Formation of a digital transformation system for the transport complex

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Abstract. The presented study is devoted to assessing the level of digital development of organizations and the formation of a digital transformation system for the transport complex. The digital transformation of the transport complex is considered in the framework of the concept of the cyclic sequence of the spread of basic technologies in the economy, in accordance with which the full-scale deployment of the “transport” technological structure is predicted within the framework of the third mega technological cycle in the middle of the 21st century. The study analyzed indicators reflecting the level of digital development of organizations, transport companies and the amount of data protection tools used. Because of the analysis, it was revealed that in general, organizations have a high share of digitalization, but they are significantly lower in organizations of the transport complex, while about a third of organizations do not use data protection technologies. The study proposed a model for providing digital transformation of the transport complex, containing the types of activities that should be involved in digital transformation, the potential used for digital transformation and tools for digital transformation of the transport complex. In conclusion, conclusions were drawn from the results of the study.

1. Introduction

In recent years, the issues of the transition of industrial complexes to innovative, digital and intelligent technologies in all areas of activity, which will ensure a qualitative transition to a new level of existence and development of activities, have been updated. On a global industrial scale, the stages of transition to a new development path are associated with the introduction of artificial intelligence in the production process, but in Russia, it is based on the need to ensure innovative and digital development. The production potential of Russia was created back in the Soviet period, which today is used almost unchanged and requires the speedy resolution of issues related to the introduction of new technologies in all areas of activity.

The transport complex was also created in the Soviet period, namely during this period transport routes were built, new modes of transport were created, the main transport hubs were built and a large number of transport infrastructure was created. However, during the formation of these types of activities, the task was solved to ensure the transportation of goods and passengers in order to reduce operating and capital costs. To date, the indicated infrastructure and modes of transport do not always meet modern requirements for environmental safety, trends in innovative and digital development [1].
The significance of the study of the laws of digitalization of the transport complex is theoretically justified in the concept of the industry sequence of the spread of basic technologies. In accordance with this concept, each industrial revolution is a mega-technological cycle, consisting of three technological structures that cyclically replace each other - production, transport, and information and communication. The latter plays the role of a transitional link between the industrial revolutions, preparing the mass renewal of production assets in industry and transport.

In the middle of the XIX century, within the framework of the first megacycle, a transport system based on a steam engine developed - steamboats, steam locomotives. In the middle of the twentieth century, based on advances in basic technologies of electricity and an internal combustion engine, the transport system in the form of motor vehicles, electric trains, and aviation received an impetus for growth [2].

Finally, in our time, in the process of deploying the technologies of the fourth industrial revolution in the field of production (digitalization of the manufacturing industry), a technological basis is being prepared for the future transport system, which will enter a phase of rapid growth in the middle of the 21st century. We give it the conditional name "seventh transport technological structure." The fundamental technological basis for it will be well-established developments in the field of the Internet of things, artificial intelligence.

At present, we are already seeing the first breakthrough pioneer developments that are in the phases of a pilot test or first commercial application. In the field of automobile transport, the massive use of “drones” will continue. Very promising in the near future will look and investments in the production of individual vehicles: electric scooters, electric street etc.

In the field of air transport, drones already have a number of important functions: monitoring weather conditions and territories, quickly delivering the necessary cargo, conducting military operations without the need to include human units, etc. However, it is not too long now, when, probably, everyday use will become a reality passenger drones [3-5].

In the field of railway transport, a shift to magnetic repulsion technologies is planned to increase the composition and ensure the movement of the train. Deep technological modernization of rail transport is already taking place in line with the digitalization of its basic technical content.

Finally, low-pressure technologies can become a revolutionary breakthrough based on the use of new physical principles in the field of transport - Hyperloop is the fifth mode of transport after a train, plane, car and ship.

In all areas of activity there is a gradual process of introducing innovative technologies, issues are being considered to create new technologies for production activities and introduce stand-alone devices for managing various processes in enterprises and organizations [6]. The transport complex is also subject to transformation, as a result of which various digital devices for tracking goods and modes of transport are introduced, technologies in the field of intelligent control of transport systems are developed, new modes of transport are created, and much more. At the same time, not all activities of the transport industry have undergone digital development, which is why, we believe, it is necessary to assess the level of digital transformation of the transport complex and form a system of digital and intellectual transition of the transport complex to a new development path.

