

Feature of Building the Organizational and Technological Platform of the Digital Economy Agricultural Sector*

Rena R. Timirgaleeva¹[0000-0002-3078-1050] and Igor Yu. Grishin¹[0000-0001-5839-1858]

¹ V.I. Vernadsky Crimean Federal University, Yalta, Russia
igugri@gmail.com

Abstract. The analysis of the main processes taking place in the digital economy in the world is conducted; the place and role of the Russian Federation in the implementation of these processes are shown. The task of the study was the development of proposals for the formation of an industrial ecosystem of the regional digital economy. The paper shows that in the ranking of countries implementing technologies for the digitization of economic relations, Russia is in the group of "beginning leaders" (the level of digitalization is higher than the level of economic development), but it is still lagging behind the leading countries, including South Korea, Netherlands, and China. The article substantiates the conclusion that it is expedient to build a virtual environment on the basis of university data processing centers that are built on new principles based on an innovative engineering solution that allows it to scale and connect new participants as needed without requiring additional investments. The platform of digital products and services is an essential element of the ecosystem of the digital regional economy that allows linking resources and consumers of products and services. The set of the most important tasks that should be solved when creating the organizational and technological platform of the regional ecosystem of the region is substantiated. The creation of a cloud for individual sectors of the economy of the region. Launch of cloud-based industry services and individual projects. Digitalization of the life cycle in the cloud. Development of the environment of business tools. Creation of an integrated system of data centers. The proposed structure of the industrial ecosystem of the digital economy of the region is universal and can be applied to most industries in different regions of the country.

Keywords: Digital economy; Industry 4.0; digitalization; sectoral ecosystem; platform of digital products and services; business tools environment.

1 Introduction

Nowadays, as well a hundred years ago, the world economy is on the verge of tremendous technological changes that, without doubt, will change not only the life and economy but also society itself.

* Copyright 2019 for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

The development of infrastructure, reducing the cost of processing, storing and transferring data are taking technology to a new, qualitatively higher level. Humankind has already entered the fourth industrial revolution.

The coming decade will be the decade of struggle for the possibility of forming technological zones (between potential technological zones) and struggle for control over these zones (both between oligarchic groups and between individual countries).

The problems of the digital economy, the analysis of individual technologies, and the effect of the introduction of such technologies are devoted to the working of both domestic and foreign researchers and practitioners.

It should be noted that the concepts of “digital economy” and “Industry 4.0” adopted in Western countries are not identical, since in our country we bear in mind the economic order, new economic relations that are based on the digital ecosystem, digital infrastructure, i.e. it is more systematic, complex concept related to the understanding of Western researchers.

Papers [2], [3], [4], [5], [6], [7], [8] note that Industry 4.0 is characterized by advanced digitalization and integration of industrial production and logistics processes, as well as the use of the Internet and “smart” objects (machines and products) and merging of physical and virtual worlds through the introduction of information and communication technologies (ICT), which contributes to the creation of new human and industrial-organizational systems and new organizational business models that affect the overall value chain, society and environment. Digital transformation will require strong leadership, enhanced employees’ skills and overcoming a number of barriers to its successful implementation. Among negative effects, we should mention that there would be jobs cut for employees with low qualifications. However, this will lead to a significant amount of new jobs for highly skilled employees. For the first time in the history of industrial production, people act as partners, not resources, while the emphasis is made on innovation and development, with machines performing routine work.

A significant number of papers [9], [10], [11], [12], [13], [14] are devoted to various aspects of information security of new intellectual production systems. Special attention is paid to the application of new technologies, mobile devices, and wireless communication of the 5G generation in digital control systems of various levels. It is noted that the existing technologies do not meet the requirements for ensuring the sustainability of business processes of production in the emerging digital economy. There is a strong need for new approaches, focused on integrated solutions that take into account both economic and technical requirements based on the methods of systems theory and system analysis.

