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## THE IMPACT OF DIGITAL TRANSFORMATION ON OIL GAS SECTOR: THE CASE OF AZERBAIJAN

### Summary

Currently, the digitalization of an oil and gas company should be understood as applying new high technologies within the framework of existing business processes without changing their principles and structure.

According to the author, the concept of "digital transformation" is somewhat different from digitalization. Digital transformation in an oil and gas company is a constant process of improving and transforming an oil and gas company's business model based on digital asset management. Digital assets in an oil and gas company, according to the author, are digital twins of physical assets (factories, wells, fields), which are cyber-physical systems for the most efficient management of the existing infrastructure.

In digital transformation, many oil and gas executives see the potential for long-term success. Nowadays, cost competitiveness is becoming more and more critical.

**Key words:** *digital transformation, oil and gas sector, Azerbaijan, technology*

### Introduction

World energy consumption is constantly growing, the use of alternative energy sources is expanding, and there is an increasingly difficult production of oil and gas from existing and new fields. A standard consequence of a deteriorating external and internal industry competitive environment is the need to save capital expenditures and improve operating efficiency. These factors are accelerating digital technologies' adoption in the oil and gas sector.

An analysis of domestic and foreign sources made it possible to conclude that digital changes in the oil and gas industry in the era of the fourth industrial revolution were not thoroughly studied. Consideration of the peculiarities, trends, and potential of digital technologies for the oil and gas industry in modern economic realities determined the articles relevance.

The fall in world oil prices in 2015 exacerbated the systemic economic crisis. It raised the need for a radical diversification of the national economy, which is still largely dependent on energy exports.<sup>1</sup>

The oil and gas industry has always been considered one of the most conservative. However, recently, due to the fall in oil prices and the changing macroeconomic global situation, oil-producing and refining companies have begun to actively look at technological solutions that would reduce capital and operating costs. The world market is changing rapidly today - we see an increase in takeovers and increased competition.

Over the past two years, there has been a stabilization of prices in the global commodity market. However, today the oil and gas industry is faced with several problems that require a new technological and managerial approach to new principles and methods of management.

In this, new economic reality, oil and gas companies solve a difficult task - reducing costs and increasing profitability along the entire value chain.

The oil industry is one of the largest consumers of IT services, and it is an anchor customer for which products are created that can then be released to a broader market. The development of technologies does not stand still: the bandwidth of channels is constantly growing, cloud applications are developing everywhere, data is processed faster. All this provides new opportunities for collecting information and using it.<sup>2</sup> **Oil and gas sector of Azerbaijan.** Since 1998, Azerbaijan's economy has entered a growth trajectory, which has noticeably accelerated since 2004 due to the rapid growth in oil prices: over the period 1998-2003. The

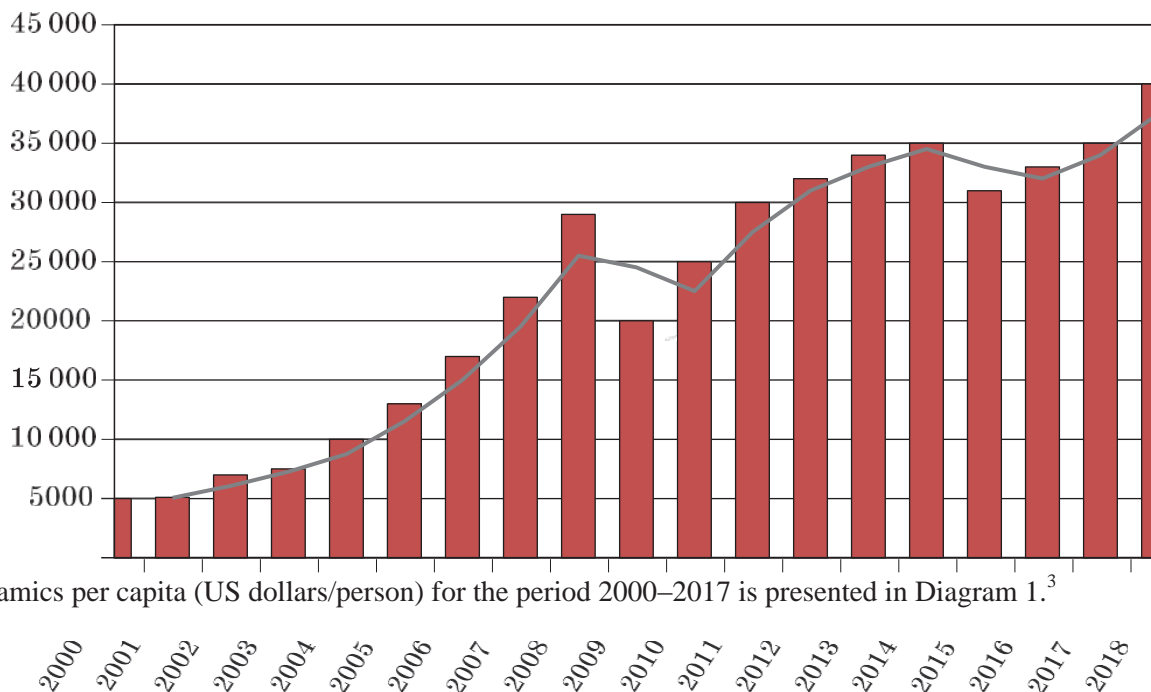
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<sup>1</sup> Hajizade E.M. (2015) Economic reforms in the onshore oil production complex of Azerbaijan and efficiency issues. Baku.

