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The Impact of Digital Technologies on the Economic Processes of Oil Companies

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Abstract— **Within the framework of this article the impact of digital technologies on the economic processes of oil companies was analyzed. Digital (information) technologies were considered as a significant economic resource, and special attention was paid to the implementation of the program –Industry 4.0" in Russia. The article explores some concepts – cloud technologies, Internet of things, Big Data. Digital technology expenses in the Russian oil and gas industry are shown. Trends of digital technologies in the economic activity of the oil companies, and pros and cons of their implementation are disclosed. The deterrent factor for implementation of digital technologies is shown – lack of –digital managers, Chief Data Officers (CDO) in the oil companies. International statistics data show that the number of chief data officers (CDO) in the biggest companies increases, oil companies being included. The vulnerability of information as an economic resource was investigated. Some risks of losing competitive advantages by reason of commercial information disclosure were discussed. The administrative role in innovation implementation was described, which is manifested as digital technologies have become a significant link in the chain of measures aimed at increasing business efficiency of oil companies.**

Keywords— digital, information technologies, "Industry 4.0" program, cloud technologies, Internet of things, Big Data, Chief Data Officers (CDO).

1. INTRODUCTION

Currently the oil industry in Russia and overseas is the key constituent of the economy, therefore updating of the oil industry is an essential condition for development of the nation.

In present-day realities, digitalization of activity, including the oil industry, has become one of the global trends in the development of economy. Numerous and diverse data which an oil company deals with, come from hundreds of sources by different ways, handling all these data sets within the company is a problem which is solved by a variety of ways. Systematization of this work, monitoring and continuous big database management is an important task.

So, the development and influence of digital technologies on the economic processes in oil companies is a topical research issue, which is the subject of this work.

In view of acceptance and implementation of the program "Digital Economy" in the Russian Federation, it is planned to spend 100 billion rubles from the federal funds on the industry modernization in 2018 – 2024.

The program establishes the objectives, trends and timelines for principal measures in the state politics to provide necessary conditions for development of digital economy in Russia, in which the digital data are the key factor of production in all the spheres of socio-economic activity.

The program covers three levels of implementation: markets and sectors of economy; platforms and technologies forming competences and normative regulation; information infrastructure, staff and information security.

The solution of the Program's tasks is based on using advanced home and foreign technologies, "digital' (information) technologies ranking high among them.

Nowadays, digital technologies are one of the main tools of improving the efficiency of oil companies, as it is a way to increase financial availability, entry of the products into new markets, and also a factor to decrease costs of sales information processing. Thus, studying the degree of digital impact on the economic process in oil companies is an important task.

The Program accentuates the development of Russian computer and telecommunication facilities, and Russian software including installation of antivirus software in all the imported computers (target shares by the end of the Program implementation for foreign software and hardware purchased by the state authorities being 10% and 50% accordingly).

Under the Program Russia must enhance its position in the world market for information processing and storage services (from today's share of such services at a global scale less than 1% to 10% by 2024). Also, the Program plans that by 2024 up to 97% of the Russian households will have broadband Internet access with the rate as much as 100 Mbit/s, and all the cities with a million-plus population will be 5G mobile networked.

The Program is focused on the support of "national IT-leaders": by 2024 there will be minimum ten of such high-tech enterprises in the sphere of high technologies.

The configuration of global markets undergoes substantial changes under the influence of digitalization. Many traditional industries lose their significance in the world economy structure at a time of rapid growth of new sectors generating revolutionary new needs. Importance is being attached to research and development in the transformation under way, which calls for a research and development management system in the field of digital economy providing coordination of efforts of the related parties – representatives of federal executive authorities, companies, higher educational institutions and scientific establishments.

Russian and foreign oil companies more often form joint ventures and actively cooperate with petroleum universities, research centers in the field of information technologies. At the same time the researchers note the importance of digitalization and automation of production processes, which drive up the productiveness of human capital.

Methods of analysis.

The information basis of the analysis was the normative documentation regulating the digitalization of economics, the results of the top economic scientists, reporting forms of oil companies. The research was based on systematic, monographic, calculation and structural methods.

The results of the analysis.

To reveal the main problems of the digital economics and economic processes in oil and gas companies, one should explore the situation of the main oil powers, which was done by this study with analysis and synthesis, induction and deduction, generalisation and graphical method.

