROMASH 2022"*. Lecture Notes in Networks and Systems (Vol. 574). Springer, Cham. https://doi.org/10.1007/978-3-031-21432-5_235

Mamedov, I. E. (2021). Problemy razvitiya bankovskogo sektora v usloviyah cifrovizacii ekonomiki [Problems of Development of the Banking Sector in the Digital Economy]. *Journal of Economy and Business*, *4-1*(74), 245-249. https://cyberleninka.ru/article/n/problemy-razvitiya-bankovskogo-sektora-v-usloviyah-tsifrovizatsii-ekonomiki

Melkadze, A. (2023, Jan. 11). Forecast of the Internet User Penetration Rate in Russia from 2018 to 2027. *Statista*. https://www.statista.com/statistics/567578/predicted-internet-user-penetration-rate-in-russia/#: ~:text=The%20share%20of%20monthly%20active,growing%20over%20the%20given%20period.

Mingaleva. A. D. (2019). Ocenka poter' organizacij kreditno-fininsovoj sistemy ot kiberprestupnosti [Estimation of losses of the organization of the Finnish credit system from cybercrime]. Electronic Scientific Journal "Vector of Economy*", 8* http://vectoreconomy. ru/images/publications/2019/8/financeandcredit/Mingaleva.pdf

Ministry of Economic Development of the Russian Federation. (2021). Regulation of the Digital Environment. https://www.economy.gov.ru/material/directions/gosudarstvennoe_upravlenie/normativnoe_regulirovanie_cifrovoy_sredy/

Mohan, R. (2007). Determinants of ICT Expenditure Using Logit Transformation for Proportion Data Analysis. *Journal of Information Technology Impact*, *7*(2), 145-158. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=453324abb054696d957dcf31b0de84fa4532274c

Morakanyane, R., Grace, A. A., & O'Reilly, Ph. (2017). Conceptualizing Digital Transformation in Business Organizations: A Systematic Review of Literature. BLED 2017 Proceedings (No. 21). http://aisel.aisnet.org/bled2017/21

Nitsevich, V. F., Moiseev, V. V., Sudorgin, O. A., & Stroev, V. V. (2019). Why Russia Cannot Become the Country of Prosperity. *International Science and Technology Conference "Earth Science"* [*IOP Conf. Ser.: Earth Environ. Sci. 272 032148*]. https://iopscience.iop.org/article/10.1088/1755-1315/272/3/032148/pdf

Novikova, N. V., & Strogonova, E. V. (2020). Regional Aspects of Studying the Digital Economy in the System of Economic Growth Drivers. *Journal of New Economy*, *21*(2), 76–93. https://doi.org/10.29141/2658-5081-2020-21-2-5

OECD. (2021a). Digital Security and Privacy. Organization for Economic Cooperation and Development. https://www.oecd.org/going-digital/topics/digital-security-and-privacy/

OECD. (2021b). Understanding the Digital Security of Products: An in-depth Analysis. OECD Digital Economy Papers (No. 305). OECD, Paris. https://doi.org/10.1787/abea0b69-en.

Orzkhanova, M., Hubolov, S., Polyakova, E. (2021). Digitalization of the Russian Federation's Economy in the Context of Global Transformation: Problems and Development Prospects. *SHS Web of Conferences* 106, 01013. https://doi.org/10.1051/ shsconf/ 202110601013

Oxford Economics. (2011). The New Digital Economy, How It Will Transform Business. https://www.pwc.com/cl/es/publicaciones/ assets/the-new-digital-economy.pdf

Pang, J., Jiao, F., & Zhang, Y. (2022). An Analysis of the Impact of the Digital Economy on High-Quality Economic Development in China—A Study Based on the Effects of Supply and Demand. *Sustainability*, *14*, 16991. https://doi.org/10.3390/ su142416991

Pishchik, V. Y. A., & Alekseev, P. V. (2021). Kiberprestupnost' kak klyuchevoj operacionnyj risk platezhno-raschetnoj infrastruktury global'noj finansovoj sistemy i podhody k ego regulirovaniyu v EAES [Cybercrime as a Key Operational Risk in the Payment and Settlement Infrastructure of the Global Financial System and Approaches to its Regulation in the EAEU]. Financial Magazine, *13*(3), 54–66. http://oaji.net/articles/2021/8467-1625847880.pdf

