

Original article

## DEVELOPMENT OF INFRASTRUCTURE TO SUPPORT THE NATIONAL TECHNOLOGICAL INITIATIVE: THE CASE OF THE RUSSIAN FEDERATION

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**Abstract:** The modern world lives in a digital transformation. Many researchers consider this period to be a new technological paradigm or a digital economy. The widespread digitalisation of production and management processes not only affects the processes of global globalization, but also contributes to the rapid growth of the economy, enhancing living standards. While the global economy identifies some common characteristics of the development of the digital economy, there is no consistent methodological approach. The Russian Federation in the world scores to evaluate the development of the digital economy, in general, is in the group of developing countries. Therefore, at the state level, the digital transformation is recognized as a strategic priority for Russia's developers. Since 2014, the development strategy of Russia has been the National Technology Initiative (NTI), a long-term program to create new markets and lay the groundwork for Russia's technological leadership by 2035. Its first steps served as a foundation for the adoption of the national project "Digital Economy of the Russian Federation". This study analyses the implementation of joint government and corporate efforts in this direction. It was revealed that the main NTI operators are both state institutions (state investment bank "Bank VEB", "Innovation Promotion Fund"), and business partially government-owned communities – Agency for Strategic Initiatives (ASI), Russian Venture Company (RVC). Based on the analysis of NTI roadmaps and events, a model of institutions to support the digital economy in Russia has been built. The conclusion concerns the overall support of the State during the construction of an ecosystem of technological entrepreneurship. At the same time, there is a certain differentiation of the NTI infrastructure, tending towards large subjects of the Russian Federation with a high level of Information and Communication Technologies (ICT) development - Moscow and St. Petersburg.

**Keywords:** Digital economy of Russia; National Technology Initiative support institutions; Technology development; National Technology Initiative markets.

### 1. INTRODUCTION

It is impossible to imagine a modern society without the widespread penetration of

information and communication technologies (ICT) into all spheres of human life. The rapid development and spread of ICT around the world has changed economic relations and led

to a new model for the development of the global economic system, which today is called the “digital economy.” All researchers agree that the digitalization of production and management predetermines the success of both business and consumer relations. The results of its distribution demonstrate a huge potential for economic growth. According to McKinsey’s study, digital data currently has a greater impact on the gross domestic product (GDP) growth than traditional trade in goods and services (Aptekman et al., 2017). Therefore, most countries in their strategic development priorities focus on the need to become digital leaders in the global market. The widespread globalization of the economy based on the openness of the digital market “predetermines new rules of the game for all stakeholders of the global world. This is why innovation and trust play a decisive role in the digital development of the economy” (Zvereva, Belyaeva & Sohag, 2019).

The world has not formed a unified methodological approach to restructuring production, economic and socio-social relations in the context of the “new technological paradigm – the Fourth Industrial Revolution” (Balatsky, 2019) and their transition to digital platforms. Consequently, each country is required to choose its own direction, focusing on the world processes of globalization. International ratings are used to determine the criteria for digitalization by the world community. Therefore, there are global approved indicators of the digital economy in the international system of indicators for measuring the process of countries progress towards the building of the information society, which include:

- Global Cybersecurity Index;
- ICT Development Index;
- Global E-Government Development Index;
- Networked Readiness Index;
- Global Competitiveness Index;
- Global Innovation Index;
- Drivers of Production Index;
- Social Progress Index;
- International Digital Economy and Society Index (Kuzovkova, 2018).

Although many indicators of the mentioned ratings overlap, in general they determine such

basic criteria for building a digital economy as:

- presence of e-government;

- society's readiness for innovation;
- development of ICT infrastructure;
- interaction between the state and business.

Since 2007, joint work between state authorities, scientific and public organizations has been carried out in the Russian Federation in order to reveal promising areas for the information society development. After President V.V. Putin addressed the Federal Assembly on December 4, 2014, the results of this work were formulated in the form of the National Technology Initiative. The National Technology Initiative is the main guideline for building a new socio-economic system aimed at developing high-tech sectors of production.

“The National Technology Initiative is a union of business representatives and expert communities to develop promising technology markets and industries in Russia that can become the basis of the global economy” (Canon of National Technological Initiative, 2021). It appears that this definition is too broad, not giving a clear distinction between the conceptual construct about the directions of the digital economy development in Russia and the ways to implement the large-scale goals and objectives facing the state. Therefore, this article discusses the direction of the NTI development, its institutions, and infrastructure.

