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**DIGITAL ECONOMY AND BREAKTHROUGH TECHNOLOGIES
AS FUNDAMENTALS OF INNOVATIVE REGIONAL ECONOMY**

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Abstract

The paper considers the state of digital economy formation and achievements in the field of quantum revolution as a basis for regional economic development. It describes the background of the innovative mechanism in the field of information and computer technologies through the creation of the quantum computer. All these achievements in the field of information and computer technologies provide for the transition to a new quality of life. The purpose of the study was to analyze the development of digital economy, innovative technologies in the region, as well as achievements in the field of other breakthrough technologies. The study was performed using the statistics of innovative activity of the republic, logical generalizations and forecasting of innovative activity in the republic over five years. Due to designed tools and complex statistical indicators characterizing the level of development and use of innovative activity and activity of enterprises, the condition of innovative development of the Republic of Dagestan over five years is analyzed on the basis of statistical data. The analysis confirms considerable decrease in innovative activity in the republic and the reasons for recession on the basis of internal and external factors.

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1. Introduction

The economic development in Russia and its regions takes place in specific globalization conditions of the world economy, on the basis of information, computer and innovative technologies and thus established digital economy. The foreign policy factors play a certain role in economy in Russia in general, i.e. the imposed economic sanctions of the West against Russia and countermeasures against the countries of the West demonstrated by mechanism of import substitution, which began in 2014; and strengthened, tightened new economic sanctions against Russia in 2018. All these factors fostered extreme aggravation of competition in the world market and the access to important raw material resources. The specified processes and transformations in economy of modern Russia required new progressive information and innovative technologies for revolutionary changes in these areas. This mainly refers to the economy of the Republic of Dagestan since the territorial subject of the federation, being a region with excess working population, extremely needs modern progressive technologies and has a number of specific features.

2. Problem Statement

To study the condition of digital economy in the region in the conditions of information and innovative technologies to increase the efficiency of public production, material well-being of citizens and to create a new quality of life. At the same time, the introduction of these innovations for common usage requires considerable financial inputs and qualified staff. The republic faced these difficulties when it was implementing and introducing the program on Digital Economy of the Republic of Dagestan and was activating its innovative activity. It is known that the republic belongs to agrarian and industrial region, therefore there is no developed industrial and production base for the implementation of progressive technologies in the region economy. Besides, the fact that the republic is a subsidized region is the key reason, which restrains the introduction of the developed program on Digital Economy of the Republic of Dagestan and innovative technologies. At present, the governmental grants received by the republic from the center make 59.6% of the revenues of the Republic of Dagestan (earlier this indicator was about 80%). According to media sources, to implement the program in the field of computer technologies the republic needs from 1.5 thousand to 1.7 thousand qualified staff (*TASS ... 2017*).

3. Research Questions

The economic development in Russia and its regions takes place in specific globalization conditions of the world economy, on the basis of information, computer and innovative technologies and thus established digital economy (Kungurov, 2017). Complex modern production required an essentially new and innovative mechanism to receive, process, distribute and store the available information. Such essentially new and innovative device was the supercomputer or the quantum computer, which differs from all existing computer predecessors by the principle of action, and, the most important, by the speed of receiving, processing, disseminating the information, as well as by reliability of its storage. The specified computer performs operations with information million times faster than the standard computer. The quantum computer has such innovative approaches and mechanisms, which provide for fast and efficient transition to essentially new quality of life.

As it was stated above, the key advantage of the quantum computer is time saving during collection, processing and distribution of large volumes of information flows. At the same time, the capacity measurement, i.e. the power of the quantum computer with actions with information flows, is made in qubits. According to media sources, the pilot quantum computer with a memory size of 51 qubits was created. This hot news was officially announced in Moscow at the IV International conference on quantum technologies. The computer was created by the co-founder of the Russian Quantum Center (RQC) and professor of Harvard University M. Lukin, who reported that he together with his American colleagues created and successfully tested the programmable quantum computer on the basis of 51 qubits. Thereby, M. Lukin's group became one of the leaders among the participants of the quantum computer campaign.

