DIGITAL ECONOMY AND ITS IMPACT ON THE DEVELOPMENT OF DIGITALIZATION OF THE TRANSPORT INDUSTRY IN THE WORLD

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Abstract: This article examines the impact of digitalization processes on Uzbekistan's transport sector, focusing on the implementation of automation technologies, intelligent transport systems, robotics, and digital platforms. The study highlights how digital transformation encompasses all levels of transport infrastructure — from management and logistics to maintenance and customer interaction. Special attention is given to the prospects and challenges of introducing autonomous systems, drones, and AI, as well as the risk of market monopolization. The article concludes that a proper regulatory framework is essential to ensure sustainable and equitable development of the industry.

Keywords: digitalization, transport sector, automation, intelligent systems, robotics, logistics platforms, artificial intelligence.

Introduction

Uzbekistan, as an active participant in the global economy, is also aware of the importance of digitalization processes in the transport sector. The introduction

of digital technologies in this industry is of strategic importance for the modern development of the country. However, there is still no unambiguous assessment of the potential transformations that may occur in the Uzbek economy as a result of digitalization, and there is also no clear understanding of how and in what time frame these transformations will manifest themselves.

Uzbekistan's transport sector was one of the first to feel the impact of digital technologies. The need to automate management and improve the reliability of the transport system has prompted transport companies to strive for computerization of management processes before other industries, and then expand digitalization to the entire transport sector [2].

There are several approaches to the definition of digitalization in the scientific literature. The following approach is used in this work: digitalization is a complex of processes in the economy and society based on the widespread use of technologies using binary code. As a result of this digital transformation, there are noticeable qualitative changes in the organization of technological and social structures [8].

Materials and methods. In this article, the methodological basis was the scientific research of such scientists as T.V. Avdienko, A.N. Dmitrievsky, T.N. Yudina, J.E.Grunig, A.J.Ritchie, F.A.Abdulloeva, B.M.Karimov, B.S.Alimov, T.U. Kodirov who consider digitalization as an economic phenomenon. In addition, the works of N.P. Tereshin, V.P. Bychkov and V.I. Belov were used as a conceptual basis for understanding the technical and economic foundations of the transport sector. The very concept of digitalization has a wide range of meanings, and without delving into the discussion about all its manifestations, we took into account the fact that in the context of the transport sector, digitalization is a large-scale introduction of digital technologies both at the management level and at the technological level [5].

One of the characteristic features of digitalization in the transport sector is its uneven development in various directions, despite the significant potential need for

digitalization. The active use of digital technologies seems to be the most promising way to increase the economic efficiency of this area. Table 1 shows the most common areas of application of digital technologies in transport.

Table 1.

The Directions of using digital technologies in the transport sector.

The direction of the impact	An example of the technology application
Electronic document management	Introduction of electronic tickets, remote registration of travel documents; creation of "virtual offices", customer service without personal contact
Remote communication	Using digital communication technologies for live remote communication
Making a payment	Mobile payment, unified travel documents, use of mobile applications to receive transport services
Cloud technologies	Data processing at a qualitatively new level: collection and analysis of data on traffic flows, the use of "big data" 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 flow control, forecasting of the transport situation, support for autopilot systems
Platforms for the provision of logistics services	Creation of digital platforms focused on the provision of logistics services, including booking and booking tickets, search for a carrier for goods, identification of the optimal route

Thus, digitalization in the transport sector is a heterogeneous process that can bring significant economic benefits.

Indeed, the transport industry is one of the most affected by the processes of digitalization in the economy. This impact can be divided into two main categories: superficial changes associated with the penetration of already successfully tested technologies into the transport sector, and changes occurring in the very technical and economic base of the transport infrastructure [11].

In the first case, digitalization of the transport sector means the introduction of technologies that are already successfully used in other industries, such as big data analysis and intellectualization processes. An example of such technologies is intelligent transport systems (ITS), which are the main trend of technological development in the industry. In the second case, digitalization of the transport sector involves changing the very technical and economic basis of production. Currently, there are four key areas of the digitalization process in the transport industry: 1) digitalization of transport infrastructure and logistics chains (including warehousing and service centers); 2) robotization of production processes; 3) large-scale automation, including management processes; 4) introduction of autopilot systems [14]. It will be better to analyze these processes in more detail:

Digitalization of transport infrastructure and logistics chains, including warehousing and service centers. This includes the introduction of digital technologies to optimize and improve management and coordination in the transport infrastructure.

These areas of digitalization have the potential to significantly improve efficiency, safety and management in the transportation industry. Digitalization of transport infrastructure includes the involvement of each stage of the logistics chain and vehicles in the digital sphere. This is achieved by assigning a personal identification to each element through an internet connection and software control. One example of such digitalization is the equipping of shipping containers with chips that allow you to track and control the movement of each container in real time. Thanks to this, it is possible to effectively manage the entire traffic flow,

predict and optimize logistics processes. The advantages of digitalization of transport infrastructure include:

Improved management: digital systems allow real-time tracking and control of the movement of goods and vehicles, which ensures more efficient and accurate management of logistics processes.