A number of works [15], [16], [17] are also devoted to various aspects of the Internet of Things, as well as to the prospects for their use in industries and development prospects in various countries. For example, paper [17] marks that companies should take Industry 4.0 seriously, since they are developing their future initiatives, and traditional business process models do not correspond to Industry 4.0 technologies. Some of the following issues should be addressed with caution: information technology (IT) security, reliability and stability required for critical communication between machines; necessity to maintain the integrity of production processes, avoid networking and protect

industrial know-how; lack of adequate skills, a general reluctance to change by stakeholders, and a major loss of jobs due to automated and IT-controlled processes.

Analysis of publications, works of scientists from leading countries of the world shows that the largest number of publications belongs to authors from the USA, China, and the UK. At the same time, in recent years, the number of publications revealing various aspects of Industry 4.0 has increased dramatically.

It should be noted that in recent years, researchers also started using the concepts of “digital economy” and “ecosystem” [18], [19], [20] but now they interpret them significantly less comprehensively than domestic researchers are used to. At the same time, most researchers and practitioners agree that the digital economy is a complex concept based on the convergence of technologies but such works are practically absent in both domestic and international databases.

The purpose of the study is to analyze the main processes occurring in the digital economy worldwide, to clarify the place of Russia in this area, as well as to develop proposals for the formation of the sectorial ecosystem of the region's digital economy.

2 Methods

In today's digital economy, the main advantages go to those who own and manage virtual digital space and provide access to the digital products and services platform. Fig. 1 shows a pattern of the interaction between existing resources and consumers in the virtual world based on the corresponding digital platform.

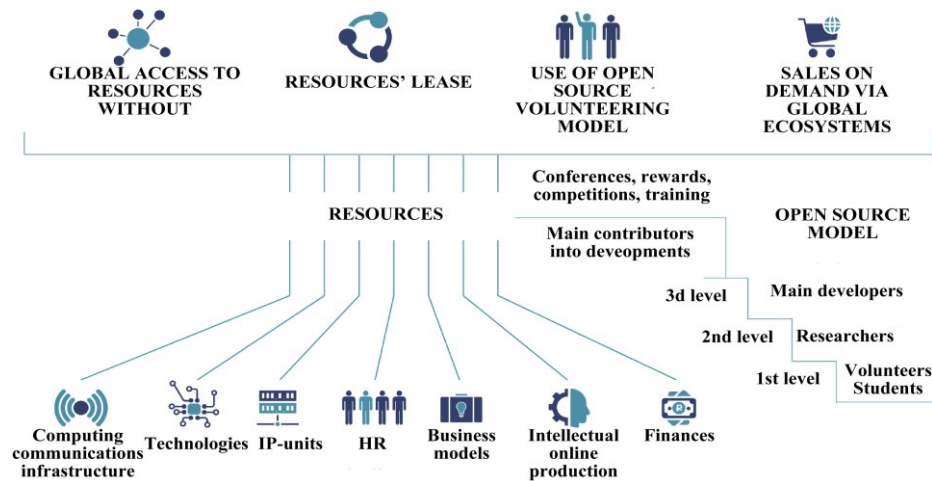


Fig. 1. The pattern of interaction between resources and their consumers

One of the main tasks of business in a digital economy is the ability to restructure corporate culture and organization. This also requires more resources for storing and processing large amounts of data. A consistent restructuring of business within the digital transformation will eventually bring the company to a new level of efficiency. In this

case, the main trends that determine the essence of the processes of the digital economy are presented in Fig. 2.