The functioning mechanism of the quantum computer is based on the principle of the so-called qubit or a simulator. It is known that the PC processor conducts processing in two provisions – “0” and “1”, which are united in information “bits” (zeros and units) according to the existing classification. The standard personal computer, consisting of cells, performs operations in the position “0” or “1”. In the quantum computer the cells form a “qubit”, which simultaneously functions in two states or positions, i.e. in permanent state “0” and “1”, therefore the qubit as such gets bigger number of qubits in this computer (Wolf, 2009). In recent years, special attention is paid to artificial intelligence and investments into this area. According to media sources, among the developed countries China – 48% and the USA – 38% make more investments from the total amount of investments into this field of research. This demonstrates that the developed countries make more and more investments into information and virtual areas but not into the sphere of material production. Thereby, in the near future these countries hope to manage the artificial intelligence to ensure economic security and efficient management of the entire economic system. The system of digital economy with the quantum computer forms the basis for artificial intelligence. This situation triggers the virtual cost represented by virtual money or cryptocurrency (Gasanov, 2018a; Pshenichnikov, Babkin, 2017).

With reference to the importance of the new direction in economy, we deem it advisable to give the extensive definition of digital economy. Digital economy is a broad range of institutional categories functioning within the economy, which covers the whole system of public relations based on advanced scientific achievements and innovative technologies, first of all, in digital information and communication technologies aimed to increase the efficiency of public production, to maintain stable growth rates of the economy in order to improve public welfare and quality of life of citizens, ensure economic security of the country and national sovereignty of the state (Gasanov & Gasanov, 2017).

Therefore, from logical and strategic perspective there is a need to adopt the program on Digital Economy of the Russian Federation for 2017-2030, which was approved and accepted in 2017 (*Digital Economy of the Russian Federation ...*, 2017). The Roadmap defining three fundamental stages – 2018, 2020, 2024 was developed for staged implementation of the specified program.

The importance to adopt and implement such key document as the Digital Economy of the Russian Federation Program was caused by the fact that the potential economic effect of Russia's economy digitalization will ensure the GDP growth in the country by 4.1-8.9 trillion rubles by 2025 thus making from 19 to 34% of the total potential GDP growth (Kudrin, 2017). In 2016, according to Rosstat, the total GDP of Russia made approximately 86 trillion rubles.

At the same time, the analysis of digitalization of the national economy revealed that regarding many indicators of digital economy development, namely the level of digitalization, share of this economy in the total GDP amount and other indicators used in western countries, Russia considerably lags behind the developed countries of the West. For example, the ratio of the digital economy in Russia's GDP sums up to 3.9%, which is on average 2-3 times lower than the level of the developed countries (Kudrin, 2017) thus making from 5 to 10% of the specified potential economic effect gained from the results of the Russian digital economy in 2025.

Thus, the program on Digital Economy of the Russian Federation was launched in 2017 and may be considered quite successful. However, in regions this process is not that promising requires a thorough study taking into account the specifics of each region. In particular, the Republic of Dagestan hasn't adopted and publicized the program on Digital Economy of the Republic of Dagestan yet.

Some features typical for the republic shall be taken into account in the preparation of the program on Digital Economy of the Republic of Dagestan. First, this includes agrarian and industrial focus of the republic and considerable ratio of its rural population. This also covers the lack of the necessary industrial and engineering capabilities, backward digital and other cross-cutting technologies in comparison with the average indicators in Russia and the North Caucasian Federal District, which shall serve the impetus to stimulate the development of these processes and to reach, in terms of certain segments, or even to surpass the average indicators and rates of their development in Russia and the North Caucasian Federal District.

There is a need to plan and include such indicators into the Program that would in the near future appeared make the Republic of Dagestan among the most advanced across the North Caucasian Federal District in the field of digital economy and innovative technologies. Not considering the actual delay of the republic in information and innovative technologies, and thus plan the average growth rates, in the short term the Republic of Dagestan may be among countries lagging behind in this important indicator – digitalization of economy. To overcome this negative trend there is a need to create the program on Digital Economy of the Republic of Dagestan with high and advanced development rates of information and innovative technologies in the republic.

Based on the existing circumstances, only such approach to closing the gap between the republic and other regions and plan the Program of Digital Economy, will provide for successful development of the Republic of Dagestan in the field of digital economy and innovative technologies, since digital economy and advanced technologies ensure new quality of life, increase welfare of citizens and increase public production (gross domestic product).

