Russian industrial sector in the conditions of the Fourth Industrial Revolution

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Abstract. The Fourth Industrial Revolution is taking on an ever-increasing scope in the world. The construction of the digital economy is the core of the revolution. Russia's potential in digitalizing the economy is promising. The potential effect on Russia's GDP from digitalization of the economy by 2025 is estimated at 4.1-8.9 trillion rubles, which is 19-34% of the total increase in GDP. The purpose of the study is to describe and to analyze the current state of the Russian industry under the conditions of the Fourth Industrial Revolution with a focus on the agile management methodology in industry. It is a review-based work. Theoretical and practical aspects of agile management are presented. It is concluded that the agile approach in industry corresponds to the goals of the Russian economy at the present stage of the development of the world community.

1. Introduction
The Fourth Industrial Revolution is actively developing in the world. Since 2011 it has become widespread. As part of the previous industrial revolution, the model of the economy is based on the idea of improving production efficiency through automation without changing the processes themselves. It is noteworthy that these processes can exist without information technologies. Within the framework of the Fourth Industrial Revolution, information technologies will become the core of business and will lead to irreversible transformation in production and business. All decisions in the digital economy will be based on the capabilities and resources of information and communication technologies. The technological basis for the transition to a new paradigm is the industrial Internet of things. Thanks to it, an intelligent system through interaction with the global environment will manage production in real time. All technical devices will give feedback and make technological solutions with the subsequent reconfiguration of production. The data will become the core of the organization. The Fourth Industrial Revolution leads to the following fundamental consequences [1]:

- consumer expectations are changing;
- operating models are transformed into new digital models;
- new partnerships are formed as companies realize the importance of new forms of cooperation;
- the quality of products is improved through data that increases the productivity of assets.

That's why it is important to identify an effective management model for the industrial development under such conditions. The agile management is the most effective management methodology in the conditions of the Fourth Industrial Revolution. It is a strategy whose purpose is to achieve a sustainable company's development by adapting to all kinds of unpredictable changes. Thus, this method is able to withstand the main challenges of the new revolution. The theoretical
and practical aspects of agile management are studied by many scientists. Among them the following scholars are highlighted: J. Goodpasture (2010), K. Hass (2007), J. Highsmith (2000, 2004), C. Larman (2004), K. Schwaber (2003, 2007), J. Sutherland (2014), F. Benaben (2017), H. Yang (2016), R. Sindhwani (2017), A. Gunasekaran (2014, 2017). Attention is drawn to the fact that this methodology has been widely recognized abroad, both at the theoretical and practical level. Unlike developed countries, agile management has not yet received sufficient development in Russian industry. Thus, the aim of the study is to review the current state of the Russian industry under the conditions of the Fourth Industrial Revolution with a focus on the agile management methodology.

2. Materials and Methods

Agile management method [2-13] becomes particularly relevant in the context of the formation of the Fourth Industrial Revolution. This model is able to solve the most urgent modern problems, which consist of uncertainty and rapid changes in business environment. Agile is a management strategy for achieving a sustainable development through adaptation to all kinds of unpredictable changes. Initially, the agile methodology has successfully proved itself in the field of information technologies. The aforementioned software development methodology succeeded in squeezing the waterfall model, which is traditional for this industry. The essence of the agile system is based on the following fundamental principles:

- technical units in cooperation with the business department are located in an open area;
- test scripts are developed before programming stage;
- daily morning meetings with a brief discussion of the problems encountered;
- the development process consists of "sprints" (work cycles lasting from one to four weeks). The output of each cycle is the working code. The widely-known Deming cycle (PDCA) underlies the logic of the algorithm of this process.

There are five stages of agile management [14]:

1. envision (how to determine the product vision, the project objectives and constraints, the community and how the team work together);
2. speculate (developing an ability or feature based release plan to deliver on all aspects of the vision);
3. explore (planning and delivery project running tested stories in a short iteration, constantly seeking to reduce the risk and uncertainty);
4. adapt (reviewing the obtained results, the situation and the teams’ performance and adapting as necessary);
5. close (concluding the project and passing on the key learning’s).  

Summarizing, agile management can be defined as short cycles of product development that deliver product incremental updates rapidly based on the changing needs of the customer. This methodology is the opposite to the waterfall management, which values extensive planning and preproduction.

The functioning principle of the agile methodology in IT-sphere is transformed into its application in the most effective management strategy within the framework of the Fourth Industrial Revolution. The main regularities of the mechanism for introducing and using the model under consideration, with an emphasis on the scale of activities and taking into account modern means of developing communications are preserved. Next, it is necessary to highlight a number of characteristic features of the agile management:

- rapid reconfiguration of labor and material resources;
- avoiding multitasking;
- multidisciplinary team of the main company;
• dual operating system, consisting of the synthesis of a classical hierarchical organizational structure and a dynamic network structure;
• an extensive partner network of companies (with duplicate and complementary competences) and suppliers;
• wide application of cloud technologies for integration of interacting companies among themselves and with the external environment;
• big data;
• high-tech industry is the most suitable sphere of application;
• high level of customization;
• minimization of losses from possible, unexpected negative changes.

So, the fundamental advantages of agile management include:
• quality improvement;
• just-in-time delivery;
• flexibility of internal processes;
• cost reduction.

Thus, agile management methodology meets the requirements of modern conditions created by the new industrial revolution. It is the best method of organizing the most advanced production process.