## 2. MATERIALS AND METHODS

Social and public life in the digital economy is relatively new, so it is of interest to explore its forms of institutional support in different countries. Is only the state capable of influencing the development of the digitalization processes of society? What forms of cooperation between the state and business are the most effective and cause the explosive growth of the new economy? How does societies readiness for widespread digitalization affect the forms of business? Government agencies and society as a whole are becoming increasingly relevant to these and many other issues. Thus, in the Russian Federation, the implementation of the National Technology Initiative in the second half of the

implementation of the state program “Information Society-2020” (Information Society. Official portal of state programs of the Russian Federation, 2021) contributed to the development and approval of the National Project “Digital Economy of the Russian Federation” (Passport of the national project “National Program “Digital Economy of the Russian Federation”, 2019), which is the main state priority at the moment. However, the level of relations between the participants in these projects remain unrevealed, which is why the purpose of this study was to analyze and build a model of the institutional environment to support the development of the digital economy in Russia.

This article attempts to systematize information about the institutions supporting and developing the National Technology Initiative by analyzing the current general information in Russian Internet using the method of generalization and systematization. The authors generalize the state tasks facing Russian society on the course of building a new economic system based on high-tech industries, new business models, interaction between the business environment and executive authorities.

In addition, a review of studies on this topic is given, on the basis of which a number of priority problematic issues are systematized and formulated, which are the main obstacle to solving the problems formulated in the national project “Digital Economy of the Russian Federation”.

### 3. RESULTS

The IT industry is dominated by American-based companies, such as Apple, Google, and Microsoft, which have covered the whole world. The primary objective of NTI was to change Russia's role from a passive consumer to a technology leader. In order for state development institutions to build an effective model for growing new industries, the National Technology Initiative (NTI) was developed as a long-term strategy for Russia's technological development.

Therefore, the objective of the NTI is to focus Russia's efforts on creating conditions for

Russian companies to enter foreign world markets. The National Technology Initiative requires the creation of appropriate services, the identification of scientific and educational priorities, and the training of effective personnel (National Technology Initiative. Online course, 2021). The program's main objective is not to improve existing markets, but to create conditions for a technological breakthrough and subsequent successful competition at the global level. The NTI is designed to take into account the analysis of new industries that will be formed by 2035 (Canon of National Technological Initiative, 2021)

Nine promising markets were identified that meet certain criteria for the prospects for the development of the global digital economy, following the results of the Foresight Fleet strategic session held in May 2015. So, technology entrepreneurs, venture investors, scientists, representatives of the educational environment and development institutions and other participants in a large-scale brainstorming grouped the NTI markets.

At the time of the first start of the national program, namely in 2016, only nine markets were determined:

- EnergyNet (smart energy services market, ecosystems of energy producers and consumers that without restriction integrate into a common infrastructure and exchange energy);
- FoodNet (smart marketplace for the production and distribution of food and products with individual logistics);
- SafeNet (new personal security systems);
- HealthNet (personal medicine);
- AeroNet (market of services based on aerospace and unmanned vehicles);
- MariNet (market of globally distributed intelligent control systems for maritime transport and technologies for the use of the oceans);
- AutoNet (market of unmanned aerial vehicles and solutions based on them);
- FinNet (market of decentralized financial systems and currencies);
- NeuroNet (the next generation information exchange market, whose products and services are based on

knowledge about the brain and are aimed at expanding brain resources) (National Technology Initiative, 2021).

According to trends in the global development of digitalization, the list of markets is not definitively established and is constantly being reviewed.

The National Technology Initiative was a prerequisite for the development of the national project “Digital Economy of the Russian Federation”. Approbation of the first models of interaction between the state and business within the framework of the NTI suggested a model for the gradual transition of Russia to a digital economy.

The main targets and goals of the national project are:

- 1) An increase in domestic costs for the development of the digital economy from all sources (as a share of GDP) by at least 3 times compared to 2017.
- 2) Creation of a sustainable and secure information and telecommunications infrastructure for high-speed transmission, processing and storage of large data volumes, accessible to all organizations and households.
- 3) The use of predominantly domestic software by government agencies, local governments and organizations (National projects: targets and main results, 2019).

