

Advances in Economics, Business and Management Research, volume 81 1st International Scientific Conference "Modern Management Trends and the Digital Economy: from Regional Development to Global Economic Growth" (MTDE 2019)

# Prospects and problems of the formation of ''Industry 4.0'' in Russia

Digilina O.B. Peoples' Friendship University of Russia Moscow, Russia <u>o.b.digilina@mail.ru</u> Teslenko I.B. Vladimir State University named after A.G. and N.G. Stoletovs Vladimir, Russia <u>iteslenko@inbox.ru</u>

Abdullaev N.V. Vladimir State University named after A.G. and N.G. Stoletovs Vladimir, Russia nizamka33@mail.ru

Abstract — In the article, the authors set a goal to analyze the prospects and problems of the formation of Industry 4.0 in Russia. The authors emphasize that the fourth industrial revolution completely changes not only the production processes and economic life of a person, but completely changes his view of the world, moving it into digital reality. Industry 4.0 is the production side of the Internet of Things, which is identically oriented towards consumers, where absolutely all household items are connected to the Internet. The emergence of Industry 4.0 is characterized by the growth of integrative interaction of enterprises both horizontally and vertically, flexibility and individualization of products and technologies, growth of labor productivity, new character of accumulation of human capital, growth of threats to cyber security. The success of the formation of Industry 4.0 is possible with the active state support of innovation in such areas as: creation of infrastructure, training and development of digital culture, ensuring cyber-security, promotion and financing of new domestic developments, assistance in the development of digital platforms and the industrial Internet.

Keywords — digital economics, digital technology, cyber security, industry 4.0, information infrastructure

### I. INTRODUCTION

The whole world today is on the verge of global change in all areas of society. These changes are associated with the development of the fourth industrial revolution (Industry 4.0), which began in 2011 and will soon change the world beyond recognition.

Industry 4.0 relies on the introduction of information technologies, which leads to an increase in the rate of information dissemination and technological innovations, and represents a fundamentally new approach to determining the properties of all human things, as well as methods for their production and consumption.

The definition of "Industry 4.0" was first given by the German federal government in developing a strategy for the development of German industry, the main purpose of which was to unite industrial equipment and information-communication technologies in a single information space,

this will allow it to interact with each other and with the external environment without human intervention.

Around the phenomenon of Industry 4.0, there are heated debates among Russian and foreign researchers of various branches of knowledge. Points of view on its perspectives and influence on the state of the modern world are sometimes diametrically opposed: from the statement that Industry 4.0 is a new paradigm of technological development to the interpretation of this phenomenon as ideological propaganda, especially in the electoral period.

It is worth noting that there are many interpretations of this concept. For our research we will focus on the traditional interpretation of this concept. "Industry 4.0" is a massive introduction of cyber-physical systems in production, maintenance of human needs, including life, work and leisure [2]. Accordingly, all this fundamentally changes human activity.

In order to use the capabilities of the fourth industrial revolution for a technological breakthrough in Russia, it is necessary to determine the content of this phenomenon, as well as identify the risks and opportunities that it carries with it.

## II. METHODS

The object of study of this work is a set of changes related to the new realities of the fourth industrial revolution, determining the further development of the world economic system. The subject of this article is the prospects and problems of the formation of "Industry 4.0" in Russia.

Then the authors conducted a study of the content of "Industry 4.0" and the structural elements of this phenomenon. The authors studied regulatory documents, state federal and subfederal programs aimed at stimulating the development of a new technological order in Russia, identified emerging problems and institutional traps. The article used the studies conducted in the works of G. B. Kleiner, Sh.A. Makale, Sergi, Bruno S. and other scientists.

On the basis of the material studied, the main results of the research were formulated and directions for their practical application were proposed.

## III. RESULTS

The fourth industrial revolution is realized through the Internet of Things, cloud computing and cyber-physical systems. In his interview for IK4-TEKNIKER, German professor E. Abele highlights several features of Industry 4.0: compatibility, virtualization, decentralization, and real-time operation [3].

In other words, Industry 4.0 is the production side of the Internet of Things, which is identically oriented towards consumers, where absolutely all household items are connected to the Internet. That is, in the broad sense of the word, the fourth industrial revolution is a characteristic of the modern trend in the development of automation and data exchange, including cyber-physical systems, cloud computing and the Internet of Things [5].