<sup>2</sup> Mirzayev R (2009). H.Aliyev and the new oil of the independent Azerbaijan State strategy. Baku.

country's GDP increased by 61.1%; over the next six years, in the context of a doubling of crude oil price and an increase in oil production by more than 3.3 times, economic growth amounted to 185.3%.

The foreign capital attracted to the NGS allowed the economy in 2001-2009 and grow much faster than the average for the CIS countries. Moreover, according to the World Bank, in 2007, Azerbaijan surpassed the average world level of GDP per capita, calculated in PPP. Up to 2015, it annually outstripped the world economy by this indicator by 13-22%. Dynamics of Azerbaijan's GDP (million US dollars) and GDP



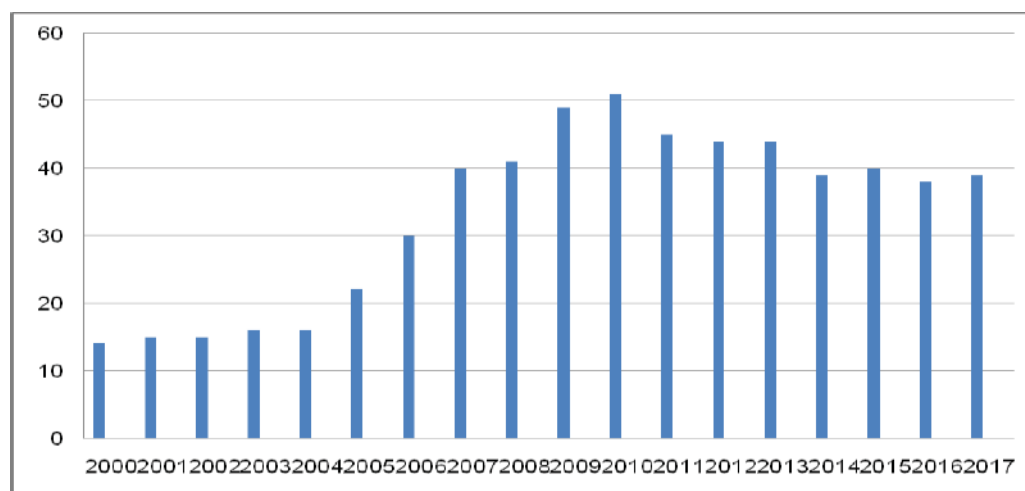
dynamics per capita (US dollars/person) for the period 2000–2017 is presented in Diagram 1.<sup>3</sup>

Diagram 1. Dynamics of GDP and GDP per capita in Azerbaijan for the period 2000-2017.

Source: State Statistical Committee of Azerbaijan, 2019.

Subsequently, after the conclusion of the first "Contract of the Century", more.

Twenty-six contracts, implementing the production sharing agreements (PSA) mechanism, with 41 oil companies representing 19 countries of the world. In order to fulfill the provisions of the contract on time and to supply the produced oil to the world market, new oil pipelines were built and put into operation: at the end of 1997, and the oil began to be exported to the Black Sea via the Baku-Novo-Rossiysk pipeline with a length of 1330 km. In 1999, an oil pipeline was laid and put into operation from Baku to the Black Sea port of Supsa with a length of 833 km. In 2002, the foundation was laid for the main export oil pipeline Baku-Tbilisi-Ceyhan with a length of 768 km, the construction of which was an essential step towards turning



Azerbaijan into an energy corridor.<sup>4</sup>

<sup>3</sup> State Statistical Committee of Azerbaijan, 2019

The total length of the constructed oil pipelines is one-tenth of the Earth's equator. On May 25, 2005, the opening ceremony of the Baku-Tbilisi-Ceyhan oil pipeline took place; in 2006, the transportation of Azerbaijani oil from the Turkish port of Ceyhan began.