The program includes seven federal projects:

- 1) “Legal regulation of the digital environment”. It means the creation of a system of legal regulation of the digital economy, based on a flexible approach in each area, as well as the introduction of civil circulation based on digital technologies.
- 2) “Information infrastructure”. It is the creation of a competitive, sustainable and secure infrastructure for high-speed transmission, processing and storage of data, accessible to citizens, businesses and authorities.
- 3) “Personnel for the Digital Economy”. It means providing the labor market with professionals in the fields of IT,

information security and digital technologies, creating online services for educational organizations, ensuring accessibility of educational programs for the population related to the acquisition of digital competencies.

- 4) “Information security”. It involves increasing the security of state information systems and resources, moving the work of authorities and state organizations to domestic software, and creating conditions for reducing the number of offenses using information technologies.
- 5) “Digital Technologies” means the creation and development of end-to-end digital technologies based on domestic developments, the development of high-tech products and services, import substitution in quantum technologies, 5G and other areas.
- 6) “Digital public administration”. It is the introduction of digital technologies in the field of public administration, the provision of public services to citizens and business representatives in a digital format, the development of a coordinated policy of the member states of the Eurasian Economic Union in the development of the digital economy.
- 7) Recently, the seventh federal project, “Artificial Intelligence”, was added. It implies supporting advanced scientific research, creating and developing software that uses AI technologies, stimulating demand for products created using AI technology, popularizing and developing a community of dedicated experts (National projects: targets and main results, 2019).

According to the Deputy Prime Minister of the Russian Federation Maxim Akimov: “The funds should be used to develop products and solutions based on end-to-end digital technologies. End-to-end digital technologies refers to 11 sub-technologies. These include quantum computing, quantum communications, quantum sensorics and metrology (general package of quantum technologies), 5G, satellite communications, Internet of things technologies (general package of wireless communication technologies), distributed ledger systems, robotics and sensorics, new production

technologies, technologies of virtual and augmented reality, as well as artificial intelligence (AI)”.

Also, at the plenary discussion “Leaders of technological breakthrough” at the “Global Technology Leadership” forum held in December 2020, it was announced that: “Funds are distributed on a competitive basis by support measures operators – this is the Innovation Promotion Foundation, Russian Venture Company (RVC), VEB Ventures, RUSNANO, Russian Information Technology Development Fund (RITDF), Russian Direct Investment Fund (RDIF), Skolkovo Fund; as well as two government department – the Ministry of Industry and Trade and the Ministry of Communications of Russia” (Development of National Technology Initiative. Official website of Russian Venture Company, 2021).

Thus, Russia has already established an official network of operators that will implement state-supported projects in the digital economy. Seven working groups on the legislation of NTI markets have been created, which coordinate the development of markets and areas of NTI, which are now 12. Several additional markets have been added:

- EduNet (market of products and services that involve a person in the development and realization of their potential);
- SportNet (a market of value propositions for transforming the surplus of human resources through physical activity based on platform and infrastructure solutions);
- HomeNet (high-speed unlimited Internet access, digital TV and advanced information technology solutions).

New business support programs have been launched at NTI in 2019. Technology companies can obtain grant and investment financing in the NTI markets up to 500 million rubles, and the programs are aimed at supporting projects in the following areas:

- NTI technological breakthrough;
- NTI infrastructure;
- NTI spin-off;

- NTI Export (Russian Venture Company will provide businesses with up to 500 million rubles of support for the development of National Technology Initiative projects, 2019).

The NTI infrastructure began to develop with the construction of road maps. In 2017, seven working groups from the NTI area, with the support of RVC JSC, developed drafts of the relevant road maps, which were adopted by the Government of the Russian Federation. In the projects of NTI “regulatory road maps”, it is planned to implement more than 250 events in the relevant areas of development of the NTI markets. In order to develop the NTI markets, 7 venture funds were launched with the participation of the Russian Venture Company Joint-Stock Company (RVC JSC). These funds focused on the development of markets and NTI end-to-end technologies.

An NTI franchise has also been developed; it is a model for releasing the NTI brand and sub-brands (for example, Boiling Points). The purpose of this franchise is to maintain the coherence and consistency of the NTI model, the logic of all actions with a huge expansion of the project scale. A NTI representative or partner's status determines the right to represent the platform, use the developed services, and communicate with partner organizations.

Such platforms as "Boiling Points", "Mind Clubs", and "Technoparks" are the objectives of the franchise. The roles assigned on a personalized basis are also taken into account - the status of companies (for example, a partner of the NTI Platform), personal roles (for example, a member of a working group, an expert etc.)

For the period of 2019, there were already more than 80 Boiling Points of city and / or university type, united by the Leader-ID digital environment, which has become part of the technology entrepreneurship development ecosystem.