Almost all of these elements have long been successfully applied in practice. However, combining them into a single holistic system will help develop the idea of Industry 4.0 and provide increased production efficiency and additional profit through the use of digital technologies, the formation of network interaction between suppliers and consumers, as well as the implementation of innovative business models.

The "Internet of Things" or the industrial Internet network of devices that are equipped with sensors, software and network equipment, are capable of collecting and exchanging data through the Internet. This term refers to any device that can be accessed online. According to the outlook of the Accenture company, by 2030, this sector will add \$ 14.2 trillion to global GDP (for the 20 leading economies of the world, this is plus 1% above the projected growth rate), and the number of items connected to the network will be 75,4 billion in 2025 [4]. Industrial Internet will help in the fight against global problems.

Augmented reality - adding information to the world around you - overlaying graphics or audio series to get more familiar with a task or product. This effect occurs with the help of assistive devices.

Autonomous robots are electromechanical devices or virtual agents, autonomously or according to instructions (usually a computer program) those automate, enhance or support human actions.

Cloud computing is providing storage, network equipment and databases via the Internet (acts as the so-called "cloud"). It is this accelerates the introduction of innovations in various services, increases the flexibility of resources and even provides savings. Cloud services improve infrastructure management as your business changes.

Big Data is a system of technologies designed to perform some operations: processing large amounts of data; processing fast incoming data and working with structured and poorly structured data in various aspects. From the big data stream you can extract many different ideas. Purposes of use: increasing product quality, energy saving and improving equipment maintenance. For the purpose of successful use, the integration of information with some informative concepts is significant, including production management, resource accounting, customer relationship management, etc. From the previous technological revolutions "Industry 4.0" are distinguished by the following characteristics:

Firstly, Industry 4.0 takes into account the digitalization and integration of actions according to the vertical within the whole company, starting the research of goods and purchases and ending with production and logistics. Without exception, information about production operations, their efficiency, quality management and operational planning are available in real time in the general information space and optimized for various platforms.

Secondly, horizontal integration goes beyond the boundaries of a single enterprise and includes suppliers and customers. Apply integrated planning devices that take into account the characteristics of materials and components coming from partners. In numerous firms, including in the Russian Federation, information concepts are in no way interconnected or only partially connected. In addition, it is extremely rare to integrate companies - manufacturers, suppliers and buyers. Industry 4.0 implies that multifunctional divisions within one firm and entire firms create a single universal informational space with the goal of simultaneously automating a number of value chains.

The production process becomes more flexible and adaptive. Innovative robots are configured and created in such a way as to interact with each other and with employees, without the help of others, learn and improve their own actions. For example, Kuka company founds independent robots that have every chance to change and amend their own operations in connection with the next product on the line. Detectors and control panels enable them to interact with humans. ABB launches a YuMi robot with 2 manipulators designed to produce a product (for example, consumer electronics). Manipulators and computer vision enable the robot to interact harmlessly with humans and distinguish elements.

Thirdly, the digitalization of products involves the application to existing products of smart sensors or devices that are compatible with devices for studying consumer characteristics of products and the degree of customer satisfaction. Owing to the introduction of digital technologies, specialists of firms have the opportunity to acquire information about the use of goods and revise these products in accordance with the latest conditions of the final users.

Fourthly, companies use high-tech mechanisms and special equipment, information and communication solutions and cyber-physical concepts that ensure the digitalization and integration of production. Digital technologies are used in the organization and management of production processes.

Digital technologies and penetrating the operating systems of enterprises increase labor productivity and, as a rule, relieve people from the routine hard work, as well as change tastes and preferences.

The fourth industrial revolution significantly changes the economic world. The connection between the virtual and the real worlds will make it possible to speed up the manufacturing procedure and develop individual solutions at the best price for the client.

Fifth, Industry 4.0 completely changes the nature of human capital accumulation. Human knowledge becomes obsolete almost instantly. The half-life of competence is estimated at just 1.5 years today. That is, the competencies with which our

students leave universities, depreciate by 50% over one and a half years. The main task is to develop and accumulate knowledge in response to the challenges of the fourth industrial revolution. From 2016 to 2017, the demand for machine learning and artificial intelligence specialists in Russia increased 10 and 8 times, respectively.

