

# Digitalization of The Transport Industry in The Context of Globalization of The World Economy

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## **Abstract.**

**Research background:** The article reveals the nature and mechanisms of the influence of the digital economy on the development of the transport industry in the world. The prerequisites for researching the problems of digitalization in the transport sector are determined by several factors. Firstly, the use of digital technologies is especially evident in the transport sector. Secondly, it is the efficiency of using the latest technological achievements that determines the competitiveness of transport companies.

**Purpose of the article:** The aim of the study of this topic is to identify the most significant manifestations of the impact of digitalization on the transport sector, trends and the nature of this impact.

**Methods:** The methodology of the work is to use the method of scientific abstraction, analysis of facts and observation of the real existing picture, as well as induction and deduction to determine the relationship of concepts in general to individual cases. The authors of the study identified the key components of the digitalization process of the economy, and identified those that have the greatest impact on the transport sector. The article contains an analysis of the existing experience of transport digitalization, the consequences of this process. Also in this article, the authors made their forecast for the further development of transport digitalization processes.

**Findings & Value added:** The main result of the study was the conclusion that the objective need of the transport industry for new innovative developments is very high. The economic effect, that the introduction of transport sector digital technologies, brings, is obvious and tangible.

**Keywords:** *digital economy; digitalization; transport digitalization; digital technologies for the transport sector.*

**JEL Classification:** *L9*

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## 1 Introduction

In the knowledge economy, digitalization processes are recognized as one of the most significant manifestations of innovative and also scientific and technological development. At the same time, there are no unambiguous estimates of how large-scale the transformations of the economy will be due to digitalization, in what way and when they will manifest themselves. The transport sector was one of the first to experience the introduction of digital technologies: the objective need for automation of management, increases of the reliability of the transport system pushed transport companies to computerize management processes earlier than others, and then to digitalize the entire sphere [1].

In the scientific literature, there are several approaches to defining the essence of the digitalization process. In this work, the following approach is used as a basis: digitalization is a complex of processes in the economy and society, which consists in the massive dissemination of technologies based on the use of a binary code, which entails obvious qualitative changes in the organization of the technological and social order [2].

## 2 Materials and methods

The methodological basis for writing the article was the scientific understanding of digitalization as an economic phenomenon of such researchers as T.V. Avdienko, A.N. Dmitrievsky, T.N. Yudina, J.E. Grunig, A.J. Ritchie. Also, the article used the works of such scientists as N.P. Tereshina, V.P. Bychkova, V.I. Belova as a conceptual basis for understanding the technical and economic foundations of the transport sector.

The concept of digitalization itself is very broad, and without going into a discussion about all the manifestations of this process, we took as a basis the fact that in the transport sector, digitalization is a large-scale penetration of digital technologies, both at the management level and at the technological level [3].

A distinctive feature of digitalization in the transport sector is that it occurs unevenly in each direction, while the potential need for digitalization is great. It is the active use of digital technologies that seems to be the most promising way to increase the economic efficiency of this area. We can identify the most popular areas of using digital technologies for the needs of transport (Table 1).

The transport industry is one of the areas of economic activity that is most influenced by digitalization processes. This influence can be divided into obvious, superficial changes in this area and those that occur in the transport infrastructure itself. In the first case, we are talking about the penetration into the transport sector of those technologies that have been successfully tested in other areas: "big data", intellectualization processes [4].

Thus, intelligent transport systems (ITS) are the main trend in the technological development of the industry. In the second case, the digitalization of the transport sector implies a change in the very technical and economic foundations of production. At the moment, there are four key areas of the transport sector digitalization process:

- 1) digitalization of transport infrastructure and supply chains (including warehouse facilities and service centers);
- 2) robotization of production processes;
- 3) large-scale automation, including management processes;
- 4) the introduction of autopilot systems [6].

**Table 1.** Directions of application of digital technologies in the transport industry [5].

Direction of impact	Technology application example
Electronic document management	Introduction of electronic tickets, remote processing of travel documents; creation of "virtual offices", customer service without personal contact
Remote communication	Using digital communication technologies for live remote communication
Payment processing	Mobile payment, uniform travel documents, the use of mobile applications to obtain transport services
Cloud technologies	Data processing at a qualitatively new level: collection and analysis of data on traffic flows, the use of "bigdata" technologies
Integrated transport management systems	Reorganization of transport management systems, their automation; involvement of the client in the process of cargo management and control
Intelligent transport systems	Automation and robotization of traffic control, forecasting traffic conditions, support for autopilot systems
Logistics service platforms	Creation of digital platforms focused on the provision of logistics services, incl. booking and booking tickets, searching for a carrier for goods, identifying the optimal route

Let's consider these processes in more detail.