In 2018, the procedure for the work and provisions of state support for the NTI Infrastructure Centers (see Table 1), the procedure for the competitive selection of

subsidy recipients were determined. Their main functions are the following areas:

- forecast for the development of NTI markets;
- analysis of existing barriers;
- implementation of legal and technical regulation of new markets;
- promotion of goods and services obtained as a result of the operation of markets on the world market.

**Table 1:** NTI infrastructure centers

No.	NTI marker	Name of the winning organization
1	AutoNet	Association of Designers, Manufacturers and Users of Equipment and Applications Based on Global Navigation Space Systems “GLONASS/GNSS Forum”
2	AeroNet	INPO Aeronet Analytical Center
3	EduNet	Organization Association of Technology Kruzhoks
4	NeuroNet	Neuronet Industry Union
5	TechNet	TechNet Association
6	HealthNet	“Scientific and technological park of the Novosibirsk Akademgorodok” Foundation
7	EnergyNet	Center for Strategic Research “North-West” Foundation

*Source:* Russian Venture Company named seven winners of the competition for the selection of National Technology Initiative infrastructure centers, 2018.

Competence Centers (NTI divisions) have been operating since 2018, which were created on the basis of educational or scientific organizations and are engaged in the development of end-to-end NTI technologies, including big data, artificial intelligence, quantum technologies, new and portable energy sources, robotics components, wireless communication technologies, virtual and augmented reality. The first results of the work of competence centers have already been

summarized in 2019. Thus, the centers provide for work on 150 projects, 12 of which were successfully completed in 2019. In educational programs in the field of end-to-end technologies, over 9,000 specialists have been trained. Over 350 participating companies joined the consortia of the NTI Competence Centers by the end of the year.

The list of NTI competence centers is shown in Table 2.

**Table 2:** List of NTI competence centers

No.	End-to-end technology	Competition winner	Name of the Center
1.	Artificial intelligence	The Moscow Institute of Physics and Technology	NTI Center in the field of “Artificial Intelligence”
2.	Quantum technologies	Lomonosov Moscow State University	Center for Quantum Technologies
3.	Technology for creating new and portable energy sources	The Institute of Problems of Chemical Physics of Russian Academy of Sciences, Moscow	Competence Centre of Technologies of New and Mobile Energy Sources
4.	New manufacturing technologies	Peter the Great St. Petersburg Polytechnic University	NTI Center “New Production Technologies” on the basis of the Institute of Advanced Manufacturing Technologies
5.	Managing properties of biological objects	The Institute of Problems of Chemical Physics of Russian	Center of technologies managements of properties of biological objects

		Academy of Sciences, Moscow	
6.	Neurotechnologies, technologies of virtual and augmented reality	Far Eastern Federal University, Vladivostok	NTI Center for Neurotechnologies, Virtual and Augmented Reality Technologies
7.	Big data storage and analysis technologies	Lomonosov Moscow State University	Big Data Storage and Analysis Technology Center
8.	Technologies of robotics and mechatronics components	Innopolis University, Innopolis	Center for Technologies in Robotics and Mechatronics Components
9.	Sensorics technology	National Research University of Electronic Technology, Moscow	“Sensorica” NTI Center of National Research University of Electronic Technology
10.	Distributed registry technologies	Saint Petersburg State University	Center for Distributed Registry Technologies at St. Petersburg State University
11.	quantum communication technologies	National University of Science and Technology “MISIS”	NTI Center for Quantum Communications
12.	Technologies for Electricity Transportation and Distributed Smart Energy Systems	Moscow Power Engineering Institute	Center for Electricity Transportation Technology and Distributed Smart Energy Systems
13.	Wireless and Internet of Things technologies	Skolkovo Institute of Science and Technology	Competence Center “Wireless Communication Technologies and Internet of Things”
14.	Machine learning technologies and cognitive technologies	Saint Petersburg State University of Information Technologies, Mechanics and Optics	National Center for Cognitive Research

*Source:* Competence centers of National Technology Initiative on the basis of universities and scientific organizations, 2021.

An important direction of the NTI is to support the “Kruzhok Movement”. This is a new type of all-Russian community of technology enthusiasts and entrepreneurs, united on the digital platform “University 20.35”. This digital service is “a university of a new format that guarantees professional development through the construction of individual educational programs” (National Technology Initiative, 2021), in which all interested institutions of vocational education can become participants. Furthermore, the Kruzhok Movement has established a network of child centers for supplementary education, 'Quantorium'.