Diagram 2. Oil production in Azerbaijan, mln. tons:

Source: [http://anl.az/el/i/ia\\_nqsi.pdf](http://anl.az/el/i/ia_nqsi.pdf)

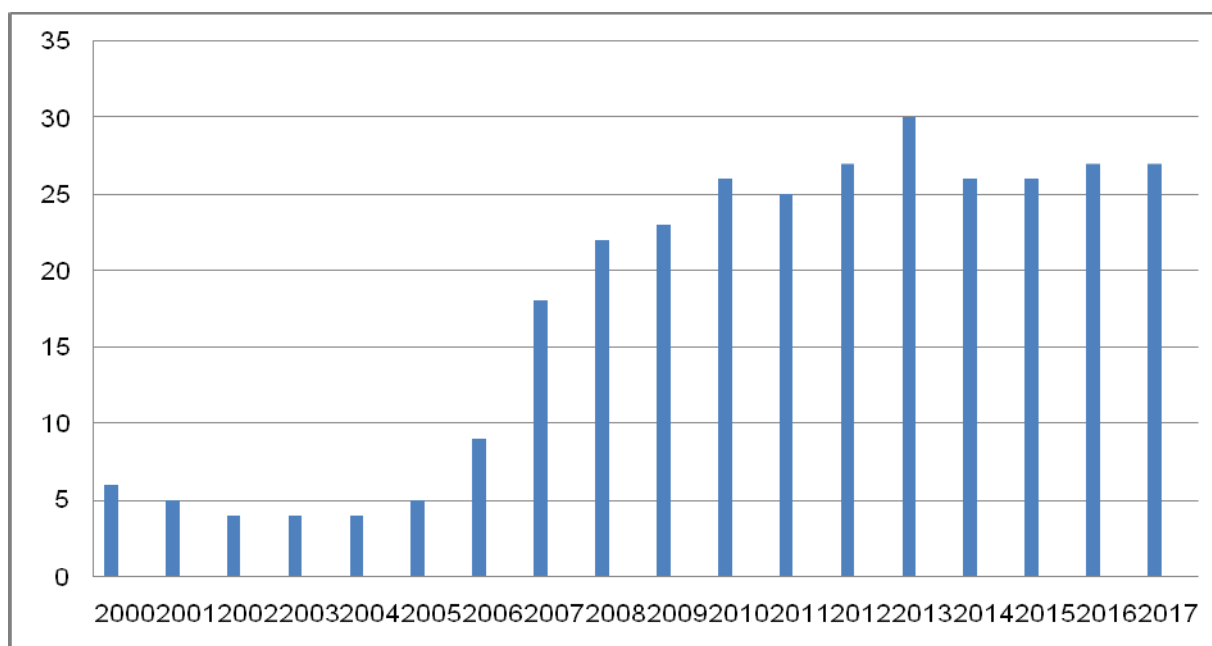


Diagram 3. Gas production in Azerbaijan, billion cubic meters:

Source: [http://anl.az/el/i/ia\\_nqsi.pdf](http://anl.az/el/i/ia_nqsi.pdf)

Gas output in the Shahdaniz-2, Absheron, and Umid fields is projected to increase. Previously, the “Contract of the Century” deal opened the way for the negotiation of nearly 30 deals with 41 oil firms from 19 nations. The “Contract of the Century” is one of the world's most significant deals, both in regards to hydrocarbon deposits and financing. As per the signed oil agreements, \$ 57.6 billion of the \$ 64 billion budget for the growth of Azerbaijan's oil sector was geared toward the development of offshore fields and production work in promising frameworks.<sup>5</sup>

**Features of digital transformation in the oil and gas industry.** We should consider the digital transformation features of Azerbaijan's oil and gas companies.

1. High dependence on imported technologies and an unstable geopolitical situation cause an increase in the negative impact of sanctions risks on companies' strategic directions in the oil and gas sector. To minimize sanctions risks, oil and gas companies switch to domestic developments and import-independent equipment.

2. Depletion of proven reserves in traditional mining regions and aging infrastructure entail a drop in productivity and an increase in resource constraints. The need to develop hard-to-recover hydrocarbon reserves (low-debit wells, deep-water shelf, etc.) requires the use of high-tech solutions at all stages of project implementation.

3. Optimization of traditional processes reduces costs in all areas of production activities of oil and gas companies, from exploration and production to the sale of petroleum products. For these purposes, companies are introducing digital technologies to solve two main tasks: firstly, to optimize production (increase oil recovery) and, secondly, to reduce the number of failures of various equipment and, as a result, operating costs.