The technological development of oil companies is accompanied by the steep rise in information demand, expansion of using innovation technology trends: “Big Data”, “Internet of things”, “Cloud technologies”, etc. Application of them can build up serious capabilities to improve the efficiency of oil companies.

Nowadays, information can be considered the first string affecting the oil company’s economy in which the information technologies have been increasingly used.

Information or digital technologies have already been widely used in the world oil complex at all the stages of the oil production chain. The expenses for them are one of the important items in the world’s leading companies, enhancing the efficiency indicators of field production, increasing the rate of production, decreasing the costs at all the stages of oil production cycle.

The digitalization of the economy fits well into the program “Industry 4.0” implemented in Russia (fig.1), the main concepts being Cloud Computing, Internet of things, Big Data [1, p.8].

Cloud Computing is an IT concept meaning a universal and easy network access on demand to the total scope of configurable resources which can be provided and deallocated on-line with minimum operating costs or provider calls. Examples of resources can be data transmission networks, servers, storage devices, applications and services both combined and individual. It is necessary to say that cloud technologies made an enormous contribution to the foundation of emerging “digital” economy. This contribution is not limited to a technological component but also involves economic and ideological components.

The Internet of things is a concept unifying lots of technologies, meaning instrumentation and internet connection of all the devices (and things in general), which allows remote monitoring and control of all the processes on-line (also in automatic mode).

Big Data is a collection of approaches, tools and methods to process structured and unstructured data (including those from independent sources), with the purpose of obtaining human-readable outputs. Big Data is characterized by considerable volume, diversity and update rate, which makes standard methods and tools of data processing rather ineffective. So, the technology of Big Data is a decision-making tool based on large quantities of data.

The economic activity of modern companies focuses on the Platforms of “Digital” economy. The Platform of “Digital” economy is digital media (a software-hardware complex) with a set of functions and services, which meets the requirements of users and producers, and also provides direct interaction between them. The value of the Platform is in providing a possibility of direct communication and facilitation of the interaction procedure between the participants. The Platforms reduce costs and provide an additional function both for suppliers and consumers. They are also supposed to provide data exchange among the people involved, which should considerably improve cooperation and promote producing innovation products and decisions.

In spite of the difference in the names, the new management technologies are similar in their essence and equal in their goals and tasks solved on-line: rapid processing of the increasing volume of information; modeling lots of production scenarios; oil production maximization and achieving high hydrocarbons recovery factors; selecting a rational development alternative; making management decisions and performance of work on production optimization [1, pp.8-9].

Fig. 1 Industry 4.0 and trends of «digital» economy [2]

Data for costs of digital technologies in Russian oil companies are not systematic and by no means always disclosed in the companies’ reports because of the privacy

policy. A certain notion about the costs in this field of activity is given by the information [2, pp. 25-26] presented in fig.2.

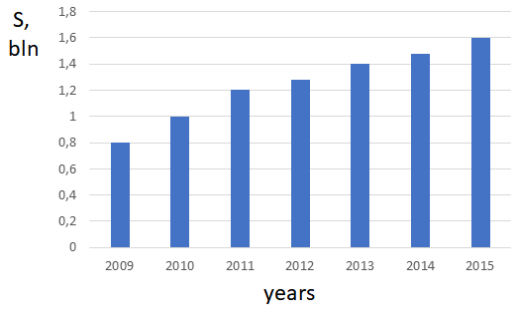
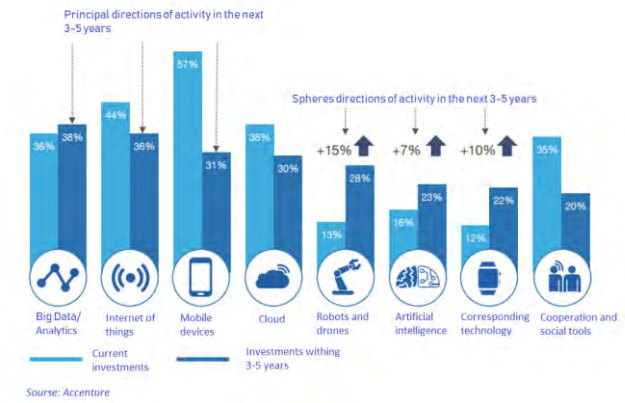


Fig. 2 Cost of digital technologies in the Russian oil and gas complex

When speaking about the tendencies in the development of digital technologies in the economy, one should keep in mind their complex nature and a possibility, apart from increasing efficiency, to gain an added value - facilitated communication with customers and users. According to the analysis carried out by the company Accenture [3, p.9], the most discussed issues in oil and gas companies have become methods of big numbers (Big Data), new analytic approaches, Internet of Things and mobile devices. The comparative volumes of investments in separate lines of using digital technologies are shown in fig.3.



