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IMPACT OF DIGITAL TWIN TECHNOLOGY ON THE FINANCIAL PERFORMANCE OF CORPORATIONS

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Abstract

Nowadays this research is gaining relevance due to the digitalization of society, the development and implementation of innovative technologies. The fourth industrial revolution involves the digital transformation of industrial production, which consists not only in the use of innovative technologies, robotization of production, the use of machine methods, artificial intelligence, intelligent devices, but also in the development of modern management accounting methods capable of linking all production business processes as a whole. The digitalization of the national economy, with the need to use data protection, requires significant investments in national digital products and technologies. Further digitalization will lead to the need for total changes and infrastructure modernization in almost all areas of society. As a result, the introduction of digital technologies will lead to the need for digital transformation of processes and changes in business models, to a change in the demand for factors of production, and this, in turn, will entail a change in the structure and inter-industry interaction. The article explores the concept and technology of the digital twin of an organization, discusses the prospects for digital transformation of corporations, the problems and risks that arise in this case, the key factors of using this technology for corporations operating in various sectors of the economy.

Keywords: Corporation, digital twin, efficiency, financial performance, production

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1. Introduction

The process of increasing digitalization of the economy over the past decades brings to the fore the technology of "digital twins". This technology is a software product that synthesizes a virtual prototype of a real object by collecting and analyzing initial data about a real object and processes. Also, digital twins allow you to simulate any situations of the technological and organizational process, in order to predict the development of the situation and take preventive measures. This mostly allows not only to prevent emergency and force majeure situations, but also to reduce production and management costs and to maximize the return on investment. This positive effect contributes to the growth of competitiveness and customer confidence. "Digital twins" in the modern world are becoming one of the key areas of digital transformation of production, including related industries, support and maintenance of the production process. The digital transformation of production requires changes in the enterprise management system.

2. Problem Statement

The production process and management of corporations should be structured in such a way that the use of operating assets is as efficient as possible, due to which the financial results of activities are in the optimal range, and the profit would be of maximum value. The corporate management process should be optimized in such a way that as little time as possible is allotted for making management decisions. For this, it is necessary to optimize the process of collecting information for the subsequent adoption of management decisions on the principle: "as accurately as possible, as quickly as possible". The existing control system of the process model in large corporations shows the irrationality of spending time and economic resources due to overlapping processes, duplicating functions, the lack of optimal control of sub-process models. By taking employees' time and slowing down the decision-making process, the existing system does not allow corporations to become more competitive and works to create a negative image. These factors, in turn, affect the financial results of corporations, thereby reducing profits. A review of the literature on this issue shows the absence of not only a single terminological base, but also a legal framework governing the mechanism of the process of creating and distributing an innovative product.

3. Research Questions

The following tasks were set for the study:

- to reveal the content of the concepts "digital twins" and "digital twins of organizations", to find out the similarities and differences in the use of terminology;
- to define the tasks of applying the technology "digital twin" in corporations;
- to identify the basic principles of building a "digital twin" of a corporation;
- to identify the main benefits of using digital twin technology for corporations and identify the associated risks;
- to consider foreign and Russian practices of introducing digital twins into the activities of industrial corporations;
- to formulate conclusions and forecast the development of this technology in Russia.

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4. Purpose of the Study

The aim of the research is to study the possibilities of using digital twin technology by industry corporations in Russia. Comparison of the expected result and the costs of the development and implementation of technologies will allow us to propose indicators for assessing their effectiveness. The paucity of existing domestic analytical reports and expert opinions confirms the need for a comprehensive study of the possibilities of introducing technology, the necessary resource base and forecasting the final results. The goal of introducing digital twins is to improve production processes that affect the financial results of industrial manufacturing corporations. It also seems necessary to study the experience of introducing digital twin technology from the standpoint of assessing financial efficiency. Digital twins can have an impact not only on the activities of industry corporations, but also on the growth of the national economy as a whole. The global goal is to find ways to ensure national competitiveness in this technology.

5. Research Methods

Theoretical and practical methods were used for the research. The analysis and generalization of scientific works of scientists on the research topic is carried out. The features of this technology have been identified, as well as risk factors have been identified and generalized by studying and generalizing the practical experience of implementing and using the technology of "digital twins" by leading foreign and Russian corporations. The prospects for the development and application of the technology of "digital twins" in Russia are determined by the method of scientific generalization of knowledge. An innovative approach is based on a combination of the following: in order to create a concept and model for corporations to use digital twin technology, to obtain financial results, and to align supply and demand over time for each specific production system, it is necessary to determine:

- conceptual process model;
- consistency for designing and managing the behavior of the production system;
- methods of process control; - methods of predictive analysis and calculations (Gallego-García et al., 2019).