Sixth, virtual forecasting of goods, used materials and processes is already used at the engineering research stage; in the future, its use will expand to simulate a whole cycle of operational and production activities. These models will receive information in the real-time process in order to form a virtual copy of true production with the participation of machines, goods and workers. This will enable operators to check and improve equipment options for a subsequent product on the line with the support of a virtual model, up to making changes directly in the physical production.

Seventh, with increased connections and the use of typical connection protocols, which Industry 4.0 implies, there is a clear need to safeguard key production concepts and directions against cyber threats. For this reason, secure connections and a reliable combination of access control to concepts are considered a necessary circumstance for the formation of corporate information concepts. With the growth of Industry 4.0, it is possible to terrorize production systems remotely by manipulating the manufacturing protocol of a product or simply paralyzing this procedure. The security of smart factories is becoming an increasingly urgent problem.

Another significant security issue is: the formation of secure networks is a serious goal, and the integration of physical concepts with the Internet makes them most sensitive to cyber attacks.

The implementation of Industry 4.0 has both advantages and certain difficulties from both the technical and social aspects.

Maximizing the benefits of the 4th industrial revolution will require powerful cooperation, not limited to corporate aspects, especially if the problem reaches to the point that all machines understand one language without exception. If the unfinished product arrives in a machine that is not capable of examining its RFID chip at all, due to the fact that it is programmed at a different frequency, the industrial procedure will turn to mess.

On the other hand, excessive uniformity is also unsafe. By sticking to the pattern of Google, a handful of reputable companies are able to master the unnatural superiority in Industry 4.0.

Klaus Schwab, the creator and unchanging head of the World Economic Forum in Davos, defines the scale of change as incredible for the history of mankind. Changes touched absolutely everyone: Man's relations with the world, with himself and with other peoples will change substantially. The fourth industrial revolution has enormous potential according to the increase in the standard of living of people, the solution of many pressing issues, but also allows for the emergence of new challenges. [11]

Economic spheres with access to vast amounts of information will be able to drastically increase the quality of the conclusions adopted in their database, especially ordinary ones. This applies to banking, legal services, insurance, accounting, management, consulting and auditing, metrological support, health care and much more. On the other hand, tremendous development will acquire logistics. The importance of traditional advantages based on diverse rents and the importance of the arbiter in favor of consumer properties of the product and technological rents will decrease. In general, the expediency of resource consumption will increase, including natural. The economy will be the most transparent, predictable, and its formation will be rapid and systemic.

Exemption from the routine. As well as at one time the individual essentially got rid of hard physical work, and then with a certain uniform activity, the fourth industrial revolution is expected to save a person from solving a large number of standard questions. The capacity for highly intellectual and creative activity will increase, in which case it will be the most sought-after and preferred.

The more closely the material world will interact with the digital one, the more opportunities will arise to control and remove the threat of unwanted incidents around the world using digital networks. For example, it will be easier to search for offenders.

Consumption will become more individual from several positions. Firstly, the ability to customize products and services, a narrower setting for a particular customer, will significantly expand. Secondly, the connection of items will be more integral, and, therefore, customizable, again, under a particular buyer. The same means and means of virtual and augmented reality, allowing to form a personal offer for each person.

As a person dives into the digital sphere, his personal actions will become the most and most digitized, i.e. easily accessible for analysis and accounting, which will form even greater abilities for personal adjustment of the surrounding world. On the other hand, all this causes alienation from the person of his inner world, the lack of independence of the development of his own person, segregation of people based on their identity, and, equally as a consequence, the polarization of human communities.

The fourth industrial revolution carries simultaneously a number of prerequisites for the differentiation of society. The creation of robotic solutions to a large number of questions will lead to a decrease in the value of low- and semi-skilled labor. This can destroy the material well-being of a large number of certain groups of the population, which limits the ability of its representatives to invest in personal human capital, which limits education opportunities, which creates difficult obstacles for high-skilled labor to enter the market, and the individual is deprived of prospects for high incomes. On the other hand, the devaluation of low-skilled human labor leads to the loss of the superiority of cheap labor, which increases the differentiation in welfare among states.

For the Russian Federation, Industry 4.0 represents an opportunity to change the role and importance of global economic competition, but the domestic economy has not yet fully utilized these existing opportunities.