Plakhotnikova, M., Anisimov, A., Kulachinskaya, A., & Liliya Mukhametova, L. (2020). The Impact of Digitalization of the Economy on the Development of Enterprises in the Arctic. E3S Web of Conferences 220, 01041. https://www.e3s-conferences.org/ articles/e3sconf/pdf/2020/80/e3sconf_ses2020_01041.pdf

Platunina, G. P., & Ermolenko, D. S. (2021). Kiberbezopasnost': iskusnaya zashchita cifrovoj ekonomiki [Cybersecurity: The Artful Defense of the Digital Economy]. *Economics and Quality of Communication Systems*. https://cyberleninka.ru/article/n/kiberbe zopasnost-iskusnaya-zaschita-tsifrovoy-ekonomiki

Popkova E. G., & Gulzat K. (2020). Contradiction of the Digital Economy: Public Well-Being vs. Cyber Threats. In E. Popkova & B. Sergi (Eds.), *Digital Economy: Complexity and Variety vs. Rationality*. ISC 2019. Lecture Notes in Networks and Systems, vol 87. Springer, Cham. https://doi.org/10.1007/978-3-030-29586-8_ 13

Popkova, E. G., & Sergi, B. S. (2020). A Digital Economy to Develop Policy Related to Transport and Logistics: Predictive Lessons from Russia. *Land Use Policy,* 99, 105083. https://doi.org/10.1016/ j.landusepol.2020.105083

Pradhan, R. P., Arvin, M. B., Nair, M., Bennett, S. E., & Bahmani, S. (2019). Short-term and Long-term Dynamics of Venture Capital and Economic Growth in a Digital Economy: A Study of European Countries. *Technology in Society*, 57, 125-134. https://doi.org/ 10.1016/j.techsoc.2018.11.002

Pratt, M. (2022). 10 Ways Inflation Will Impact IT. The CIO Tech Tack Community. https://www.cio.com/article/400369/10-ways-inflation-will-impact-it.html

Prihod'ko, D. V., & Bel'kova, A. A. (2021). Kiberprestupnost' kak gloaal'naya problema sovremennosti [Cybercrime as a Global Problem of our Time]. *Journal of Economy and Business*, *4-2*(74), 90-94. https://cyberleninka.ru/article/n/kiberprestupnost-kak-globalnaya-problema-sovremennosti

Puspaningtyas, M., & Mukhlis, M. (2021). The Important Role of Inflation in Developing Economic Growth and Its Impact on Information Communication and Technology. *Tamansiswa Accounting Journal International, 4*(1), 66-71. http://ejurnal. stiekn.ac.id/index.php/taji/article/view/180/165

ReportLinker. (n.d.). Russia Industry ICT Outlook 2022-2026. https://www.reportlinker.com/clp/country/597055/726380#:~:text=Russian%20ICT%20Export%20is%20set,Philippines%20came%20ahead%20with%20%246%2C216%2C100%2C000.

Rostbk. (2023, Mar. 4). Cybersecurity in Russia. Retrieved from https://rostbk.com/o-kompanii/stati/kiberbezopasnost-v-rossii/

Rusakova, O. I., & Golovan, S. A. (2021). Vliyanie kiberprestuplenij na bankovskuyu sistemu Rossii [The Impact of Cybercrime on the Russian Banking System]. Journal of Baikal State University, *12*(1), 1-12. https://doi.org/10.17150/2411-6262.2021.

Russian Government. (2021a). Opublikovan pasport nacional'noj programmy «Cifrovaya ekonomika Rossijskoj Federacii». Informacionnye materialy o nacional'noj programme «Cifrovaya ekonomika Rossijskoj Federacii Federacii» [The Passport of the National Program "Digital Economy of the Russian Federation" has been Published. Information Materials on the National Program "Digital Economy of the Russian Federation"]. http://static.government.ru/media/files/3b1AsVA1v3VziZip5VzAY8RTcLEbdCct.pdf

Russian Government. (2021b, May 14). Dmitrij CHernyshenko: Na pyati kiberpoligonah projdut ucheniya v 2021 godu. http://government.ru/news/42174/