1) digitalization of transport infrastructure means that every stage in the supply chain, as well as a vehicle, must be involved in the digital sphere, that is, have personal identification on the Internet, and is also controlled by software. This allows you to manage the entire traffic flow in real time, reduce costs, non-core costs, and also make the transport sector more predictable. An example of such digitalization is equipping all sea containers with chips, tracking the movement of each container;

2) the robotization of production processes in the transport sector is already happening at a very fast pace. However, the most labor-consuming components are warehousing (especially packing and picking of cargo), maintenance of vehicles still require extensive manual labor;

3) automation of management processes has been going on for a long time. Actually, it was the transport sector that was one of the first in which management processes began to be automated. The speed of modern traffic flows is such that a person, in principle, will not be able to make competent, well-thought-out decisions without the risk of a critical error;

4) the introduction of autopilot systems from a technological point of view has been going on for a long time: first of all, it concerns the autopilot for civil aircraft, sea freight transport. The massive introduction of these technologies in most countries is constrained by legislative restrictions. So, now only some experimental projects in public transport are in operation (unmanned buses, for example).

Digitalization as a trend in the technological development of the transport sector has been identified for a long time. In fact, we can talk about the fact that the penetration of digital technologies into the transport sector began with the emergence of electronic computers. During this period, a large number of different projects were implemented, both at the initiative of governments and private companies (Table 2).

It should be noted that the use of automated transport systems is still a controversial issue on which there is no consensus in society. The threats and risks that are indicated as a direct consequence of automation in transport include: 1) the immediate release of a large number of drivers who, in principle, will no longer be able to find a job by profession; 2) difficulties in determining the measure of responsibility in the event of an insured event; 3) the risk of software failure, and loss of control over the controlled vehicle.

**Table 2.** Examples of digitalization in the transport sector [7].

Technology example	Technology functions
SARTRE	The program to create passenger vehicles with a single remote control, bladeless for pedestrians and the environment
Open Shuttle	Interactive cargo picking system using automatic carts
Pick by light	Use of special indicator lights to facilitate the operation of robotic vehicles
Put by Beamer	Warehouse technology for receiving and distributing goods in automatic mode
Automated port complexes	Use of automated warehouse systems in seaports, primarily in container terminals

At the same time, the advantages of introducing such technologies are unambiguously recognized: 1) increasing the efficiency of the transport sector as such (reducing fuel costs, increasing road capacity, reducing accidents, reducing the number of people injured in transport accidents and the share of cargo damaged during transportation); 2) reducing the cost of wages for drivers and many employees, whose workplaces will be automated; 3) reduction of vehicle downtime; 4) elimination of the so-called. "Human factor", that is, the risk of human error [8].

One of the major trends is that artificial intelligence (AI) technology is becoming a general-purpose technology (GPT) for the transport. In addition, the person himself (including the layman) is becoming more and more "armed" with a variety of technologies, first of all, thanks to his smartphone. The presence of a mobile device for accessing the Internet, the massive distribution of such devices allows you to build a new way of interaction of the entire transport sector with users. The emergence of such a service as UBER and the followed term "uberization" has radically changed the fundamental principles of providing services in the transport sector.

Robotization in transport has its own specifics, which distinguishes this area from other areas of economic activity. So, robotization is often viewed as the production and use of some physical machines that are capable of imitating any human actions. However, in reality, autonomous systems cover a much wider range of areas. Robotics should be more correctly considered as the production and use of self-controlling adaptive intelligent systems that can perform their production functions regardless of the degree of human intervention. In the transport sector, robotization implies both the introduction of autonomous vehicles, and as the automation of production itself and the use of equipment that works without human intervention. It is customary to distinguish the following types of robotic technology used in the transport sector: 1) robots operating in the human environment; 2) robotic production systems that do not require human intervention; 3) autonomous vehicles [9].

So, speaking about specific examples, it should be said that autonomous systems have been used for a long time at service stations (both road and rail). In the future, the accumulated experience will make it possible to expand the practice of using such technologies to all constituent parts of the transport sector (including with the increasing involvement of AI technologies in this process).

For example, in railway transport, automated autonomous systems can be used to monitor the condition of rails. This reduces the risk and does not require the involvement of additional workers, moreover, control work can be carried out at any time of the day with the same efficiency. It is on the railway that the most favorable conditions already exist for the introduction of robotic systems. With their help, you can carry out routine maintenance (cleaning, distributing salt, strengthening the embankment). At such autonomous stations, it

is very convenient to place scanning devices and other equipment for testing the track, rail and track infrastructure [10].

A separate issue is the use of drones (hereinafter - unmanned aerial vehicles). Although the legal basis for the use of atomic flying vehicles in most countries has not yet been created (or the use of such devices is simply limited), the potential for their application for transport needs is very great. Drones can be used for aerial photography, as well as constant monitoring and cargo escorting. With the power of drones growing steadily (in every respect), it will soon be possible to use these devices to transport people and goods to remote areas. "Swarming robots", that is, the simultaneous use of a large number of drones controlled by one operator (or one AI), in principle, allows for repair work. At this stage, drones are mostly used for external surveillance. For example, in Germany, patrol drones are used to monitor sections of the railway in order to identify violators of the regime and vandals. Of course, the potential of drones is such that soon they themselves will be able to become a new type of transport [11-13].