The backlog that has accumulated during the period of the previous industrial revolutions, along with unresolved institutional difficulties, have become major obstacles to the Russian Federation's newest modernization. Unquestionably, understanding and accepting these difficulties is already a step forward. Is the Russian Federation ready for the offensive of the Fourth Industrial Revolution? More likely no than yes. The formation is hampered by the great importance of the state apparatus, institutional barriers to the development of small business, the continuous leakage of human capital, coupled with the lack of conditions for comfortable work inside the country, the lack of modern equipment.

Within the framework of Industry 4.0, the following tasks become relevant [2]:

1. The multiplication of existing technological developments;

2. Involvement of young people in scientific activities and the creation of conditions for the realization of their research potential in the Russian Federation;

3. Increasing the competitiveness of Russian products on the world market.

The first step in the transition of Russia to Industry 4.0 can be considered the formation of the Association for the Promotion of the Industrial Internet on the initiative of Rostelecom and Roskosmos [9]. The organization is formed to support the creation of domestic equipment and concepts in the field of industrial automation, including in such areas as the fuel and energy complex, housing and communal services, transport and communications, and also the development of conditions for the promotion of goods and services to foreign markets . The main activity of the association will be the formation of standards in the field of security of the industrial Internet of things and the provision of protection of industrial items by means of domestic production.

The main obstacles to the transition of the Russian Federation to Industry 4.0, as the researchers note, are the low level of digitalization and the small costs of enterprises for innovation [7]. The share of expenditure on research and development in the budgets of world leaders in the automotive industry is more than 6 times higher than that of domestic firms, and in the case of the telecommunications sector, the gap is 10-fold in nature [12, 13].

In February 2017, the Russian government adopted the first "roadmap" according to the development of the National Technology Initiative (NTI) - "Advanced Production Technologies" - "Technet". The goal of the roadmap is to increase the share of the Russian Federation in the global services market that meet the conditions of Industry 4.0 at least to 1.5%. The most promising trends for the formation should be digital design and modeling, the latest materials, additive technologies, industrial Internet and robotics.

The difficulty and distinctive feature of the transition to Industry 4.0 lies in the fact that in a number of directions an abrupt change is made in the applied practices. In fact, production is formed from scratch. And such a transition eliminates both the lag and the primacy [10].

In the early stages, the roadmap covers at least 8 areas of industry. The implementation of such projects has already begun: in the automotive industry, this is the unmanned commercial transport of Volgobas, in shipbuilding it is the largest nuclear-powered icebreaker in the world of the project 22220 Arktika.

In implementing the policy of introducing digital technologies into the country's economy, an important role is played by the state. It is this that should pay attention to the

risks associated with the use of completely new approaches in the management of the production process and the introduction of innovative technologies.

The state has direct and indirect methods of stimulating enterprises. Direct methods are various types of financing for innovative developments or projects, and indirect methods are tax and customs privileges.

The listed methods are present in modern Russia, however they are used with different effectiveness.

To increase business readiness for changes, insurance of risks associated with financial losses must be developed. For example, it may be subsidies or other benefits to industrial enterprises from the state by the amount of risk or by an amount comparable to the costs of innovation.

Moreover, management retraining and advanced training in digitalization of production can play a positive role in stimulating the implementation of Industry 4.0. This is what will strengthen the desire for innovative technologies and change the thinking of management at all levels.

One of the main directions of stimulating the development of Industry 4.0 is the issuance of grants to leading companies in the field of innovation. Grant competitions are usually held by funds that streamline budget funds and attract additional sources of funding. The purpose of such funds is to stimulate and support enterprises engaged in the field of innovative technologies. At the moment in Russia there are a considerable number of such funds. The largest of these are the Russian Foundation for Basic Research and the Skolkovo Foundation.

Government orders play a large role in the implementation of Industry 4.0, as they form the initial demand for products. Public-private partnership - the participation of government and business in all areas of activity, as well as co-financing of scientific research. In Russia, this is the most effective measure to stimulate innovation, since 70% of all goods are purchased by the state.

Russia is taking active measures to stimulate the implementation of Industry 4.0, however, only 10% of companies are ready to completely move to a new stage of the industrial revolution.