The production system of corporations is considered under the production system within the framework of this research.

6. Findings

In a highly competitive environment, manufacturing companies are required to create customized, high quality products that are dynamic in terms of production volume and with shorter delivery times. The requirements of the modern market force companies to adapt their production processes using flexible, efficient process solutions, which leads to the need to develop new management and control systems that contribute to increased efficiency, reliability, responsiveness, while ensuring stable process stability and maintainability of production resources (Borangiu et al., 2019).

The digital transformation of the world economy is an accomplished process. Competition has shifted to the design stage, and in industrial production there is a digital transformation of business processes and models, and the key concept of digitalization of the industrial sector, with its robotization,

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the use of big data, the industrial Internet of things, artificial intelligence, are becoming “digital twins” (Technet-NTI, 2019).

Despite the popularity of the term “digital twin” in the information environment, the basic definition of the key concept of this technology, not to mention the legal framework and methodology of the regulatory mechanism, has not yet emerged. For example, according to Tadviser (2020), a “digital twin” is a complex software product that creates a virtual prototype of real production assets based on data using IoT sensors. RUSBASE believes that a "digital twin" is a complex software product that creates a virtual prototype of a real object, a group of objects or processes, based on data, for data analysis and performance evaluation, during the entire life cycle of a real object (RUSBASE, 2019). According to Dmitry Schwartz, a digital twin is a complex of digital technologies that use various methods of data analysis (RUSBASE, 2019).

In the version of the United Engine Corporation, the digital twin is a unified, learnable digital system that describes the operation of a product throughout the entire life cycle, from design to operation, based on complex methodologies and mathematical models (United engine corporation, 2020).

Summarizing the existing approaches to the interpretation of the term "digital twins", we formulate the following definition. A digital twin is an innovative software product that creates a virtual prototype of a real object, consisting of a real object / group of objects, technological and managerial processes, a base of initial data about the object for data analysis and performance evaluation throughout the entire life cycle of a real object.

Digital twins of a production system are a digital model of a real organization that combines the technological, economic, managerial, logistic and other processes of the corporation's operating cycle, which makes it possible to analyze the state of the processes, identify dependence, and accordingly improve the key performance indicators of the company.

The task of the "digital twin of a corporation" is the selection and adoption of management decisions at every stage of the business process. The use of digital twin technology in corporations will lead to significant reductions in transaction costs, optimization of investment activities, increased efficiency in the use and development of assets, and reduced operational risks.

Gartner (2017) predicts that by 2021 the efficiency of most industrial companies using digital twin technology will increase by 10%. Consider how the industrial Internet of Things, artificial intelligence, machine data processing and other advanced technologies can affect the activities of corporations. Reduction in operating costs is achieved by modeling organizational processes, and determining the most efficient way to conduct the process. Modeling market conditions, supply and demand based on the analysis of consumer behavior can help improve products, taking into account customer focus and, accordingly, lead to an increase in the competitiveness of products.

The ability to quickly analyze data affects the speed of making management decisions, which in general increases the flexibility of the organization and the ability to quickly respond to a changing environment. The main function of using digital twins in major corporations is to improve the technology of production processes. Through their counterparts, companies can identify bottlenecks in all components of production activities, and by modeling the situation, predict the likely outcome of decisions, thereby saving the organization's main resources, time and money.

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Despite the advantage of using "digital twins" by corporations, in order to increase the return on the introduction of new technologies, the top managers of the corporation, before making a decision, need to comprehensively work out the economic and process business model of the organization, taking into account the costs of developing a model, preparing or creating the necessary infrastructure. for its further service. To create a "digital twin" of an object (equipment, part, assembly), and build a template model, the data of a physical object needs to be digitized, but templates cannot exist to create a "digital twin" of a corporation, since each corporation is unique and requires an individual approach. Therefore, the models of "digital twins" for each corporation will be unique, but nevertheless, they should be based on a typical platform. To assess the possibilities of introducing digitalization on an industry or production scale, it is necessary to take into account the following factors: the presence of end-to-end inter-process integration of data and products; continuous information management based on the automation of the collection, processing and analysis of data; product lifecycle management; ensuring cybersecurity; predictive management of production and business processes; digitization of modeling objects and processes; automation of labor and processes, electronic document management; flexibility of corporate culture, interaction with remote employees of the branch system using Internet technologies (Pavlova, 2020).