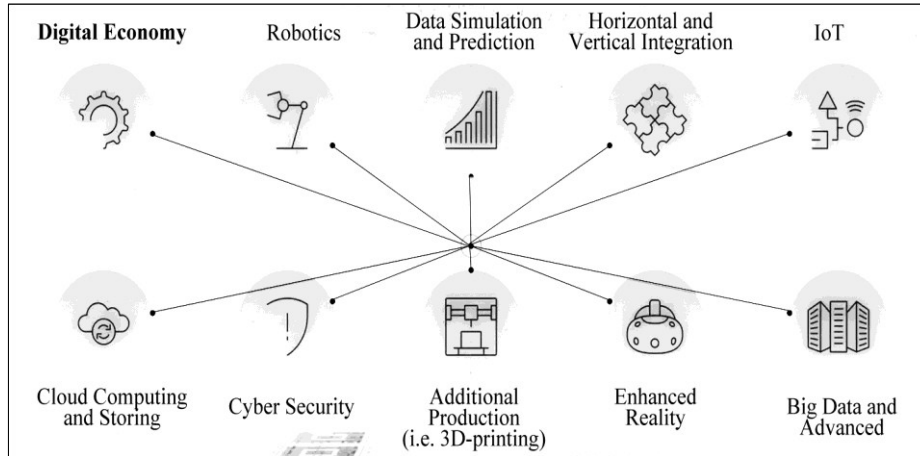


Fig. 2. Basic trends in the digital revolution

At the same time, cloud technologies allow sharing infrastructure and thus using resources more efficiently. Big Data and advanced analytics allow making more accurate and faster decisions from primitive production processes to preventing fraud transactions.

The size of the market and the economy of joint consumption, which implies a more efficient utilization of capacity, is already estimated at 150 billion dollars. This fundamentally changes the structure of the global economic system, expands the consumers' capabilities, as well as affects the structure of industries and the role of states in this system.

The development of infrastructure increasing incomes of potential consumers and the advent of a new generation of users also leads to the growth of online consumption. This in turn also stimulates an increase in the share of the digital economy (Fig. 3).

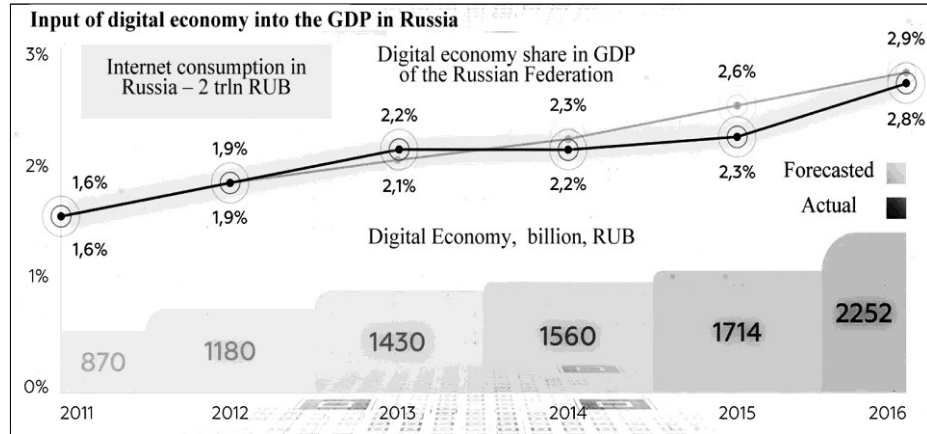


Fig. 3. Basic trends in the digital revolution

The level of digitalization of the world economy is constantly growing, quite unequally though. All countries can be divided into five groups according to the intensity of digitalization: leaders, main group, countries lagging behind, beginner leaders and catching up countries (Fig. 4).

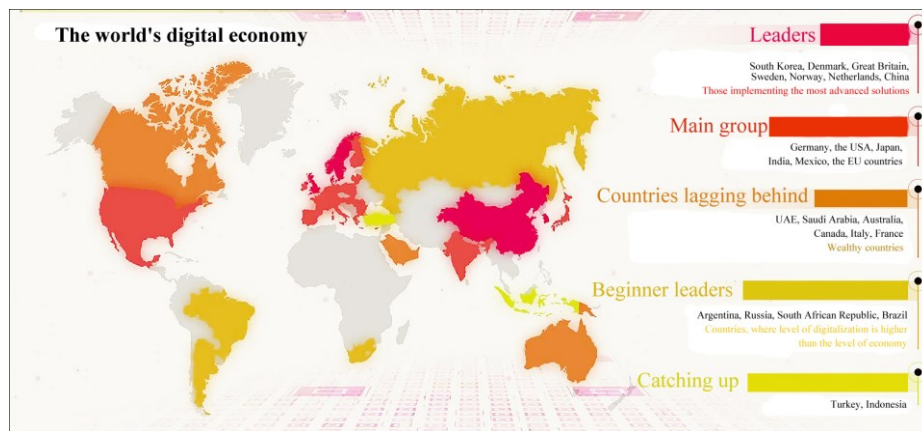


Fig. 4. Place of Russia in the world's digital economy

Russia remains on the periphery. However, over the past 5 years, it has moved from a group of catching-up countries to the main one. Comparing the current level of digitalization of the Russian economy with the dynamics of the development of the rating leaders, we can conclude that at the moment Russia's lag is 5-8 years.