#### IV. CONCLUSIONS

We live in a period of significant changes in the economy, industry, education and medicine. Today, the formation of digital technologies sets the pattern for our near future saturated with thinking devices in digital factories and beyond, capable of resolving routine procedures without human help. The planned actions to consolidate the largest companies with 3D printing leaders prove the importance and inevitability of the leadership of additive technologies in relation to traditional approaches. In a society of innovations, those manufacturing firms will begin to win, who will have flexible equipment and technologies that can instantly rearrange themselves for fresh tasks. This is the birth of a new technological order "Industry 4.0".

The definition of Industry 4.0 has been used for more than 10 years to denote the latest innovative approach to the organization of a company. There are many formulations of this term, but this term is well-established, since, based on it, components and signs of the Industry 4.0 trend have been singled out.

Since the current production is based on technologies, a concise list of the main technologies that guarantee the implementation of the concept of Industry 4.0 in practice is organized, and the trends in their application are given. The impetus for changes in production is the desire to increase the effectiveness and efficiency of the company.

It is assumed that in the next 20 years, digital production will replace certain types of mass production, especially with the high final cost of the product. In accordance with the concept of "Industry 4.0", the production of "tomorrow" will not have a significant cost of equipment. They will be built on the basis of flexible production cells as part of cyber-physical systems. Systems will be able to adapt to a specific order by reprogramming, replacing production modules, tooling, tools, materials, redirecting logistic flows - and all this will be done in an extremely short time. Such production centers of the future will have a developed network, build up literally full technical and technological cloning and are close to the main points of consumption of the product.

The characteristics of the Russian Federation are significantly lower than in other states. In this connection, it is necessary to study the experience of foreign countries and the formation of their own development tools for Industry 4.0. However, nevertheless, it must be borne in mind that there is no exemplary model of stimulation in society and, first of all, the state should pay attention to its economic opportunities in accordance with the implementation of certain events.

## References

[1] Berberov A. B. On the way to digitalization of the Russian economy: problems and prospects // Journal Management of Economic Systems: electronic scientific journal 2017 <u>http://uecs.ru</u>

[2] Report of the Center for Strategic Research: "New technological revolution: challenges and opportunities for Russia " <u>http://www.stankoreport.ru/news/article/2018-rossia-planiruet-operedit-konkurentov-za-scet-industrii-40</u>

 [3] Interview E. Abele. [Electronic resource] - electronic data. URL: http://www.tekniker.es/en/industry-4-0-the-computerization-of-manufacturing
[4] Industry 4.0. [Electronic resource] - electronic data. URL: http://kaspersky.vedomosti.ru/industrii/industry4

[5] The end of the analog world: industry 4.0, or what the fourth industrial revolution will bring. [Electronic resource] - electronic data. URL: https://theoryandpractice.ru/posts/14610-konets-analogovogo-mira-industriya-4-0-ili-chto-prineset-s-soboy-chetvertaya-promyshlennaya-revolyutsiya

[6] Naumkin M. Five Trends of the Russian Digital Economy in 2018. [Electronic resource]. - Access mode: URL: https://rb.ru/opinion/ekonomikarossii

[7] Russia online: four priorities for a breakthrough in the digital economy. The Boston Consulting group2017. [Electronic resource]. - Access mode: URL:http://image-src.bcg.com/Images/Russia-Online\_tcm27-178074.pdf

[8] Russia 4.0: the fourth industrial revolution as an incentive for global competitiveness. [Electronic resource] - electronic data. URL: <u>https://tass.ru/pmef-2017/articles/4277607</u>

[9] The Association for the Promotion and Standardization of Industrial Internet Systems was created. [Electronic resource] - electronic data. URL: <u>http://www.cnews.ru/news/line/2017-05-</u> 29 sozdana assotsiatsiya sodejstviya razvitiyu i standartizatsii

[10] Trauchuk A.V., Linder N.V., (2016). Adaptation of Russian firms to changes in the external environment: role of e-business tools // Management Sciences. No. 1. P. 61 - 73.

[11] Expert Online. "The 4th Industrial Revolution in Davos". [Electronic resource] - electronic data. URL: http://expert.ru/2016/01/21/chetvertaya-promyishlennaya-revolyutsiya/

[12] Sergi, Bruno S. (2019). Modeling Economic Growth in Contemporary Russia. Bingley, UK: Emerald Publishing.

[13] Sergi, Bruno S. and Cole C. Scanlon (2019). Entrepreneurship and Development in the 21st Century. Bingley, UK: Emerald Publishing.