2. Materials and methods
The purpose of this study is the formation of a digital transformation system for the transport complex. The following tasks were set in the work:

- Assess the level of digital transformation of organizations and the transport complex;
- Form a digital transformation system for the transport complex.

The study used common methods and approaches that made it possible to reveal the purpose of the study, and information published in open sources and on the Internet were used as a statistical base.
3. Results
The digital transformation in Russia began after 2016, when regulatory acts were adopted aimed at ensuring the transition of all areas of activity, including the state apparatus, to innovative and digital technologies. Similar requirements are contained in industry documents and corporate development programs, which are aimed at improving the efficiency of production activities, reducing operating and capital costs, improving the quality of products, reducing negative environmental impact, and much more [7].

Digital transformation is aimed at improving the quality of managerial decisions, monitoring production activities, reducing human participation in production, ensuring remote management, collection, processing, accumulation and storage of various information. In general, for an objective determination of the level of digital development, it is necessary to analyze organizations that use information technology and information and telecommunication networks in their activities (figure 1) [8].

![Figure 1. Organizations using information technology and information and telecommunication networks, as a percentage of the total number of organizations.](image)

From the presented figure it can be seen that over the considered period of time, all indicators for information and telecommunication technologies increase. At the same time, it can be noted that almost all organizations use personal computers, the Internet and e-mail, but only half of the organizations use servers, local area networks and websites.

Next, we consider the volume of use of information technology and information and telecommunication networks in the field of "transport and storage" (figure 2) [8].
The figure shows that 83.5% of organizations use the Internet, 71.9% of transport companies use local area networks, about 58% use servers and electronic data exchange, and less than a third of organizations use websites and cloud servers. Thus, we can conclude that the level of digital development in the transport sector is lower than in the economy as a whole.

Consider the number of organizations in the transport complex that use information security tools (figure 3) [8].

The presented graph shows that, in general, the transport complex uses technologies to protect information and data, however, we see that about a third of organizations do not use such means of protection.

Thus, the analysis showed that the digitalization level of the transport complex is lower than the average for all economic organizations. Of course, this situation indicates the need to create a system for digital transformation of the transport complex, which would include measures to introduce common information technologies in production and organizational activities, activities aimed at
collecting, processing, accumulating and storing data, as well as protecting them from external interventions and impacts [9-11].

4. Discussion
The formation of a digital transformation system for the transport complex should be based on a set of measures that will ensure a high-quality transition of the industry to new technologies. Among the main areas providing digital transformation, it is advisable to provide for the following activities [12-15]:

- The development of Internet of things technologies in order to ensure continuous interaction of various types of activities within the framework of a single transport and logistics system;
- Implementation of the “intelligent transport” system, which will allow for intelligent decision making and management of the entire transport system;
- Development of an artificial intelligence system that allows to evaluate and control the functioning of the transport-logical system;
- Implementation of GPS - systems for all freight and passenger vehicles;
- Development of a system for protecting data, information and the safe digital functioning of the transport complex.

To implement the tasks set, it is necessary to propose a model that will allow achieving the goals and objectives of the digital transformation of the transport complex (figure 4) [16-19].

Figure 4. A model for providing digital transformation of the transport complex.

The presented model for ensuring the digital transformation of the transport complex should contain:

- Activities that should be digitalized;
- The necessary potential that will enable the digital transformation;
- Tools that enable digital transformation.
Thus, we can conclude that the activities in the field of digital transformation of the transport complex should contain the necessary potential for its implementation and the tools by which the digital transformation process will be carried out.

5. Conclusion
Thus, in the framework of the presented study, we analyzed the indicators of the level of digital development of economic organizations, the level of digital development of organizations of the transport complex, and the volumes of information protection tools used in the transport industry. Data analysis showed that the level of digital development of economic organizations is at a high level, and in the transport sector, these indicators are much lower, while it was revealed that one third of organizations in the transport industry do not use information security tools. In order to ensure further digital transformation of the transport complex, a model was proposed that reflects the types of activities subject to digital transformation, the presence of the necessary potential and the tools by which digital transformation is carried out. The model presented in the study should ensure a high-quality transition of the transport complex to a digital and innovative development path.

Acknowledgments
The article was prepared as part of the fundamental research work “Cyclical development of world economic structures” according to the state order of the Financial University under the Government of the Russian Federation for 2019-2021.

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