Some positive trends should also be mentioned. First of all, Russia is improving its position in the segment of broadband Internet access and increasing the share of smartphone sales. In addition, the speed of the 3G connection in Russia is higher than the average speed in Central and Eastern Europe.

In terms of infrastructure development for digitalization, Russia is the leader among the BRICS countries, but it is not even up to the average for OECD member countries. The state encourages involvement in the digital economy, introduces digital technologies, e-procurement and e-government.

The level of involvement in the digital economy is presented in Fig. 5. According to the I-DESI index, published by the European Commission in 2016, Russia's development of the digital economy used to lag behind the EU, Australia and Canada but was ahead of China, Turkey, and Brazil. In terms of the availability of fixed broadband, Russia was ahead of the EU and the rest of the countries. In terms of human capital, Russia had better positions than the average for the EU, Turkey, Mexico, and Brazil but significantly lagged behind Japan, Korea, Sweden, Finland, the United Kingdom, and the leading EU countries.

Regarding the frequency of using the Internet (on average daily and regularly), Russia showed not very high positions in comparison with the EU, the USA, New Zealand, and Australia but was ahead of China, Brazil, and Mexico. In the field of digital technology adoption by enterprises, Russia lagged far behind the EU and other countries and was only slightly ahead of Turkey, China, and Mexico. Russia ranked 46th in the Global Innovation Index. In 2017, the Russian Federation was in 45th place.

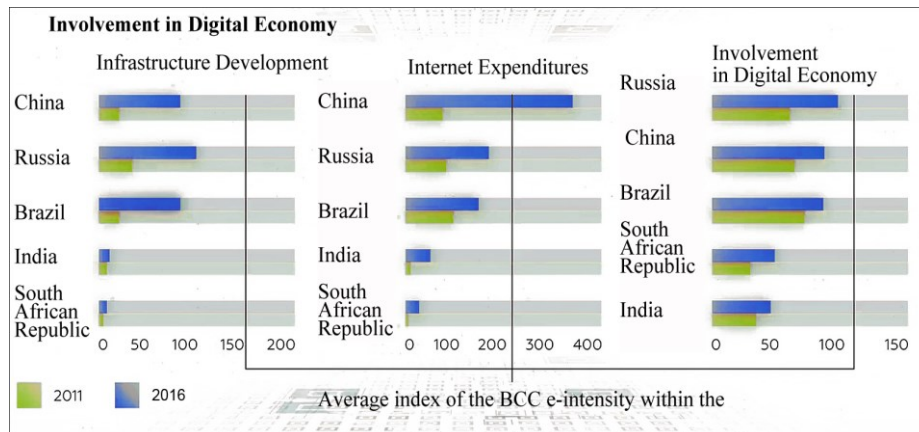


Fig. 5. Place of Russia in the world's digital economy

Leadership in the list remains with Switzerland. The second position is occupied by the Netherlands, the third one – by Sweden. The first five included the United Kingdom and Singapore. The United States, Finland, Denmark, Germany, and Ireland were in the top 10. China scored five lines at once and became the 17th. The rating was launched by the World Intellectual Property Organization (WIPO), Cornell University and the independent organizations of GII Knowledge Partners and INSTEAD. The Global Innovation Index has been published annually since 2007. It represents an international rating, within the framework of which its experts are trying to assess how different countries of the world are developing innovative sectors of the economy and trying to bring them to life. The evaluation uses 80 parameters that give a complete

picture of innovative development, including an overview of the political situation, the state of education, and level of development of infrastructure and business.

The most important digital trends of the modern world can be divided into three groups.