As practice has shown, the most effective application of digital twin technology is for the products of those industries that have the following features: availability of highly qualified service (control, monitoring, maintenance); long duration of the product life cycle; typing of the equipment used; wide geography of operating conditions; inaccessibility of the product for maintenance.

This list of criteria meets the products of various industries - the fuel and energy complex (electric power, oil and gas, nuclear, etc.), aviation, transport systems (railway, automobile), production of medical equipment, industrial equipment and mechanical engineering (Tadviser, 2020).

The main resource for the "digital twin" of the corporation is the physical data of the object. The problem lies in the lack of practical skills and technical capabilities for most corporations to analyze data in order to make management decisions aimed at getting ahead of events. According to the research results by the Capgemini Research Institute "The data-driven enterprise: Why organizations must strengthen their data mastery", based on an analysis of the financial results of more than 700 organizations for 2019-2020, it was revealed that the financial performance of organizations using BigData technologies is significant. exceed the financial indicators of other organizations. In addition to significant productivity gains, these organizations recorded a 70% increase in revenue per employee, a 245% increase in capital productivity, and a 22% increase in profitability. Only in 23% of cases, organizations use data for a predictive approach (what may happen in the future), another part of organizations makes decisions based on that descriptive forecast (what happened in the past), or on a diagnostic approach (analysis of the reasons why it happened). Only 43% of surveyed organizations can monetize their data, and 39% are able to transform data analytics into competitive advantage (Capgemini Research Institute, 2020).

Those corporations that use innovations and technologies of "digital twins" will receive a significant advantage over the rest, at least in terms of profitability and profitability, and, accordingly, in operational efficiency and cost reduction. In addition to the advantages and benefits, the introduction of a digital twin entails the emergence of typical problems that do not depend on the scope of the corporation and the structural area: having a good IT infrastructure; good quality data is needed in sufficient quantity, data must

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be constantly updated; trust (from the point of view of the organization and from the point of view of the user) (Fuller et al., 2020). Due to the fact that with the introduction of a digital twin, a large amount of data is generated daily, it is necessary, before the start of implementation, to determine the ownership of this data and the procedure for its use in order to extract maximum profit from this data (Wanasinghe et al., 2020).

Like any innovative technology, digital twins attract the interest of cyber attackers, being attacked by them, in connection with which it is required to ensure data security and confidentiality at different levels of this technology (Al-Ali et al., 2020). In addition to those listed, three problematic tasks should be noted that are associated with ensuring the mobility of a corporation, and can entail significant financial costs:

1. Realization of effective empowerment of the digital twin. Due to the physical and obsolescence of fixed assets or the improvement of technologies, significant investments will be required in updating components, expanding them, or replacing them with other digital technologies. The higher the moral and technical wear and tear, the higher the cost of improvements.
2. The second concerns the potential social, ethical and political issues that arise from the use of digital forecasts.
3. Technical risks. The costs of downtime due to disruption to digital, intelligent infrastructure can be high. According to research, the number of losses can be up to $ 540,000 per hour due to a technical failure, or up to $ 647 billion per year (Parmar et al., 2020).

According to researchers, the development time and costs associated with creating a digital twin make this task difficult for many organizations. Often, authors of publication materials do not focus on the cost of developing a digital twin, which can be an obstacle to its implementation (Bickford et al., 2020).

To eliminate the possibility of significant financial costs for correcting technical errors that may arise due to giving a fundamental role to digital twins in the organization's work, it is necessary to provide the necessary level of support and maintenance of the infrastructure by highly qualified personnel.

The technology of "digital twins" is successfully applied in the practice of both foreign and domestic corporations in various manufacturing industries, while achieving significant results in saving costs, time, and financial resources (Table 1).