*Per cent in the columns corresponds to oil and gas companies under survey
Fig. 3 Investments in digital technologies

Also, it is good to consider “cloud computing” which has already become ingrained in the life of every company. At one time the use of cloud servers helped facilitate communications inside and outside a company, whereas implementation of cloud computing allows companies not to have in service big computing facilities because this work can be transferred to special computing and simulation centers. As such centers are expansive to run, only big companies can afford it, but by the provision of such sphere of services now small firms can also model and simulate different market situations and check their business decisions at an adequate level.

Why ever is not the use of digital technologies increasing as high as wished it to be in spite of the distinct benefits? One of restricting factors is lack of experienced “digital managers”, the head running the digital reform or chief digital officers (CDO) in oil companies.

CDO are called to use interactive and mobile communication in view to get the customers success pattern, and fully transform the experience of the staff and the way to gain the company’s superior performance of its products and services. It means that the role of CDO in most companies is to transfer the companies into the stage of digital technologies with minimum organizational costs, controlling the operations, sales and marketing, systems and production. Besides, they also work with specific internal culture. This executive authority (CDO) serves a dual purpose – to develop both comprehensive digital patterns for clients and internal resources to support these efforts. Unlike other top managers, the chief digital officer (CDO) is an executive officer who has both responsibilities and powers to convert the company into a completely digital enterprise.

World-wide research works [5] reveal that in 2015 in 6% of 2500 companies Chief Digital Officers were assigned, and in 2016 – 19%.

But assignment of CDO does not bring about a success and digitalization of the company at once. The experience, knowledge, competencies are different in companies. In addition, companies have old back-office systems installed and overall organizational structure. Such approaches are not easy just to change; digital managers must know how to work within such constraints as they tend to move the organization forward. Otherwise they risk to be locked into their efforts to overcome the deficiencies which can be corrected by digitalization.

On top to the above, there appear risks in spite of lots of positive sides in digitalization. Beyond all doubt, they are weighty costs. Studies indicate that the digital changeover will require significant investments, up to 50 per cent of capital expenditures for about five years [4].

The information security doctrine in the Russian Federation, approved by the Edict of the President of the Russian Federation of December 5, 2016, #646 “On the approval of the information security Doctrine in the Russian Federation” is the basis for the state policy building and development of social relations in the field of information security, and also for policy making to improve the information security system. In the Russian Federation routinely much attention is given to the safety aspects at gas-, energy supply facilities and nuclear sites. But nevertheless two thirds of the Russian companies believe that the amount of crimes in the digital sphere has increased by 75 per cent within the last 3 years, which demands modernizing the system of information security in all the sectors of the economy.

All the traffic load of the enterprise will have to fall on the connected servers (both ins and outs), so this raises two partially interconnected problems: the servers can be attacked, the purpose being hacking the company’s commercially important information, and also the operation of the servers may be obstructed by other reasons. The loss of the data itself can have a heavy impact on the competitive capacity of the enterprise. Company spying is not uncommon when the purpose is stealing new ideas and technologies which are not set in operation. Although the security of modern systems is

able to set strong barriers to the attack from outside, it is worth keeping in mind that a system being ever so good cannot be perfect, at least at the current stage of development of information security.

2. RESULTS AND CONCLUSIONS

Nevertheless, studies indicate that digital technologies have become one of the main parts of the way to improve the effectiveness of oil companies. They include a driving factor for financial availability, decrease of data processing expenditures of sales channels, increase of customer satisfaction and expansion into new markets. Digitalization in contemporary Russia is a trend which will be increasing its capabilities in oil companies. According to the latest survey of "Deloitte" [5, 6] the most popular organization structure innovations implemented by companies in Russia are: remote work of the staff – 38%, introduction of common user centers – 37% and creation of project offices like agile – 26%. As for process solutions, nowadays the most popular are: implementation of advanced ERP-systems (42%); complete automation of a particular business process (27%) and programs of processing big data (26%). Future belongs to the oil companies with advanced technological platforms and economic models which will be oriented towards use of intelligent systems and robotics in business processes.

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