Besides, for successful introduction and functioning of the program on Digital Economy of the Republic of Dagestan, it is necessary to have highly qualified specialists in the field of information and computer technologies, which are not too many in the republic and their shortage, in turn, deteriorates the development, approval and introduction of the specified Program. Obviously, for this reason the program on Digital Economy of the Republic of Dagestan and the development of standard and legal documentation cannot be adopted thus slowing its introduction into branches of the national economy of the Republic of Dagestan. The Republic of Dagestan lags behind the Russian program on Digital Economy of the Russian Federation for about one and a half years, and this is another negative factor in planning, formation and real introduction of this program in the Republic.

The importance of digital economy and innovative technologies, in particular in the field of agrarian and industrial complex, is caused by high efficiency of their application and high production growth of certain types of agricultural products. According to specialists of agrarian and industrial complex published in media, the introduction of information and innovative technologies in agriculture in the near future will increase the grain yield in Russia by up to 70 million tons per year or in the range of 70% of the average annual grain yield in the country.

Thus, the development of digital economy affects innovative technologies (in particular, within the agrarian and industrial complex), which, in turn, increases the efficiency of public production and, thereby, serves an objective accelerating factor for the introduction of digital economy. Therefore, regional problems of digital economy development shall become the priority mainly for these regions since the wellbeing of citizens, improvement of quality of their life is directly connected to all these transformations of progressive technologies.

It is expedient to begin the analysis of innovative development of the region with the criteria characterizing innovative activity in territorial subjects of the Russian Federation on the basis of the ratio of those enterprises and organizations, which introduce technical innovations into their operation. Regarding the specified indicator in territorial subjects of the Russian Federation and regions of the North Caucasian Federal District, Table 01 shows data confirming the dynamics of introduction and use of innovations for the last five years – 2012-2016.

Table 01. Innovative activity of organizations (ratio of organizations performing technological, organizational, marketing innovations in the reporting year among all organizations under study) in territorial subjects of the Russian Federation and certain regions of the North Caucasian Federal District (in %).*

Region	2012	2013	2014	2015	2016
Russian Federation	10.3	10.1	9.9	9.3	8.4
Central Federal District	10.9	10.7	10.9	10.9	10.3
Northwestern Federal District	11.0	10.7	10.3	9.6	8.3
Southern Federal District	7.4	7.2	7.7	7.6	7.1
North Caucasian Federal District	6.4	5.9	6.5	4.7	2.9
Republic of Dagestan	6.5	10.3	12.2	7.3	2.5
Republic of Ingushetia	-	-	20.0	5.6	-
Kabardino-Balkarian Republic	9.4	9.3	6.7	2.5	2.4
Karachay-Cherkess Republic	2.8	2.7	3.6	3.1	0.8
Republic of North Ossetia-Alania	4.5	5.3	6.6	3.8	3.8
Chechen Republic	-	-	0.5	1.6	0.3
Stavropol Territory	8.8	8.1	8.3	6.8	4.9
Privolzhsky Federal District	11.9	11.7	11.4	10.6	9.4
Ural Federal District	10.6	9.6	8.9	7.9	8.2
Siberian Federal District	8.5	9.1	8.8	8.0	6.9
Far Eastern Federal District	10.8	9.5	8.9	7.2	6.4

Table 01 demonstrates that the innovative activity of organizations (ratio of organizations performing innovations in %) across the North Caucasian Federal District and the Republic of Dagestan reached the maximum indicators in 2014, and then dropped sharply in 2015 with further recession in 2016.

The exception in 2015 accounts for the Chechen Republic, but in 2016 it also faced a sharp decrease of this indicator.

The Republic of Dagestan reached its maximum indicators in 2014, and then saw a drastic decrease of indicators in the field of innovative activity of organizations in 2015 with its further decrease in 2016. The value of innovative activity of organizations in 2016 was below the 2012 indicator by 2.6 times in absolute figures and by 5 times – below 2014, i.e. the ratio of innovatively active organizations was reduced from 12.2% in 2014 to 2.5% in 2016, in other words by 10 percentage points at once. (Kupriyanovsky, 2016).