For companies:

- Ownership of digital assets creates a competitive advantage;
- Fast growth: the winner gets everything;
- Digital platforms take place of classic intermediaries;
- Specialization is growing and new players are emerging;
- Digital players are entering new markets.

For consumers:

- The digital economy creates many benefits for consumers and society;
- The digital economy transforms the labor market.

For the state:

- Provision of public services in a digital format by default;
- Ease of interaction with citizens;
- The transition of internal processes and interagency interactions in a fully digital format;
- Feedback from government and social services;
- Formation and analysis of large data arrays.

In the modern digital economy, the main advantages are those who:

- Owns and manages virtual digital space;
- It provides access to a platform of digital products and services.

It should be noted that the platform of digital products and services is an essential element of the ecosystem of a digital economy at various levels, including the regional one. Let's consider the main provisions aimed at the formation of such a platform at the regional level, as well as the structure of the ecosystem being created.

3 Results and discussion

The platform is a virtual territory where business connections are established between the participants, hosting their businesses here, and developments in this virtual space.

It is advisable to build a virtual environment based on university data processing centers built on new principles. It should be borne in mind that federal universities are entrusted with the task of playing the role of scientific and technological "locomotives" of the regional economy, while leading higher education institutions and scientific organizations (for example, the Russian Academy of Sciences [21], Moscow State University [22] and a number of other organizations) solve similar problems at the state level.

An innovative engineering solution is applied to the development of the platform, which allows it to scale and connect new participants as needed, without additional investments required.

The organizational and technological platform of the region's digital economy includes, as a basis, a technological platform on which the main management tools can be implemented to ensure the operation of the digital management space, and ensures the interaction of needs and capabilities of suppliers and consumers of resources, products, and services based on innovative technologies and principles of the digital economy. The basic elements and connections of such a platform are shown in Fig. 6.

The creation of the organizational and technological platform of the regional sectorial ecosystem foresees the solution of a number of important tasks:

- Creation of clouds and sub-clouds for individual branches of the regional economy (education, medicine, agriculture, architecture and construction, engineering, electronics, government, energy, recreation, and tourism);
- Launch of cloud industry services (industry ecosystems) and individual projects;
- Development of design, production, and sales of products and services (digitalization of the life cycle in the cloud);
- Development of business tools;
- Creation of an integrated data center system (based on OpenStack, containers, SDS, SDN);
- Creation of a service management system of the Ministry of Science and Higher Education; provision of scientific services for collective use centers of organizations subordinate to the Ministry of Science and Higher Education to scientific and educational institutions of the region;
- Creation of digital school centers.

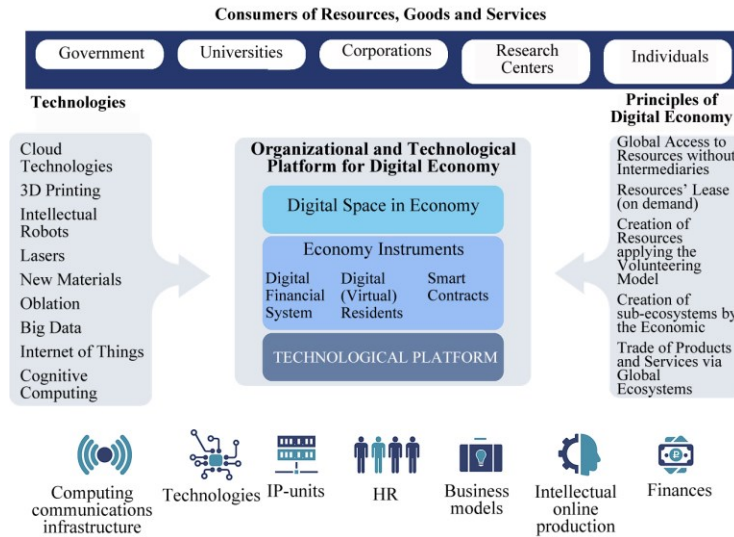


Fig. 6. The organizational and technological platform

As an option for the possible structure of the digital industry systems in the region, one should consider a set of regional ecosystems with the selected branch ecosystems “Agriculture” and “Electronics” shown in fig. 7.