Cost reduction: Digital technologies make it possible to optimize routes, manage inventory and minimize downtime and delays, which leads to a reduction in overall costs in the transport sector.

Increased predictability: Thanks to digital control and data analysis, possible problems and delays can be predicted, which allows you to take preventive measures and improve planning and response to changes.

Improving security: digital systems can provide more accurate monitoring and control of the safety of vehicles and goods, as well as warn about potential risks and emergencies.

Digitalization of transport infrastructure has great potential for optimizing and improving logistics processes, which contributes to a more efficient and sustainable transport industry.

Robotization of production processes. This means using robots and automated systems to perform various tasks in the transportation industry, such as warehousing and moving goods, sorting and packaging.

In the transport sector, there is a significant acceleration of the process of robotization of production operations. However, progress in the field of automation is especially noticeable in the warehouse sector, where tasks related to packing and packing of cargo still require extensive use of manual labor. Technological innovations and the development of robotics contribute to the automation and optimization of processes inside warehouses. Robotic manipulators equipped with advanced algorithms and sensors are actively used to perform complex tasks such as sorting, packing and packing of cargo. The ability to automatically determine the size, shape and weight of objects allows robots to perform these operations

efficiently and accurately. It is worth noting that vehicle maintenance is still an area where manual labor prevails. Technical difficulties and the variety of vehicle models pose challenges for the full automation of this process. Interaction with various types of vehicles, their inspection, diagnosis and maintenance require human involvement and experience. However, even here we can observe a trend towards the introduction of automated systems. For example, modern technologies allow the use of robotic arms to perform certain vehicle maintenance tasks, such as wheel replacement, refueling and maintenance of rolling stock. This reduces the time and increases the efficiency of the maintenance process.

Thus, although the robotization of production processes in the transport sector is progressing rapidly, warehousing and vehicle maintenance remain labor-intensive components that require further development and innovation in the field of automation.

Large-scale automation, including management processes. Digital technologies make it possible to automate various management processes, such as personnel management, finance, logistics and other aspects of the work of transport companies.

Automation of management processes has been observed in the transport sector for a long time. In fact, the transport industry was one of the first to introduce automation into management activities. The rapid speed of modern traffic flows creates a situation in which a person is physically unable to make competent and informed decisions without the risk of making a critical mistake. With the development of information technology and transport management systems, including automatic control and management systems, decision-making processes have become significantly automated. Data collection and analysis systems, machine learning and artificial intelligence algorithms make it possible to effectively manage complex transport systems. Modern automated transport management systems monitor traffic flows, predict and optimize routes, analyze data on the condition of vehicles and ensure timely response to emerging

problems. They are able to process large amounts of information and make decisions based on accurate and up-to-date data, which reduces the likelihood of errors and improves the efficiency of transport system management.

Automation of management processes in the transport sector is an integral part of modern transport management. It allows you to cope with the high speed of traffic flows and ensure that competent decisions are made based on accurate information, minimizing the risks of critical errors.

Implementation of autopilot systems. The development of autonomous and semi-autonomous vehicles, including cars, trucks, trains and drones, is a significant aspect of the digitalization of the transport sector.

The introduction of autopilot systems from a technological perspective has been going on for a long time, primarily in the field of civil aviation and maritime cargo transport. However, the mass adoption of such technologies in most countries is limited by legislative norms. Currently, only some experimental projects in public transport are in operation, for example, unmanned buses. In aviation, autopilots have long been used to automate flights and ensure passenger safety. Autopilot systems are capable of performing a wide range of tasks, including controlling the height, speed and direction of the aircraft, as well as automatic landing. They are based on advanced algorithms and sensors, as well as interact with navigation systems, which allows for high accuracy and efficiency in flight control. In maritime transport, autopilot systems are also being used to automate the management of cargo ships. They are able to control the course, speed and maneuverability of the vessel, which simplifies the tasks of the crew and increases the safety of maritime transportation.

However, issues of legislative regulation and regulatory restrictions are becoming an obstacle to the mass implementation of autopilot systems in various modes of transport. Despite the potential benefits in terms of safety and efficiency, legislators are faced with the need to develop and establish strict rules and regulations to ensure the reliability and minimize the risks of automated systems.

At the moment, unmanned buses and other similar projects are at the stage of experiments and pilot programs in various countries. Such projects help to collect data, assess the benefits and possible risks, as well as build a legislative and regulatory framework for the future implementation of autopilot systems in public transport. The introduction of autopilot systems in various areas of transport already has a technological base, however, restrictions related to the legislative and regulatory sphere have so far hindered their mass application.