Russian Government. (2021c, May 28). Dmitrij CHernyshenko provyol soveshchanie s rukovoditelyami cifrovoj transformacii [Dmitry Chernyshenko: Exercises will be Held at Five Cyber Training Grounds in 2021]. http://government.ru/news/42337/

Russian International Affairs Council. (2020). RIAC at Cyber Forum in Garmisch-Partenkirchen. *RIAC*. https://russiancouncil.ru/en/news/riac-at-cyber-forum-in-garmisch-partenkirchen/

Ruzakova, V. I., Shiptenko, A. A., & Ryabinina, E. O. (2023). Prospects of International Cooperation in the Arctic under the Russian Chairmanship of the Arctic Council in 2021–2023: Social Projects and ESG Financing. In E.G. Popkova, & B.S. Sergi (Eds.), *Current Problems of the Global Environmental Economy Under the Conditions of Climate Change and the Perspectives of Sustainable Development* (vol. 73) (pp. 167-172).Advances in Global Change Research. Springer, Cham. https://doi.org/10.1007/978-3-031-19979-0_18

Security Council of the Russian Federation. (2016, Dec. 5). Doctrine of Information Security of the Russian Federation. http://www.scrf.gov.ru/security/information/DIB_engl/

Shahim, A. (2021). Security of the Digital Transformation. *Computers and Security,* 108, 1-4. https://doi.org/10.1016/j.cose.2021.102345

Shepelin, G. I. (2017). Sovremennye kiberriski i strahovanie: sostoyanie i perspektivy [Modern Cyber Risks and Insurance: State and Prospects. *Insurance Business*, 9, 22-30. https://rucont.ru/efd/646615

Shermet, I. A. (2019). Obespechenie kiberbezopasnosti v usloviyah razvitiya cifrovoj ekonomiki. Vestnik Moskovskogo universiteta [Ensuring cybersecurity in the context of the development of the digital economy]. *Bulletin of Moscow University.Series 25. International Relations and World Politics*. https://cyberleninka.ru/article/n/obespechenie-kiberbezopasnosti-v-usloviyah-razvitiya-tsifrovoy-ekonomiki

Shkodinskij, S. V., Dudin, M. N., & Usmanov, D. I. (2021). Analiz i ocenka kiberugroz nacional'noj finansovoj sisteme Rossii v cifrovoj ekonomike [Analysis and Assessment of Cyber Threats to the National Financial System of Russia in the Digital Economy]. *Financial Magazine*, *13*(3), 38-53. https://doi.org/10.31107/2075-1990-2021-3-38-53

Shrestha, N. (2021). Factor Analysis as a Tool for Survey Analysis. *American Journal of Applied Mathematics and Statistics*, *9*(1), 4-11. http://pubs.sciepub.com/ajams/9/1/2

Shulus A. A., Zarudneva, A., Yatsechko, S., & Fetisova, O. (2019). The Algorithm of Modern Russia's Transition to the Digital Economy. In E. Popkova & B. Sergi (Eds.), *Digital Economy: Complexity and Variety vs. Rationality* (Vol. 87) (pp. 57-63). ISC 2019. Lecture Notes in Networks and Systems. Springer, Cham. https://doi.org/10.1007/ 978-3-030-29586-8_7

Stadnik, I. (2021). Seeking a New Order for Global Cybersecurity: The Russian Approach to Cyber-sovereignty. In S. N. Romaniuk, & M. Manjikian (Eds.), *Routledge Companion to Global Cyber-Security Strategy* (pp. 153-164). Taylor & Francis. https://pureportal.spbu.ru/en/publications/seeking-a-new-order-for-global-cybersecurity-the-russian-approach

Statista. (2021, Nov. 11). Level of Digitalization among Business Enterprises in Russia as of September 2020, by Indicator. https://www.statista.com/statistics/1034412/digitalization-among-businesses-russia-by-area/

Statista. (2022a, Dec. 12). Public Cloud Services Revenue in Russia from 2017 to 2020 with a Forecast until 2025. https://www.statista.com/statistics/1032049/russia-cloud-technology-market-size/

Statista. (2022b, Dec. 16). Expenditure on Digital Economy Development as a Share of Gross Domestic Product (GDP) in Russia from 2017 to 2021. https://www.statista.com/statistics/1192554/gross-expenditure-on-digital-economy-to-gdp-russia/#:~:text=The%20gross%20internal%20expenditure%20on,product%20(GDP)%20in%202021.