The practical benefits of using new digital technologies (both drones and robotic suits for workers - exoskeleton) make it possible to solve more pressing and significant problems. With the help of such devices, it is possible for workers to perform more difficult tasks, reduce health damage from work in difficult conditions (work on high-voltage lines, work in hazardous conditions, when laying tunnels, etc.).

Reducing the level of criminalization and the risk of crime in transport. Technologies for face recognition and remote identification of a person allow creating complete safety zones around key transport facilities. Such approaches can already be found at international airports: ubiquitous video filming, the use of drones, as well as the existence of a unified information system that operates on the information received, makes it possible to identify almost every person in a crowd of passengers. This will allow not only to reduce the level of potential threat at transport facilities, but also to solve more trivial tasks: to track unscrupulous passengers who damage property, for example.

### **3 Research results and their discussion**

The processes of robotization and the introduction of automatic systems in the transport sector are capable (according to their potential) to cover almost the entire transport sector, both logistics and working with customers. Principally, the potential of digital technologies is such that it makes it possible to create an autonomous rolling stock for all modes of transport. As far as can be judged at the moment, the entire port infrastructure can be automated: right now there are terminals (mainly for handling containers) in many ports of the world, that can function without human intervention at all. That is, all the constituent components of the supply chain (convergence of information flows, control) can be carried out using automatic systems. Although, according to the general opinion of market participants, the creation of fully autonomous (deserted) sea vessels is still very far away, we can already talk about the potential of organizing a "virtual logistician" - a program that has all the necessary qualities to organize the work of transport hubs.

In the Russian Federation, the digitalization processes did not go unnoticed by either government bodies or the private sector. Thus, the country is implementing a number of measures aimed at preparing the economy and society for digitalization processes. The Strategy for the Development of the Information Society in the Russian Federation for 2017-2030 is in force. In it, among other things, digital technologies are considered as a component of the global leadership of Russian companies. Specific measures that should contribute to the spread of digital technologies are: regulatory regulation (it should correspond to the realities that have arisen with the spread of digital technologies), training of relevant personnel and, in general, the reorganization of the education system in the

country, the development of the scientific and technical sphere. Actually, the state in such a situation can also contribute to the penetration of digital technologies, contributing to the development of infrastructure and protecting the rights of citizens to information security [14].

In the process of digitalization of the economy, information digital platforms (PPIs) play an important role. The purpose of such structures is to integrate all participants in the value chain, as well as communication channels, distribution paths, and a community of potential customers. The current scale of digital platforms is such that they can cover entire sectors of the economy. Actually, there are many examples of such digital platforms, especially in e-commerce. However, one can expect that such technologies will be increasingly used in the transport sector.

Actually, digital platforms are already used in the transport sector, although they are not yet as versatile as electronic platforms. So, in logistics, specialized local digital platforms are used to plan the transportation process, as well as to organize cooperation between various modes of transport and logistics centers. Digital platforms help coordinate the handling of goods in warehouses, establish communication with the end user. Digital platforms in the transport sector encompass all intermediary functions. With the help of platforms, the end user can directly establish contact with the supplier, and the platform will provide him with all the necessary tools for managing the movement of goods. In other words, this type of digital platform is able to integrate all logistics and other processes into a single system, connect consumers and manufacturers, and also take control of all additional functions.

At the same time, the digitalization of the logistics sector is also a challenge. The digitalization process can change the market in such a way that all its participants face the most serious challenges. The most significant of these can be described as the emergence of a market learned by just one monopolist: we are talking about a market model that is commonly called "winner takes all." That is, integration in each market segment reaches the point beyond which - the emergence of one, very large monopolist. This can be seen in the e-commerce market - Amazon, for example. With the emergence of such a monopolist, all other participants become very dependent on the market leader. Similar processes can be observed in the transport sector: logistics companies are increasingly dependent on the e-commerce sector (Internet exchanges, Internet shops) [15].

According to the majority of scientists dealing with this issue, in the future the delivery of goods (and, moreover, absolutely all goods) will be carried out directly from the warehouse (which will belong to the largest online store) to the client, bypassing the retail network. Convenience stores will be replaced with pick-up points for pre-ordered goods. At the same time, one more very important thing happens: Internet shops, along with the goods, also sell a delivery service. That is, soon there will be only lumps on the logistics services market [16-20].

## 4 Conclusions

Thus, it can be argued that digitalization is the dominant process in the transport sector among all manifestations of scientific and technological progress. In addition, digitalization processes themselves are happening much faster than previous technological revolutions. As a result, the end result of these transformations is difficult to predict. However, there are two most essential components. On the one hand, the effective use of digital technologies in the transport sector determines the level of the company's competitiveness. Those who ignore current changes risk leaving the market. On the other hand, it is the digitalization processes that are the source of increased risks: both in the context of economic development and in the context of social progress.

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