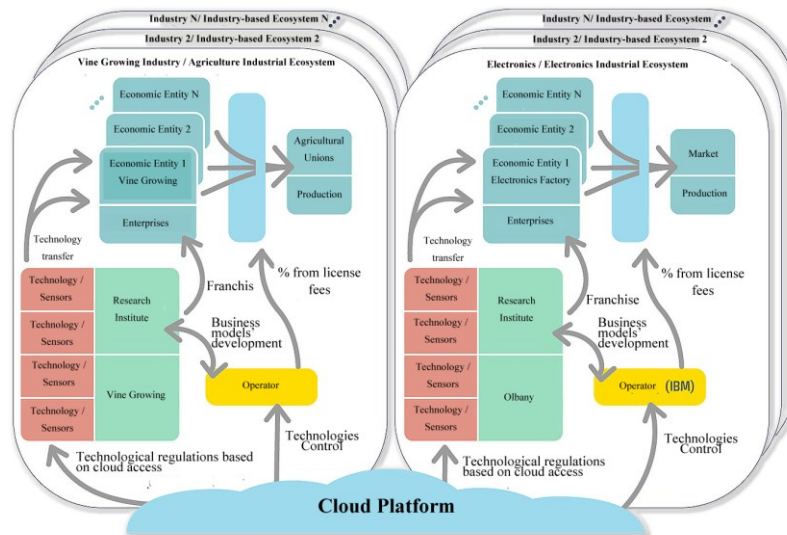


Fig. 7. Structure of the digital industry ecosystem of the region's digital economy

4 Conclusions

The purpose of this article is to analyze the main processes occurring in the digital economy worldwide, to clarify Russia's place in this area, as well as to develop proposals for the formation of the sectorial ecosystem of the region's digital economy. As a result of the analysis, the following conclusions can be formulated:

1. Digital transformation of economic relations is actively taking place in the world, which is the essence of the 4th technological revolution (Industry 4.0), while such processes in Russia (digital economy) are deeper and more complex, based on the convergence of innovative technologies of the economy, information and communication technologies, as well as humanitarian, political, legal and educational technologies.
2. In the rating of countries introducing technologies for digitalization of economic relations, Russia is in the group of “novice leaders” (the level of digitalization is higher than the level of economic development), but so far lags behind the leading countries, such as South Korea, the Netherlands, and China.
3. It is advisable to create a virtual environment based on university data processing centers built on new principles, characterized by innovative engineering solution, which allows scaling up and connecting new participants as needed, without requiring additional investments.
4. The digital products and services platform is an essential element of the ecosystem of the digital regional economy;
5. The proposed structure of the sectorial ecosystem of the regional digital economy is universal and can be applied to most industries in different regions of the country.

Acknowledgment

This work was supported by the Grant of the Russian Foundation for Basic Research and the Administration of the Krasnodar Region No. 18-410-230024.

References

1. S. Claessens ... [et al.], Financial crises : causes, consequences, and policy responses. Washington, D.C. : International Monetary Fund, 2013.
2. L.M. Fonseca “Industry 4.0 and the digital society: concepts, dimensions and envisioned benefits”, Proceedings of the international conference on business excellence, Vol. 12 (1), Oct. 2018, pp. 386-397.
3. J. Schlick, P. Stephan and D.Zuhkle “Produktion 2020. Auf dem Weg zur 4.0. industriellen Revolution”, Fachzeitschrift für Information Management und Consulting, vol. 27(3), Aug. 2012, pp. 26-33.
4. E. Bucherer, U. Eisert and G. Gassmann “Towards systematic business model innovation: Lessons from product innovation management”, Creativity and Innovation Management, vol. 21(2), May 2012, pp. 183–198.