Thus, the Kruzhok Movement ensures the formation in Russia of a new generation of trained professionals, entrepreneurs, engineers, scientists among current and future promising

enthusiasts - members of various coteries with professionalism, the ability to implement conceived projects and create new solutions.

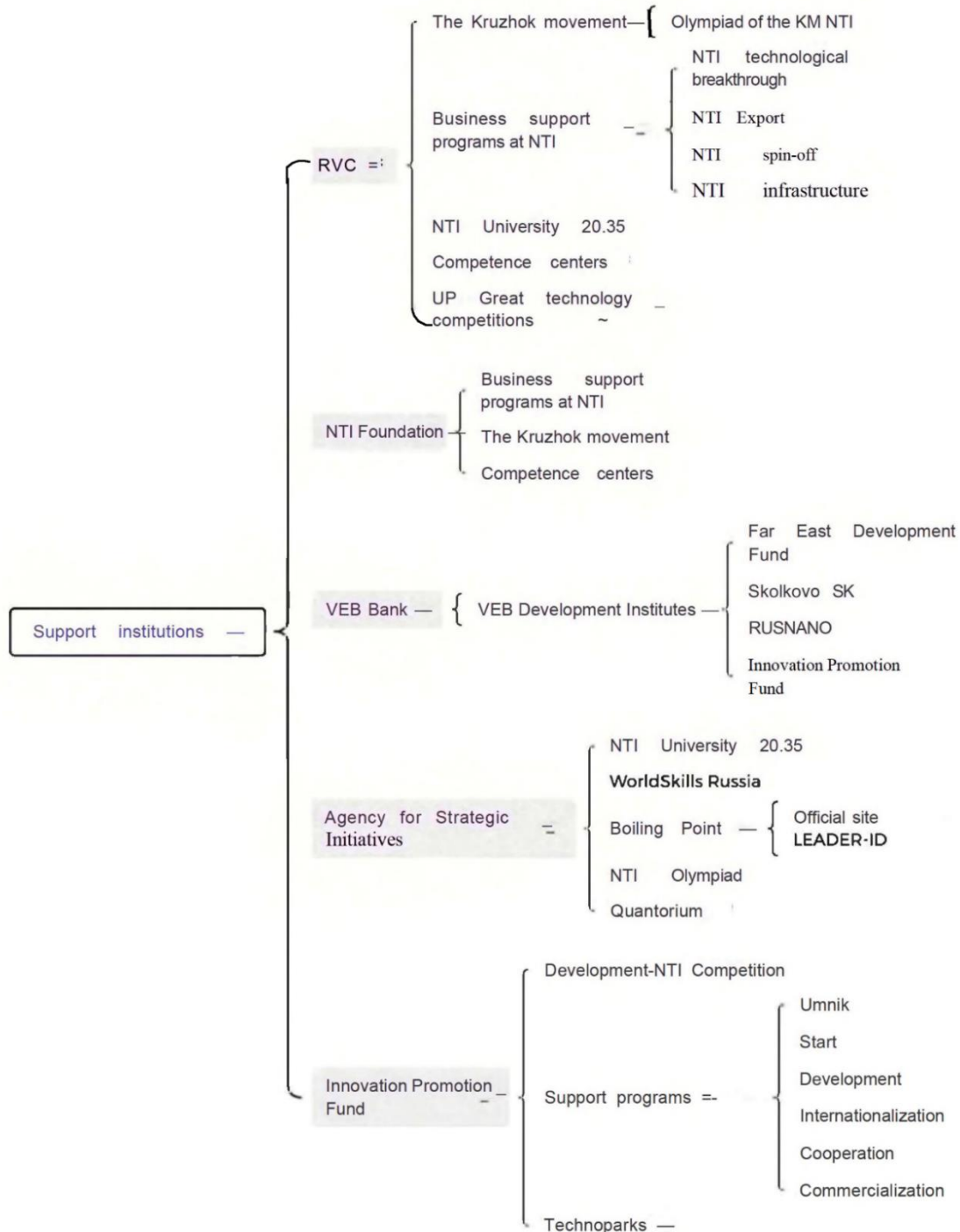
In conclusion, we can say that the main actors in building institutional support for the development of the digital economy in the Russian Federation are:

- Project Support Fund of the National Technology Initiative (NTI Foundation);
- Agency for Strategic Initiatives (ASI);
- Foundation for Assistance to the Development of Small Forms of Enterprises in the Scientific and Technical Sphere (Innovation Promotion Fund);
- Russian Venture Company Joint-Stock Company (RVC JSC);

- The VEB.RF state investment bank that provides funding for economic development projects (VEB Bank).

