Assessment of prospects and directions of digital transformation of oil and gas companies

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Abstract. The article is devoted to the prospects for digital transformation of oil producing companies using the example of Gazprom Neft PJSC. For this, the article analyzes the current state of digital technologies in industries, as well as an analysis of the risks of potential implementation of digital technologies in various industries. The main technological and economic processes in the company of the oil and gas complex were investigated, taking into account, which the assessment of the possibility of introducing digital technologies into the business processes of the oil and gas company was carried out. In the final part of the article, an assessment of the results of the introduction of digital technologies at the enterprises of the oil production complex is carried out.

1. Introduction
Russian oil and gas companies, along with foreign ones, make significant investments in the most attractive and potential projects that can increase the efficiency of oil production, refining and distribution, while simultaneously contributing to an increase in sales profitability. The first priority is to improve the efficiency of management and staff training. Augmented and virtual reality technologies, as well as systemic digitalization of fields can solve most of the problems.

According to the Strategy for the Development of the Information Society in the Russian Federation, activities "in which the key factors of production are data presented in digital form, and their processing and use in large volumes allows, in comparison with traditional forms of management, to significantly increase the efficiency, quality and productivity in various types of production ...", characterizes the digital economy [1]. The program "Digital Economy of the Russian Federation" [2] speaks of the "alternative value" of data, which becomes a "new asset" as they are used "for new purposes and use to implement new ideas". Consequently, it becomes clear that at the state level there is an understanding of the decisive role of digital technologies in significantly strengthening the competitiveness of the national economy. In this regard, the problem of the
formation and development of the digital economy from the point of view of innovative development is important for both theory and practice of management.

Accelerated implementation, the use of digital technologies and the creation of truly new investment and business models are possible with the expansion of digitalization opportunities, infrastructure solutions, reducing the cost of computing equipment and improving the software architecture. At the same time, it should be noted that with the growth of the volume of generated global information, there is no proportional development of technologies capable of processing and storing such a volume of data.

For companies, having access to a new digital or information and communication technology is a powerful driver of increasing business competitiveness, but it is worth noting that its distribution is limited among competitors due to the high cost and lack of highly qualified specialists.

The commercialization of digital technologies goes far beyond the virtual environment. Industry / Industry 4.0 and other new production and management systems based on digital technologies - such as Big Data, artificial intelligence - act because of digitalization and integration of vertical and horizontal value chains, digitalization of offered goods and services and the emergence of completely new digital business models and modern platforms for interaction with customers. It should be noted that such an important production indicator as low production costs loses its significance in ensuring the company's competitiveness in the world arena.

According to the World Economic Forum, digitalization of the oil and gas complex alone will bring additional income of $ 1.6 trillion by 2026 [3].

2. Materials and methods

The purpose of this study is to analyze the prospects for digital transformation at the enterprises of the oil and gas production complex.

To achieve this goal, the following tasks are being solved:

- Analyze the current state of digital technologies in industries;
- Conduct a risk analysis of the potential introduction of digital technologies in various sectors of the economy and industry;
- Consider the best practices in the use of digital technologies in domestic and foreign companies in the fuel and energy complex;
- Study the main technological and economic processes in the oil and gas company;
- Assess the possibilities of introducing digital technologies into the business processes of an oil and gas company;
- Assess the results of the introduction of digital technologies at oil and gas enterprises.

Within the framework of scientific research, methods of descriptive, statistical, comparative, economic analysis, the method of expert assessments are used.

The information base of the study was the materials of various studies, the analytical report "Digital Transformation in Russia" based on the results of a survey of Russian companies for 2018 from Team-A Management LLC [4], Strategies for the development of the information society in the Russian Federation [1], annual reports and the investment program of PJSC Gazprom Neft.

3. Results

One of the breakthrough trends of the last decade is the integration of digital and cloud technologies into real economic processes. "Industry 4.0", "Big Data", artificial intelligence and others are already becoming realities of everyday life. This caused a serious transformation in many spheres of social and economic life and necessitated a revision of the principles of managing the innovative development of enterprises and the national economy as a whole. Expanding digital opportunities and infrastructure solutions while lowering costs are accelerating digital adoption and enabling new business models.
The oil and gas industry includes a large number of industrial, economic business processes, a number of excerpts follow from this:

- A large number of units that poorly interact with each other;
- Bureaucratic processes;
- A lot of technologies that can be modernized by transferring to digital technologies.

According to experts, the massive use of IT technologies will help oil companies to raise the oil recovery factor by 2-7%, as well as a possible reduction in operating costs by 25%.

Vygon Consulting analyzed the potential implementation or conversion of technological processes of an oil and gas complex in Russia to digital technologies by 2030 and concluded that these innovations will help increase oil production by 155 million tons, which will help compensate for lost production with depleted long service life wells [1-4].

Figure 1 shows the production potential in Russia for 2030.

![Figure 1](image)

**Figure 1.** Theoretical production potential in Russia for 2030 in scenarios with current technologies and with the development of digital technologies.