5. J.A. Saucedo-Martinez, M. Perez-Lara, J.A. Marmolejo-Saucedo, T.E. Salais-Fierro and P. Vasant, "Industry 4.0 framework for management and operations: a review", *Journal of Ambient Intelligence And Humanized Computing*, vol. 9 (3), June 2018, pp. 789–801.
6. M.A.Sneps-Snepe, V.A. Sukhomlin and D.E. Namiot "On information models of the digital economy", *Selected Papers of the II International Scientific Conference "Convergent Cognitive Information Technologies" (Convergent 2017)*, Moscow, Russia, Nov. 2017, pp. 367–379.
7. R.R. Timirgaleeva and I.Yu. Grishin "Digital transformation as a factor in the development of the national economy", *Formation of financial and economic mechanisms of management in the conditions of information economy. Collection of scientific papers of the III International Scientific Practical Conference*, May 2018, pp. 152–153.
8. I.Yu. Grishin and R.R. Timirgaleeva "The Application of Artificial Intelligence Methods for Forming Industry Management Systems", *CEUR Workshop Proceedings 1st International Scientific Conference Convergent Cognitive Information Technologies, Convergent 2016*; Moscow; vol. 1763, Nov. 2016, pp. 115–120.
9. N.Tuptuk and S. Hailes "Security of Smart Manufacturing Systems", *Journal of manufacturing systems*, Vol. 47, 2018, pp. 93–106.
10. V.S. Garkushin, R.R. Timirgaleeva and I.Yu. Grishin "Problems of the gsm-alarm system protection in the enterprise's information system", *Maritime strategy and policy of Russia in the context of ensuring national security and sustainable development in the 21st century. Collection of scientific papers*, May 2018, pp. 200 – 204.
11. R.R. Timirgaleeva and I.Yu. Grishin "Information and logistics to ensure the security of a business entity", *Maritime strategy and policy of Russia in the context of national security and sustainable development in the 21st century. Collection of scientific papers*. May 2018, pp. 242–245.
12. A.S Matytsin, R.R. Timirgaleeva and I.Yu. Grishin "Problems of ensuring information security of business when using mobile devices", *Management in conditions of global transformations: Economics, politics, law. Collection of scientific papers of the International Conference*, Apr. 2018, pp. 514–517.
13. R.R. Timirgaleeva and I.Yu. Grishin "Ensuring information security and business continuity when using mobile technologies", *Digital Economy and Industry 4.0: Problems and prospects. Works of the scientific-practical conference with international participation*, Oct. 2017, pp. 489–493.
14. S.K. Rao and R.Prasad "Impact of 5G Technologies on Industry 4.0", *Wireless personal communications*. vol. 100 (1), 2018, pp.145–159.
15. J.I.R Molano; J.M.C. Lovelle and C.E. Montenegro "Metamodel for integration of Internet of Things, Social Networks, the Cloud and Industry 4.0", *Journal of ambient intelligence and humanized computing*, vol. 9 (3), 2018, pp. 709–723.
16. B. A. Mozzaquatro, C. Agostinho, D. Goncalves, J. Martins and R. Jardim-Goncalves. "An Ontology-Based Cybersecurity Framework for the Internet of Things", *Sensors (Basel, Switzerland)*, vol.18 (9), 2018, paper number 3053.
17. T.K. Sung "Industry 4.0: A Korea Perspective", *Technological forecasting and social change*, Vol. 132, 2018, pp. 40–45.
18. J.T. Eckhardt; M.P. Ciuchta and M. Carpenter "Open innovation, information, and entrepreneurship within platform ecosystems", *Strategic entrepreneurship journal*, vol. 12 (3), 2018, pp. 369–391.
19. D. Curran "Risk, innovation, and democracy in the digital economy", *European journal of social theory*, vol. 21 (2), 2018, pp. 207–226.

20. J. Lee “Comparative analysis of national policies for open data government ecosystem”, Journal of the Society of Korea Industrial and Systems Engineering, vol. 41(1), 2018, pp. 128–139.
21. A.A. Zatsarinnyi “Information technology in the digital economy”, Designing the future. Problems of digital reality: proceedings of the 1st International Conference (February 8-9, 2018, Moscow, Keldysh Institute for Applied Mathematics, RAS), pp. 29-35.
22. National Center for Digital Economics of Lomonosov Moscow State University, official website, Web: <http://digital.msu.ru/about/goals>.