The activities of these organizations are closely intertwined, building a modern infrastructure for interaction between the state and business in order to develop an ecosystem of

technological development in Russia. Numerous events are regularly held, the purpose of which is to search for new ideas and innovative forms of technological entrepreneurship among young people. These include the “Start” and “Umnik” competitions, the UP Great technology competitions. Figure 1 shows the main activities and institutions supporting the digital economy development.



**Figure 1:** The structure of institutions for support the digital economy of the Russian Federation.



#### 4. DISCUSSION

According to the presented analysis, the development of support institutions for the formation of the digital economy ecosystem is a priority for the executive authorities in Russia in the formation of new production relations. There is a systematic development of the infrastructure of programs for the development and support of technological entrepreneurship at the state level, together with large business investors.

The development of the digital economy, however, presents a number of challenges. First, there is a lack of trained personnel and an uneven regional ICT infrastructure. The need to solve these problems is a priority task within the framework of the national project “Digital Economy of the Russian Federation”, in the

implementation stages of which there is the revealed logic. Thus, priority financing of federal projects is focused on the “Human Resources for the Digital Economy” and “Information Infrastructure” programs.

Many contemporary researchers have noted the uneven territorial distribution of the information and telecommunications infrastructure in Russia. So, Zh. A. Ermakova and I. N. Korabeinikov (2019), I. V. Nikolaeva (2020) in their classification of regions of the Russian Federation by the level of development of the digital economy note that Moscow is ranked as the most developed region. A quantitative assessment of the accumulation of data processing centers on the territory of Russia also indicates this (see Table 3).

**Table 3.** Characteristics of the spatial development of the Russian data center market in 2011-2018, as percentage of the all-Russian indicators

No.	Name of the constituent entity of the Russian Federation	Spatial development index by years		
		2011	2016	2018
1	Moscow and Moscow region	74	67	68
2	St. Petersburg and Leningrad Oblast	11	13	15
3	Other subjects of the Russian Federation	15	20	17

Source: Ermakova & Korabeinikov, 2019

Furthermore, the list of NTI competence centers presented in Table 2 shows an uneven spatial distribution of the centers on the territory of the Russian Federation. Only two of the 14 identified centers are located outside of Moscow and St. Petersburg, these are the cities of Innopolis and Vladivostok.

Such an uneven centralized concentration of institutional support for the digital economy contributes to the differentiation of the socio-economic development of the regions of the Russian Federation. At the same time, since technological infrastructure is inextricably linked with the availability and level of development of labor resources in the sphere under study, there is an acute shortage of personnel oriented towards new production relations in the regions. This issue has also recently been discussed in the scientific community (Koropets & Tukhtarova, 2021; Litvintseva et al., 2019).

The NTI Kruzhok Movement is focused on solving this problem, but this solution is long

term, as it covers today's schoolchildren and students. Even in regions with a high level of digital economy development, a large number of specialists are already required today. The difference in wage levels in the regions compared to Moscow and St. Petersburg contribute to the internal migration of IT professionals from the regions. Furthermore, due to the uneven distribution of NTI development centers, technological entrepreneurs from the regions who become winners of all-Russian programs and competitions are also forced to move to Moscow and St. Petersburg to develop their projects.

#### 5. CONCLUSION

Since 2015, a definite infrastructure of support institutions for the digital economy development has been built in the Russian Federation. This process is facilitated by the National Technology Initiative, which brings together representatives from the business and expert communities.

The President and the Government of the Russian Federation actively support the long-term strategy for the technological development of Russia through the targeted development of entrepreneurship in technological markets. In addition, a strategy focused on the future pays sufficient attention to the development of the Kruzhok Movement, the education of future generations aimed at life in the new technological paradigm. This is facilitated by various competitions and development programs for children and student who have already become traditional.

Nevertheless, there is a certain spatial differentiation in the distribution of NTI support centers across the territory of Russia, gravitating towards the capital region. In the future, such an uneven distribution could significantly worsen the socio-economic gap in quality of life in the constituent entities of the Russian Federation. The immediate task of the executive authorities is to solve this problem, which is on course to build a digital economy in Russia.

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