3. Results and Discussion

The current state of the Russian industrial sector in the conditions of the Fourth Industrial Revolution is characterized as the beginning of the possible great way. The digital economy is a fundamental basis of the Fourth Industrial Revolution. As a result, the introduction of modern digital technologies in various fields of activity, primarily in industry, is a priority for the development of the national economy. Many efforts and actions need to be applied to the development of the digital economy in Russia [15-19]. For the first time the task of forming a digital economy was identified by the President of the Russian Federation V.V. Putin in his annual address to the Federal Assembly in 2016: "... launch a large-scale system program for the development of the economy of a new technological generation, the so-called digital economy". Approved by the decree of the Government of the Russian Federation of July 28, 2017, No. 1632-r, the Digital Economy of the Russian Federation program, guided by the "Strategy for the Development of the Information Society in the Russian Federation for 2017-2030", defines the digital economy as an economic activity, a key factor in production which is data in digital form, and contributes to the formation of an information space, taking into account the needs of citizens and society in obtaining qualitative and reliable information, development and the information infrastructure of the Russian Federation, the creation and application of Russian information and telecommunication technologies, as well as the formation of a new technological basis for the social and economic sphere.

According to the study of the international consulting company McKinsey in 2017, the share of the digital economy in Russia’s GDP is 3.9%, which is two to three times lower than that of the leading countries, for example, the USA, China, Brazil. Digital household expenditures make up 2.6% of Russia's GDP - this is the most significant contribution to the development of new technologies, but it is still lower than the average for the leading countries (3.6%). The share of public spending and private investment in the GDP structure is also lower than in the countries under consideration, and the volume of export of digital technologies is four times less than imports. If the volume of Russian investments in information and communication technologies, including digital household spending and investment companies and the state, increases compared
to the average level of countries, the share of the digital economy in Russia will grow to 5.9% of GDP, which will allow Russia to come closer to the leading countries.

The growth rates, which were fixed in 2011-2015, are encouraging. Russia’s GDP for this period grew by 7%, and the volume of the digital economy increased by 59%, to 1.2 trillion rubles. (at prices of 2015). Thus, the digital economy accounted for 24% of the total GDP growth. It is noteworthy that the volume of the digital economy is growing 8.5 times faster than other sectors of the Russian economy. There is considerable potential for further growth. As a result, it is important for Russia to accelerate the pace of digitalization and by 2025 achieve an ambitious, but very realistic goal - to triple the size of the digital economy. According to the assessment of the consulting company, an additional increase from the introduction of new digital technologies will be on average up to 2025 from 0.4 to 0.9% of GDP per year. Comparison of this growth with the forecasted growth rates of the Russian economy allows us to estimate the contribution of digitalization at the level of 19 to 34% (4.1 - 8.9 trillion rubles) of real GDP growth by 2025.

The introduction of digital technologies in the industry requires the mastery of modern management models in production. Without this, the most ambitious goals, based on positive trends, will not be achieved. In the conditions of the Fourth Industrial Revolution, many countries can compete for world leadership, including Russia, which has good potential. The potential benefits of agile management in industry are undeniable and are proved in practice (in accordance with the study «Digital Russia: new reality» conducted by McKinsey & Company in 2017). There are:

- reducing the time to market for products by 20 to 50%;
- reduction of product maintenance costs by 10-40%;
- increase of productivity by 3-5%;
- reduction of equipment downtime by 30-50%;
- improving the accuracy of forecasts by up to 85%;
- reduction of quality assurance costs by 10-20%;
- reduce costs of storing inventory at 20-50%;
- increase performance of technical functions at 45-55% because of the automation of labor.

All of the above aspects will lead to a general improvement in the quality and competitiveness of Russian products on both domestic and global markets. A significant effect of the agile approach can be obtained in the manufacturing industry due to its high labor intensity and technological backwardness of Russia from the advanced countries. Here, efficiency gains are possible in all areas of the value chain, from accelerating the development and launch of new products to the market, synchronization of the chain of production and supply of components, to a significant increase in the efficiency of planning, production, quality control and level of service for the final product. Thanks to the modernization of Russian engineering in the era of the Fourth Industrial Revolution, labor productivity can be substantially increased in this sector, reducing the gap from the most industrialized countries. Agile management is effective and the most suitable method for the Russian industrial sector under the conditions of the Fourth Industrial Revolution.

4. Conclusions

Concluding the results of the study, the following features should be noted:

1. the Forth Industrial Revolution possesses a tremendous potential for transforming the Russian industry, which was traditionally considered quite conservative in the use of digital technologies;

2. the current state of the Russian industry in the conditions of the Fourth Industrial Revolution is promising, according to forecasts the contribution of digitalization at the level of 19 to 34% of real GDP growth by 2025 can be achieved;
3. implementing of agile management in Russian industrial sector is the most suitable and effective methodology according to the requirements dictated by the next industrial revolution;

4. the change of paradigms in the organization of production provokes the redistribution of the roles of world economy leaders and Russia has a chance to become this leader.

In the future, it may be of interest to study the development of the digital economy in Russia in combination with the use of the agile management. The most striking examples of successful industrial enterprises that apply this methodology can be described. Also tracing the dynamics of the state of the Russian industrial sector in the new conditions dictated by the Fourth Industrial Revolution may be a continuation of this work.

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