In addition to the obvious advantages of transferring business processes to digital technologies, namely, such as:

- Increase in profit;
- Increase in production volumes;
- Reduction of costs at the stages of preparation.

The transition to digital technologies gives a number of non-obvious advantages, namely, such as:
• Strengthening of positions in the market;
• The reliability of the company, by reducing the likelihood of potential accidents;
• Speed up all processes, from development to sales.

Accenture, after conducting its research, concluded that 36% of the world's oil producing companies has already implemented BigData technology, and 38% are going to introduce it in the next 5 years. Despite the fact that the oil price has collapsed, the majority of companies in the oil and gas industry are not going to cancel plans for the introduction of digital technologies, as well as to reduce the flow of investments aimed at this area. There has also been an increase in demand for the work of service companies that process large, massive data that interpret the results of seismic studies. This service is very expensive, but such an investment pays off and also helps to bring additional benefits. Using targeted drilling, with the help of geophysical guidance, the accuracy of work becomes many times higher. Thanks to 3D seismic exploration, oil companies can save about 5-7% for every dollar invested. The Institute of Oil and Gas Problems of the Russian Academy of Sciences (RAS) has been trying for many years to create recommendations for the implementation of digital technologies in the oil and gas industry.

One of the main issues in the transition of the oil and gas industry to digital use is the automation of refining. All this suggests that oil companies have all the opportunities, prerequisites, and most importantly, the need for digital technologies. In Russia, the advanced process control system or APC (Advance Process Control) has become widespread, which allows you to adhere to the established regulations and predefined target functions, as well as to make timely and correct decisions in crisis and non-standard situations. Thanks to the use of on-line analyzers, it becomes possible to establish monitoring of raw materials and products in real time. Adjacent installations are usually combined into an integrated system, this helps to synchronize technical processes that are controlled from a common center. The use of the latest analysis methods in the processing of petroleum products helps to increase profit indicators. Using as an example, one of the projects in Russia that started using the Industrial Internet of Things (IIoT), also known as the Industrial Internet of Things, EY analysts demonstrated the advantages of implementing this technology. Its essence lies in the fact that data modeling takes place using neural networks and machine learning methods. At refineries that use atmospheric and vacuum distillation in their installations, the introduction of IIoT helped to raise the forecasting quality by 15%, as well as improve the accuracy of the final result, or rather, deviations from the expected result decreased by 90%.

Market leaders have already created or have begun to create digital programs (Rosneft, Lukoil, Gazprom Neft), which suggests that we are facing a serious modernization in the oil and gas industry. Confidence in digital technology is growing stronger after reports of successful pilot projects from companies that have already tried out the technology.

All this suggests that oil and gas companies have all the opportunities, prerequisites, and most importantly, the need for digital transformation.

After analyzing the strategies of the largest international companies that use digital technologies, we can conclude about the main trend groups [5-8]:

• There is a period of global introduction of technologies that have a strong impact on the success of oil and gas companies;
• Major players are increasingly beginning to invest in technology at the initial stages of development, using corporate venture funds for this;
• IT departments are being transformed into growth and development units and are increasingly moving away from the cost centralization model. Many companies are moving to a model where the IT department is directly headed by the CEO, thanks to this, the status of the CIO (Chief Information Officer), or, in other words, the head of the information technology department, is increased;
One of the most important issues is the choice between developing competencies within the company or trusting outsourcing. World experience shows that both development models have a right to exist. For example, some global companies use outsourcing to improve the efficiency of cost management (British Petroleum), but there are also opposite successful examples of company development that leave technological development within their own business, not only in order to control operations as much as possible, but also to preservation of intellectual property for inventions (Shell);

Many digital technologies are created in symbiosis between vertically integrated oil companies (VICs) and oil service companies (for example, GE and BP, Baker Huges and Shell);

However, even despite this, a large investment flow occurs in the development of competencies within the vertically integrated oil companies;

Oilfield service companies are trying to collaborate with IT companies in order to create fully integrated solutions (for example, Schlumberger and IBM, Atos and Siemens).

Based on the results of the study, the following technologies can be identified for Russian oil and gas companies, into the depths of which can be introduced in the near future:

- Compression of processes;
- BigData services;
- Robotic Process Automation (RPA);
- Internet Industrial of Things (IIoT).

4. Discussion

It should be noted that the introduction of digital technology has a number of advantages, both material and non-material [9-10]:

- Reduced costs;
- Increased income;
- Inflow of information;
- Perfect monitoring;
- Prevention of emergency incidents.

However, along with these advantages, there are risks in the development and functioning of business processes based on digital technologies, which include the following [8]:

- Low level of infrastructure;
- Lack of qualified personnel;
- Significant costs in an unstable market;
- Cybersecurity;
- Lack of a refined regulatory framework.

5. Conclusion

The study notes that oil and gas companies are always at risk, as this industry is influenced by many more factors than others are. For many companies, digital technologies are seen as what can become an "anchor" of stability in difficult conditions of existence in the market. Many companies have already or are adopting digital technologies. Other companies are already building their competitive strategies with the assumption that they will have to use digital technologies in order not to lose market share.
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