Table 1. Results of introducing digital twins technology into the activities of corporations

Name	Technology	Object	Result	Source
		Aircraft industry		
United engine corporation	Digital twin	Gas turbine engine	Reducing product development cycle time by 15-20%, increasing the accuracy of numerical modeling; reduction in design costs	https://www.uecrus.com/rus/presscenter/odk_news/?ELEMENT_ID=3251&sphrase_id=13018 U. Shmotin
General Electric Aviation	Airplane digital twins	Combining different data sources to improve defect detection rate and repair accuracy	Saving $125 million in 2016	http://www.eurasiancommission.org/ru/nae/news/Pages/10-08-2018-2.aspx

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Automotive industry				
AGAP: Avvocato Giovanni Agnelli Pkant	Maserati Ghibli, NX, TIA Portal, Tecnomatix, Tramcenter digital twins	Production optimization at the design stage based on virtual and real model data	Reducing development costs and time by 30%. Received 27 versions of the model in 13 colors and 205 configuration options. Time to market for the model was reduced by 14 months by reducing downtime and increasing throughput per vehicle by 3 times.	https://technet-nti.ru/article/ekspertno-analiticheskij-doklad-cifrovye-dvojniki-v-vysokotehnologichnoj-promyshlennosti Technet Assosiation
Oil and gas industry				
European refineries network	Schneider Electric predictive analytics system	Large compressor failure prevention 25 days before it happened	Several million dollars were saved by the company	https://rb.ru/longread/digital-twin/ T. Bocharnikova, Head of NetApp Representative Office in Russia and the CIS
Oil producing enterprises of ADNOC (Middle East)	Digital twin, predictive analytics, real-time visualization, a system for modeling various scenarios of the enterprise and various incidents. Energy Simulation and Optimization	Consolidation of 20 oil refining and oil production enterprises of ADNOC company into a single control center. Consolidation of the company's assets scattered throughout the Middle East. All processes are unified and brought to a single standard		https://rb.ru/longread/digital-twin/ N. Nielsen, Head of Business Development and Marketing in Industrial Automation department, Schneider Electric
Schneider Electric is implementing a project at the Yaya oil refinery	Digital twin, predictive analytics	A digital twin using a digital operator simulator, as well as safety and predictive analytics to help prevent emergencies.	Saving from 5 to 20% of capital costs	https://rb.ru/longread/digital-twin/ N. Nielsen, Head of Business Development and Marketing in Industrial Automation department, Schneider Electric
Gazprom Neft	Digital twins of wells, factories, production sites and fields	Testing hypotheses for field development, infrastructure construction and field operation without risks to people and facilities	High-quality planning and management	https://rb.ru/longread/digital-twin/
Petrochemical industry				
SIBUR	The digital twin of the engineering	Modeling of production processes, simulation models of	Reduced time and errors during	https://rb.ru/longread/digital-twin/

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	data management system	production and logistics	maintenance, repair and ordering parts	V. Chernatkin, Head of Complex Digital Models direction, SIBUR
Transport industry				
SIBUR	Digital twins	Railway transport optimization project	Reduce repair costs, identify dual operations in rolling stock management and more efficiently manage shipments	https://rb.ru/longread/digital-twin/
KAMAZ	Digital twins	3D models of 28 pieces of CNC machines and 20 universal machines, as well as more than 50 pieces of technological equipment (robots, manipulators, tilters, roller conveyors)	Cost reduction	https://rb.ru/longread/digital-twin/
Sapsan, Lastochka	Digital twins	Collection and transfer of gigabytes of data on the condition of components and the train itself. Predictive maintenance helps prevent equipment and component failures and carry out preventive maintenance	The operational availability of trains is 100%	https://atomicexpert.com/virtual_npp_rosatom D. Meller
JSCo "RZD"	Digital twins	Development of 130 software robots to automate routine processes of the main computing center of the holding	Labor productivity growth by 20%	https://www.gudok.ru/n

Source: authors.

7. Conclusion

According to 74% of experts, Russia lags behind the world level in mathematical modeling technologies and digital twins by 5-10 years. At the same time, it should be noted that these technologies are a priority for ensuring technological leadership and the entry of domestic companies into international markets (Technet-NTI, 2019). The analysis showed that, despite this, Russia has good potential for the formation of a national market and the implementation of the technology of "digital twins", especially among corporations engaged in the main manufacturing industries. Corporations, using modern technologies, using digitized information about assets and processes, both internal and external, modeling the interaction between various data sources, can achieve significant financial results, while saving up to 30% of costs, maintaining or improving product quality and efficiency of production processes. For the successful implementation of digital transformations, it is necessary to study and generalize the successful practice of implementing "digital twins" of both foreign and domestic corporate and industry ecosystems of digital twins. For this, in our opinion, it is necessary to create a single center of competence, to determine

the basic principles of its functioning, the composition of the participants. Moreover, ensuring national competitiveness in this area cannot be achieved without creating a legislative and legal framework regulating the process and mechanism for implementing the technology of "digital twins".

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