In 2016, Dagestan was the 3rd in the North Caucasian Federal District and the 80th among all territorial subjects of the Russian Federation. Moreover, the Republics of Tyva, Khakassia, Kalmykia and four republics of the North Caucasian Federal District follow the Republic of Dagestan.

One of the critical criteria defining innovative activity and development of economy is the ratio of costs for technological innovations in the total amount of shipped goods, performed works, services. In general, the specified indicator is analyzed at the level of federal districts and subjects of the North Caucasian Federal District. This indicator demonstrates technical and technological capacity of enterprises using innovative technologies in the course of production of goods, services, as well as computer technologies in the territorial subjects of the Russian Federation. Table 02 shows statistical data for 2012-2016 for subsequent analysis.

Table 02. Ratio of costs for technological innovations in the total amount of shipped goods, performed works, services, in federal districts of the Russian Federation and certain regions of the North Caucasian Federal District (in %).*

Region	2012	2013	2014	2015	2016
Russian Federation	2.5	2.9	2.9	2.6	2.5
Central Federal District	3.3	3.0	3.3	3.5	3.7
Northwestern Federal District	2.0	3.7	2.1	1.5	1.7
Southern Federal District	2.2	2.2	3.1	3.1	2.3
North Caucasian Federal District	0.8	1.5	2.7	1.3	1.4
Republic of Dagestan	0.1	0.5	2.7	0.2	0.1
Republic of Ingushetia	-	-	2.0	0.0	-
Kabardino-Balkarian Republic	1.3	2.3	0.7	0.0	0.3
Karachay-Cherkess Republic	0.6	0.4	0.2	0.7	0.0
Republic of North Ossetia-Alania	0.5	0.6	0.8	0.1	0.1
Chechen Republic	-	-	1.7	0.2	0.1
Stavropol Territory	1.0	1.9	3.5	1.9	2.0
Privolzhsky Federal District	3.3	3.6	3.9	3.2	2.6
Ural Federal District	1.5	1.8	1.7	1.5	1.8
Siberian Federal District	1.9	2.9	2.8	2.5	1.7
Far Eastern Federal District	2.8	2.8	3.1	3.3	2.4

* Source: processed by authors based on Rosstat data (Innovative activity of organizations (2017)).

The specified indicators given in Table 02 characterize the disastrous decreasing dynamics in the ratio of costs for technological innovations in the Republic of Dagestan starting from 2014. In 2016, the ratio of costs for technological innovations in the republic decreased to the level of 2012. In comparison

with 2014 the republic faced a decrease in absolute digital data by 27 times or by 2.6% of the ratio of costs for technological innovations.

In comparison with the subjects of the North Caucasian Federal District, the Republic of Dagestan being on 3-5 place regarding the above indicator in 2016 and hence took 81-83 place among all territorial subjects of the Russian Federation provided the Republics of Tyva and Khakassia did not have these indicators over the last 2 years – 2015 and 2016.

According to authors, some factors affecting the innovative technologies were the main reasons contributing to the decrease of innovative activity and the ratio of costs for technological innovations to the minimum in the total amount of benefits in the Republic of Dagestan. First, this is the fact that the organizations lack modern production framework based on innovative technologies. Many industrial enterprises need to renovate their production capacities and equipment. Due to lack of financial resources or their insufficient financing under the article of “innovative technologies”, our region appeared among regions lagging behind all territorial subjects of the Russian Federation in terms of progressive technologies. Even with the necessary financial means, Russia is not able to provide all its subjects with innovative technologies. Another factor is the shortage of qualified staff in the field of innovative technologies and digital economy.

The complex statistical analysis of Tables 1 and 2 for 2016 in the Republic of Dagestan showed the collapse of innovative activity and costs for technological innovations thus making the republic 5 and more years behind these important indicators of progressive technologies. Therefore, Dagestan needs considerable financial resources, at least to reach the level of indicators of 2014 and to start preparing the program on Digital Economy of the Republic of Dagestan.

Besides, the economic sanctions of the West imposed in 2014 against Russia and the countermeasures representing the import substitution mechanism were quite negative. First, this belongs to progressive and innovative technologies. Even before sanctions, the developed countries were not eager to share advanced technologies with Russia since it would aggravate the competition in the world market and make its position in this market even worse.

