System and engineering solutions in the field of digital transformation of the transport sector

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Abstract. Within the framework of the presented study, the existing possibilities of digital transformation of the transport complex are analyzed. The study identified factors that ensure the transition to the “digital”, challenges that may affect the digital transformation and the respondents’ opinion about the responsibility for the development of digital platforms in the transport industry. The obtained results of the study allowed the authors to formulate recommendations on the development of areas of activity in the transport industry, as well as present a factor model that ensures the formation of a system and engineering solutions in the field of digital transformation of the transport complex. The presented model contains factors combined into groups, the management of which will ensure a high-quality transition of the transport complex to digital technologies. At the end of the study, conclusions are drawn from the results of the work done.

1. Introduction

The transport complex is annually subject to the influence of various factors and disturbances, which negatively affect the transport and logistics systems and the processes of its functioning, are constantly complicated. The process of development of transport systems occurs only with the combined development of related activities, for example, with an increase in the volume of transfer and transportation of goods, the development of technical, technological and innovative solutions in the transport and logistics fields of activity and other industries, the emergence of innovative and digital technologies, etc [1-2]. Experts identify five main factors that affect the transport and logistics industry - this is the process of transition to digital technology, a change in international trade, technological and organizational processes in connection with the introduction of new software and information support, processes in connection with the implementation of innovative and digital technologies and equipment and volume of the domestic market [3-4].

Today, in the practice of digital transformation of industries and the transport industry, there are areas that should ensure the transition to digital technologies - these are [5-7]:
• Sustainable and developing state policy in the field of introducing innovative and digital technologies, information technologies into the functioning of industrial entities, ensuring cyber security and more;
• Use of digital technologies of responsible and foreign production for all major and auxiliary types of activities;
• Development of a digital framework for the digital transformation of industrial and transport industries, which should include an assessment of the level of preparedness of the company and areas of activity for digital transformation, preparation of plans and engineering solutions in the field of transition to digital technologies;
• Non-digital factors that affect the digital transformation of industry and the transport sector;
• Human capital for the digital economy, within the framework of which it is possible to highlight the presence of appropriate personnel in the transport sector, educational and scientific organizations, the creation of unified educational platforms in the field of digital literacy.

Thus, the system of the presented directions can provide a digital transformation of the transport complex, but at the state and industrial levels there is no necessary potential that would provide the necessary digital development of the transport and logistics system.

2. Materials and methods
The purpose of the study is to develop a system and engineering solutions to ensure the digital transformation of the transport complex. The objectives of the study were formed as follows:

• Analyze the existing factors and challenges of the transport complex that can provide digital transformation;
• To propose engineering solutions and a factor model those ensure the transition to the "digit" of the transport system.

The information base of the work was information from various industrial and consulting agencies, because of which the factors and challenges of the transport industry were identified. In the study, scientific methods and approaches were used that made it possible to achieve the solution of the set goal and objectives of the study.

3. Results
The fourth industrial revolution was marked by the transition to a qualitatively new technology - the development and implementation of artificial intelligence, the Internet of things, unmanned vehicles, biotechnology, nanotechnology, information and communication and other technologies. Of course, such a qualitative restructuring requires a significant change in the established ways of functioning and development of state and corporate structures, as well as the development of a new program for the existence of spheres of activity and industries. The transport complex plays an important role, since it is a driver for the development of other types of activities and, in fact, is a system-forming complex of the national economy [8-10]. At the same time, it should be noted that according to the World Economic Forum, Russia is in 64th place out of 144 countries in the development of transport infrastructure, which indicates a significant lag in the transport complex in terms of technical and technological characteristics and the quality of services provided [11].

At the same time, today the digitalization process has already been launched at the state and corporate levels, the necessary regulatory documents and plans have been adopted, however, there are challenges to the digital transformation of the transport complex, among which are [5-7]:

• Lack of programs, activities and mechanisms that will achieve the goals and objectives set in the plans;
Experts note that it is necessary to provide a gradual solution to these challenges, as well as the development of a system and engineering solutions that will allow comprehensively solving these problems and reaching a new path to digital transformation. In addition, a survey was conducted by the expert community, in which the question was raised about the responsible entity for the development of a unified information platform for container transportation in Russia (figure 1) [5-7].

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![Figure 1](image.png)

**Figure 1.** Who should take responsibility for the development of a unified information platform for container transportation in Russia?

The figure shows that more than 78% of respondents believe that the state should develop a unified information platform, and other market monopolists (about 16%). Of course, the answers are distributed in such a way that the development and implementation of any engineering solutions requires capital and operating costs, while other participants in the transport industry can address certain local issues.

Therefore, the analysis showed that the digital transformation of the transport complex is possible; however, it is necessary to solve a number of issues that hinder the effective and high-quality transition of transport and logistics systems to a new development path [12-15].

4. Discussion

At this stage, it is advisable to develop new types of activities in the areas of activity and industries that are related to the development of engineering solutions in the field of increasing various areas of
activity of the transport and logistics complex. Among the main events, we highlight the following areas [5-7]:

- Robotization of supply chain processes, storage facilities, storage facilities and transport infrastructure, which will include the whole range of activities from product quality assessment to product transportation to the final retail consumer;
- The introduction of electric transport, including the complete transition of railway and urban transport, as well as electric vehicles, which reduce the cost of fuel consumption and greenhouse gas emissions from vehicles;
- The use of augmented and mixed reality technologies, which will improve the efficiency of the transport complex;
- Creation of the infrastructure of a high-speed railway with the aim of improving the quality of the services provided and the creation of new transport corridors in Russia and other neighboring states;
- Development of delivery at the “last mile” site using modern technical devices - drones, robots, electric vehicles, etc.

Thus, in the transport industry there are areas for digital transformation, using the potential of the transport complex will ensure a qualitative and quantitative transition to a new path of functioning and development. At the same time, for digital transformation, it is advisable to provide for a number of measures that will allow the transport complex to provide effective management of factors affecting the transport and logistics complex (figure 2) [5-7; 16-20].

![Factor model of digital transformation of the transport complex.](image)

It can be seen from the presented figure that the digital transformation of the transport complex can be achieved by managing the presented factors, which include separate areas of activity, the study of which will allow the formation of programs and engineering solutions that allow for a qualitative and quantitative transition of the transport complex to digital and innovative technologies [21-22].
5. Conclusion
Thus, the study showed that the digital transformation of the transport complex is possible, but at the same time, the industry is subject to a number of factors that can ensure the transition to the "digital", as well as challenges that negatively affect the functioning of the system and the development of the transport and logistics system. The survey showed that respondents are hoping for the state in the field of creating the necessary tools for digital transformation. The study also proposed measures for which the transformation of the transport complex should take place in the near future, as well as a factor model containing groups of factors that could be used to achieve the set industrial goals and objectives in the field of digital transformation.

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