Statista. (2022c, Dec. 22). Country-level Digital Competitiveness Rankings Worldwide as of 2022. https://www.statista.com/statistics/1042743/worldwide-digital-competitiveness-rankings-by-country/

Statista. (2023, Jan. 11). Internet Usage in Russia - Statistics & Facts. https://www.statista.com/topics/5865/internet-usage-in-russia/#topicOverview

Tabachnik, A., & Topor, L. (2020). Russian Cyber Sovereignty: One Step ahead. *RIAC*. https://russiancouncil.ru/en/analytics-and-comments/analytics/russian-cyber-sovereignty-one-step-ahead/

TADVISER. (2023, Apr. 11). ICT Market of Russia. https://tadviser.com/index.php/Article:ICT_market_of_Russia

The Ministry of Foreign Affair of the Russian Federation. (2021). Doctrine of Information Security of the Russian Federation. https://www.mid.ru/en/foreign_policy/official_documents/-/asset_publisher/CptICkB6BZ29/content/id/2563163

The State Duma. (2019, Apr. 4). Prinyat Zakon o Suverennom Internete [Adopt a Sovereign Internet Law]. http://duma.gov.ru/news/44551/

The World Bank. (2018 Sep.). Digital Economy in Russia: Key Results of the Digital Economy Country Assessment. In *Competing in the Digital Age, Policy Implications for the Russian Federation* (Russia Digital Economy Report) (pp. 2-16). https://openknowledge.worldbank.org/server/api/core/bitstreams/e4561181-1558-5ef8-a8b7-ed2c403992ed/content.

The World Bank. (2023). World Bank County and Lending Groups. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Tian, J., & Liu, Y. (2021). Research on Total Factor Productivity Measurement and Influencing Factors of Digital Economy Enterprises. *Procedia Computer Science*, 187, 309-395. https://doi.org/10.1016/j.procs.2021.04.077

Treadwell, J. (2018). Competing in the Digital Age, Policy implications for the Russian Federation. Russian Digital Economy Report. *World Bank Group*. https://openknowledge.worldbank.org/server/api/core/bitstreams/e4561181-1558-5ef8-a8b7-ed2c403992ed/content

UNCTAD. (2019). Digital Economy Report 2019, Value Creation and Capture: Implications for Developing Countries. https://unctad.org/system/files/official-document/der2019_en.pdf

United Nations E-government Survey. (2020). Digital Government in the Decade of Action for Sustainable Development. *Department of Economic and Social Affairs*. https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2020-Survey/2020%20UN%20E-Government%20Survey%20(Full%20Report).pdf

United Nations E-government Survey. (2022). The Future of Digital Government. https://desapublications.un.org/sites/default/files/publications/2022-09/Web%20version%20E-Government%202022.pdf

United Nations. (2021). Russian Federation EGOVKB. *Public Administration.* https://publicadministration.un.org/egovkb/en-us/Data/ Country-Information/id/141-Russian-Federation

Voskanyan, R. O. (2018). Finansovaya deyatel'nost' v uloviyah kiberatak [Financial Activity in the Conditions of Cyberattacks]. In P. V. Terelyanskogo (Ed.), *Shag v budushchee: iskussvennyj intellekt i cifrovaya ekonomika revolyuciya v upravlenii: novaya cifrovaya ekonomika ili novyj mir mashin: materialy II Mezhdunarodnogo nauchnogo foruma* [A Step into the Future: Artificial Intelligence and the Digital Economy, A Revolution in Management: A New Digital Economy or a New World of Machines: Materials of the II International Scientific Forum] (pp. 347-353). https://guu.ru/wp-content/uploads/forum_bl_v2.pdf#page=347

Watanabe, Ch., Tou, Y., & Neittaanmaki, P. (2018). A New Paradox of the Digital Economy - Structural Sources of the Limitation of GDP Statistics. *Technology in Society,* 55, 9-23. https://www.sciencedirect.com/science/article/abs/pii/S0160791X17302385