It shall be pointed out that after more than one and a half years the Republic of Dagestan still did not even approve the program on Digital Economy of the Republic of Dagestan. The given facts and data dictate the need for urgent measures aimed at development and adoption of the Program (Gasanov, 2018a; Gasanov, 2018b)

The lack of such program will lead to the fact that progressive technologies will not be developed in the Republic of Dagestan since they are based on information and digital technologies. The lagging of the region in this area can last for a long time and eventually exert a negative impact on the economy of the republic and material well-being of its population.

Besides, it is worth mentioning that the development of standard documentation in the field of digital economy lags behind their practical application and functioning. The situation in the regions of the country is even more complicated. It is difficult to count on successful development of the industry, agrarian and industrial complex of the republic and other branches of economy under existing circumstances. It is only possible to introduce the elements of digital economy into practice and surpass the regulatory base of the specified Program with obtained results proving that practice is not only more important than the theoretical

knowledge, but is also above the approval of the corresponding documentation on the specified topic (Gasanov, 2018a).

4. Purpose of the Study

The purpose of the study was to analyze the development of digital economy, innovative technologies in the region, as well as achievements in the field of other breakthrough technologies – information and computer technologies using the designed quantum computer and the opportunities they offer for the entire economy to foster a new quality of life. There was a need to define particular reasons for lagging behind in the development of digital economy, innovative technologies and other progressive fields on the example of the Republic of Dagestan. Besides, the purpose of the study was to forecast and model the situation when the republic is able to develop successfully in the specified areas. Thus, it was revealed that the region needs a complex system of measures to close the gap in these areas provided the Republic of Dagestan receives real help from the federal center.

5. Research Methods

The methods and ways to close the gap in implementation and introduction of the program on Digital Economy of the Republic of Dagestan taking into account specifics of development and conditions of information and computer framework of the republic were proved based on the method of prediction estimates and modeling of processes in the field of digitalization of the Republic of Dagestan. The study was performed using the statistics of innovative activity of the republic, logical generalizations and forecasting of innovative activity in the republic over five years. Besides, it covered the study of internal and external reasons affecting innovative activity and decrease of its development rates in the region.

6. Findings

The analysis made it possible to reveal that the program on Digital Economy of the Republic of Dagestan is not publicized and requires whole package of measures for its introduction and proper functioning. This, first of all, includes the creation of new material and technical resources to expand the basic regulations and directions of digitalization of the republic – industry, agrarian sector, science and education, health care, social sphere. The subsidized nature of the republic, accounting to 59.6%, indicates the need for a targeted help from the center to improve its financial position and ensure training of specialists in such progressive directions as information and computer technologies and activation of innovative activity of enterprises. At the same time, if financial support from the federal center can be provided in short periods, then the staff training in the field of digital economy and digitalization in general takes a lot of time. Thus, the lagging of the republic from average indicators in the field of digitalization of economy and activation of innovative activity may deteriorate the republic economy. It is also difficult to predict the innovative development of economy and foster a new quality of life.

7. Conclusion

The combination of quantum developments and technologies (quantum computer) with basic elements of digital economy create essentially new innovative economy, which, according to the authors,

may be called quantum and digital economy. The content of such quantum and digital economy can be deeper than the concept of “digital economy”. Since the proposed economy is not only based on information and digital technologies, but on considerably new quantum computers in the system of digital economy, which create innovative economy, and hence are called the quantum and digital economy. Therefore, the development of innovative economy as the quantum and digital economy is closely linked to the quantum mechanism of action (qubit) in technologies of the digital economy.

The analysis of statistics on the activation of innovative activity of enterprises in the Republic of Dagestan revealed that a sharp decrease in the field of innovative activity of enterprises of the republic over 5 years of study. The republic may get finances necessary for activation of innovative activity of its enterprises from the federal center, through centrally planned investments and private investors. Since the republic developed but not implemented the program on Digital Economy of the Republic of Dagestan, there is a need to accelerate its practical implementation, to strengthen the production base of enterprises, to train the qualified personnel in the field of information and computer technologies as soon as possible. Thus, these measures will finally lead to the new quality of life in the republic, raise material well-being of citizens, and create new jobs in progressive technologies to foster the development of economy of the region.

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