4. High volatility of world prices for hydrocarbons affects the revision of strategic development plans towards optimal investment management.

<sup>4</sup> Agaheydar I. (2005). Baku oil industry. Baku, p. 88

<sup>5</sup> Aliyev I., Muradverdiyev A. (2007). "Azerbaijani oil in world politics" multivolume. 2nd volume. "Azerbaijan" publishing house.

5. New technologies are evolving exponentially and drive the transition from traditional business models to new ones based on digital ones. A modern digital enterprise should focus on asset management (service function).

Combining the traditional baggage of experience, skills, and knowledge with innovative solutions based on modern information technologies can provide a colossal synergistic effect.

The introduction of information technologies into a business requires a large set of problems. It is the collection, transmission, storage, access, processing, interpretation, and protection of a massive amount of data, making management decisions based on them, and control over their execution.<sup>6</sup>

The state of the world economy and its segments will largely depend on how successfully the tasks of transferring, storing, processing, using, and protecting data will be solved.

Over the past decade, global productivity (measured as labor productivity or total factor productivity) has remained stagnant, despite exponential growth in technological progress and innovation investment.

The focus on continuous improvement in oil and gas companies' productivity and productivity forces companies to focus on innovation trends and the potential for their exploitation.

**Global trends and innovative solutions in the field of digital technologies in the oil and gas industry.** Digital technologies are a global innovation trend today. Currently, there are seven main digital trends (innovative areas):<sup>7</sup>

1. Advanced analytics and big data. Data and the information generated from it are the building blocks of many digitalization initiatives. The accumulated data becomes an asset of the company comparable to fixed assets or financial investments. Predictive analysis of large volumes of information, the development of technologies for collecting, storing, modeling, and visualizing data can improve the efficiency of geological and technological processes and the processes of transportation, processing, and marketing of oil products.

2. Mobile and wearable devices (sensors, augmented reality glasses). In the field of exploration and production, all information about the development of the field is processed and displayed on employees' mobile devices in real-time. The project manager can see drilling and production progress on his tablet or mobile device, while the top manager can see business analytics. Mobility provides 24/7 control and quick management decisions. In the sales block, direct income for the company is achieved by optimizing logistics and reducing losses. The capabilities of mobile devices are also used to ensure industrial security, for example, to read the readings of various sensors and remote work.<sup>8</sup>

3. Industrial Internet of Things. Problematic climatic conditions and long distances necessitate constant monitoring of employees' safety. Also, almost all infrastructure and equipment in the oil and gas sector already today allow the rapid launch of new technologies. Modern equipment is equipped with various sensors, and large volumes of valuable information are collected during exploration, production, transportation, and marketing. Creating a single corporate IoT platform will allow you to get the most out of the Internet of Things shortly.

4. Cloud technologies. An oil and gas company's specifics include working with large amounts of data. Therefore, there is a need to ensure a unified information environment between structural divisions and the need for secure and joint access of company employees to various information services from anywhere in the world.

5. Block chain. As part of streamlining ordinary business processes, digitalization occurs, and each business process is being transformed into "data-driven processes." The use of block chain technology will ensure transparency of operations and save participants in transactions and transactions from many documents.

1. Block chain technology application:

- a) Inventory and Asset Management - Recording the status/origin of materials and inventories;
- b) transport and logistics - registration of the state when collecting information from sensors and sensors;
- c) trading and sales - registration and certification of property rights, trade financing; clearing-free trade; certification and traceability of the origin of goods;
- d) optimization of purchases and sales - optimization of suppliers' identification, signing of purchase contracts, audit, and tracking of transactions.

<sup>6</sup> Hajizade E.M., Abdullayev Z.S. (2017). The economic structure of the digitalization oil industry. Baku.

<sup>7</sup> Hajizade E.M., Abdullayev Z.S. (2017). The economic structure of the digitalization oil industry. Baku.

<sup>8</sup> Abdullayev Z. (2017) Economics and management of the oil industry. Textbook. Baku, p.123-124.

6. Artificial intelligence. Artificial neural networks are successfully used in solving geophysical and geotechnical problems. The use of neural networks reduces the cost of research, improves the quality of geological assessment, and facilitates the interpretation of underground layers' structure. Artificial intelligence allows you to process large amounts of various data, adapt to changing conditions, as well as generalize information, and self-learn.

The second area of artificial intelligence application is forecasting events in financial and commodity markets. The main effect of analytical methods based on artificial intelligence is that they accurately predict market participants' behavior and reflect the specifics of economic relations.