Weiyu, Z., Othman, A., & Guli, T. (2022). Role of Technological Acquisition and R&D Expenditure in Innovative investment. *Front. Psychol*. 13, 855295. https://www.frontiersin.org/articles/10.3389/fpsyg.2022.855295/full

World Bank. (2018). Russia Digital Economy Report, September 2018, Competing in the Digital Age: Policy Implications for the Russian Federation. https://www.worldbank.org/en/country/russia/publication/competing-in-digital-age

World Bank. (2021). E-participation Index. https://tcdata360.worldbank.org/indicators/entrp.sub.part?country=RUS&indicator=3469&viz=line_chart&years=2012,2016

World Bank Data Sheet. (2021). Russian Federation. *World Bank*. https://data.worldbank.org/country/russian-federation?view=chart

World Bank Data Sheet. (2023, Mar. 7). Macroeconomic Indicators of the Russian Economy. https://data.worldbank.org/country/russian-federation?view=chart

World Bank Group. (2021, May. 25). *Russia Economic Report, No. 45: Russia's Economic Recovery Gathers Pace*. https://openknowledge.worldbank.org/server/api/core/bitstreams/62f9b484-e2ab-5aa4-8b3d-a8c477ae3849/content

Yalmaev R. A., Shalaev V. A., Giyazov A. T., & Tashkulova, G. K. (2020). The Perspectives of Provision of New Quality of Growth of Economic Systems in the Digital Economy. In E. Popkova & B. Sergi (Eds.), *Digital Economy: Complexity and Variety vs. Rationality*. ISC 2019. Lecture Notes in Networks and Systems, Vol 87 (pp. 30 -38). Springer, Cham. https://doi.org/10.1007/978-3-030-29586-8_4

Yashina, N. I., Kashina, O. I., Pronchatova-Rubtsova, N. N., Yashin, S. N., & Kuznetsov, V. P. (2022). Diagnostics of the Educational Potential of Regions as a Way to Ensure the Economic Security of the Russian Federation in the Context of Digitalization. In E. G. Popkova & B. S. Sergi (Eds.), *Digital Education in Russia and Central Asia. Education in the Asia-Pacific Region: Issues, Concerns and Prospects* (vol. 65) (pp. 151-160). Springer, Singapore. https://doi.org/10.1007/978-981-16-9069-3_16

Yue, H., Zhou, X., Yaoyao, N., & Hua, Z. (2020). An Empirical Analysis on Influencing Factors of Digital Economy. *2020 Management Science Informatization and Economic Innovation Development Conference (MSIEID)* (pp. 1-7). Guangzhou, China. https://doi.org/10.1109/MSIEID52046.2020.00008.

Yurak V. V., Polyanskaya I. G., & Malyshev A. N. (2023). The Assessment of the Level of Digitalization and Digital Transformation of oil and Gas Industry of the Russian Federation. *Mining Science and Technology (Russia)*. *8*(1), 87-110. https://doi.org/10.17073/2500-0632-2022-08-16

Zavyalova E., Sokolov D., Kucherov D., & Lisovskaya A. (2022). The Digitalization of Human Resource Management: Present and Future. *Foresight and STI Governance*, *16*(2), 42–51. https://doi.org/ 10.17323/2500-2597.2022.2.42.51

Zemtsov S., Barinova V., & Semenova R. (2019). The Risks of Digitalization and the Adaptation of Regional Labor Markets in Russia. *Foresight and STI Governance*, *13*(2), 84–96. https://doi.org/10.17323/2500-2597.2019.2.84.96

Zemtsov, S., Tsareva, Y., Barinova, V. A., Belitski, M., & Krasnoselskikh, A. N. (2022). Small Business in Russia: Institutions, market Potential, Taxes and Digitalization. Post-Communist Economies, *34*(8), 1029-1053. https://doi.org/10.1080/14631377.2022.2108244

Zhang, J., Zhao, W., Cheng B., Li, A., Wang, Y., Yang, N., & Tian, Y. (2022). The Impact of Digital Economy on the Economic Growth and the Development Strategies in the Post-COVID-19 Era: Evidence from Countries Along the “Belt and Road”. *Front. Public Health*, *10*, 856142. https://www.frontiersin.org/articles/ 10.3389/ fpubh.2022.856142/full