7. Robotization (robots and drones). In the oil and gas industry, operations are usually carried out in extreme climatic conditions and at long distances, requiring remote control. In the automation of an industrial enterprise due to the introduction of robotics, the maximum effect is achieved not from the automation of individual operations. Nevertheless, due to a complete restructuring of the entire process, from the beginning to the very end.

In the oil and gas industry, robots are used to inspect equipment and maintain technological infrastructure.

Modern digital trends are changing the way we do business. Digital technologies create unique opportunities for reengineering and optimization of business processes. It allows for cost savings throughout the value chain. Reducing and changing the structure of costs in the global economy's current macroeconomic conditions is especially important for oil and gas companies. Today, there is a real risk of replacing traditional business models with digital ones and the high level of digitalization in the modern world guarantees oil and gas companies' competitiveness.<sup>9</sup>

Digital data is a critical factor of production in all spheres of socio-economic activity, which increases the country's competitiveness, citizens' quality of life, and ensures economic growth and national sovereignty.

"Technological transformation" based on the digital economy can lead not only to an explosive growth in labor productivity, but also kill, on the other hand, entire professions, increase the risks of income polarization".

Unlocking the full potential of digital technology requires integrating the entire value chain.

Now there is more data and less time to get the most helpful material. A noticeable trend is developing and implementing predictive systems, intelligent "advisors" for data processing and interpretation.

The changes brought about by new information technologies affect every person's life.

Currently, data is becoming a new asset, and mainly due to their alternative value, that is, as data is used for new purposes and is used to implement new ideas.

Information modeling and focus on digital technologies make it possible to increase the efficiency of geological exploration, design, construction, and, accordingly, operational work.

By forming various information models of objects, management can accelerate the adoption of correct strategic management decisions. Based on Big Data analysis, oil and gas companies can increase production, optimize refining, logistics, and petroleum products sales. Specialists must be able to collect and analyze a large amount of data following the company's strategy.<sup>10</sup>

Big data helps oil and gas companies develop new kinds of integrated operations that take the industry to new levels of improvement and optimization.

Information can be a source of incredible value for a platform business, and under the proper management, companies use data to strengthen their competitive position in various ways.

Over the past few years, the cost of digital solutions has decreased several times. Now, various sensors are located everywhere, allowing constant control and monitoring of the current state of all oil and gas infrastructure facilities.

The accumulation and transmission of data over long distances is only the first stage in creating the "field of the future". The data must be appropriately processed, visualized, and interpreted.

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<sup>9</sup> Isayev A.S. (2018). Organization, planning and management of digital transformation in the oil and gas industry making. Baku, p.56

<sup>10</sup> Abdullayev Z. (2017) Economics and management of the oil industry. Textbook. Baku, p.123-124.

### Conclusion

In the oil and gas industry, new opportunities allow us to model new fields, improve work over and drilling efficiency, reduce energy costs, monitor remote fields with drones, analyze production yields, and set dynamic and local pricing.

It is essential to apply digital technologies in all business aspects: from making management decisions to implementation in processes, products, and services.

To move to a digital future, IT departments of oil and gas companies need to go through a transformation stage. The main changes concern the company's business strategy, working methods, and architecture.

Today, companies that can quickly implement new digital technology solutions are becoming leaders in the oil and gas industry.

In order for Azerbaijani oil and gas companies to become digital technology leaders in the industry, the author formulated the following proposals:

1. To improve efficiency, oil and gas companies need to develop and start implementing a digital transformation strategy, which should be based on three main areas: competencies, data, and business processes. Digital transformation creates additional competitive advantages for companies and strengthens their technological leadership in the oil and gas industry. They were using digital technologies at every stage of the production chain, from geological exploration and hydrocarbons production to processing, logistics, and sales of products to the end consumer. To develop a digital transformation strategy for vertically integrated companies, it is necessary:

- to develop an approach to a common understanding of the company's top-priority business priorities,
- to identify the main challenges and problems, to rank these tasks, and to prepare a feasible roadmap,
- to carry out activities aimed at digital - new business transformation with the obligatory involvement

of experts from production functions.

2. Digital transformation should become the basis for the transition from strategic goals to implementing a technological project portfolio that takes into account the digital transformation strategy and allows covering the entire value chain and increasing the efficiency of all business processes of the company.

3. For more efficient management of digital assets, oil companies should create specialized innovative incubators - "digital technology parks" - to develop competencies in developing and testing digital solutions to stably functioning services and services.

4. For a systemic and integrated approach to project management, it is proposed to create a single (corporate) project management center - a single digital and organizational space to implement the enterprise project portfolio.

The main tasks of oil and gas companies should be to create a unified system of digital projects to increase the operational efficiency of all business processes dramatically.

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