The results of the study and their discussion. Digitalization, as a phenomenon associated with the penetration of digital technologies into the transport sector, has been identified and studied for a long time. In fact, it can be argued that the beginning of the integration of digital technologies into the transport sector coincided with the advent of electronic computing devices. Over a long period, many projects have been implemented both at the level of government initiatives and at the level of private companies (see table 2).

Table 2.

Examples of digital technologies in the transport sector

Technology	Function
SARTRE	Creation of passenger vehicles with centralized remote control, ensuring safety for pedestrians and the environment
Open Shuttle	Interactive automatic cargo picking system using trolleys
Pick by light	The use of light pointers to simplify the operation of robotic vehicles
Put by Beamer	Automated technology for receiving and distributing goods in a warehouse
Automated port complexes	The use of automated storage systems in seaports, especially in container terminals

It is important to note that the digitalization of the transport sector has had a significant impact on its technological development. The projects implemented in this area included a wide range of innovative solutions and the use of advanced technologies. Such projects have not only increased the efficiency and reliability of transport systems, but also significantly improved conditions for passengers and cargo transportation.

It should be noted that the use of automated transport systems remains the subject of active discussions, and there is still no consensus in society on this issue. There are threats and risks that are considered to be the immediate consequences of automation in the transportation industry. These include:

• A possible massive increase in unemployment among drivers who may lose the opportunity to find a job in their profession.

• Difficulties in determining liability in the event of an insured event when automated vehicles are involved in an accident.

• The risk of software failures, which can lead to loss of control over the controlled vehicle.

Nevertheless, the introduction of such technologies also brings a number of clear advantages (fig. 1):

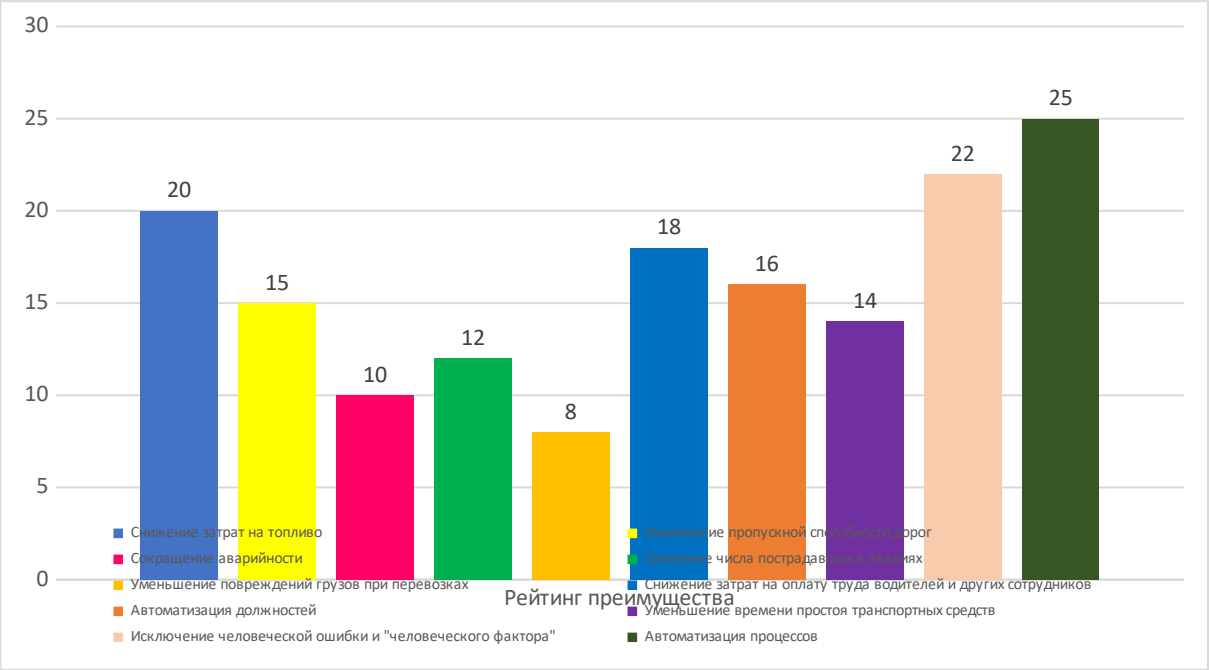
✓ Improving efficiency in the transport sector as a whole, which includes reducing fuel costs, increasing road capacity, reducing accidents, reducing the number of victims of accidents and reducing cargo damage during transportation.

✓ Reduction of labor costs for drivers and other employees whose positions will be automated.

✓ Reduction of vehicle downtime.

✓ Eliminating the possibility of human error, the so-called "human factor", through the use of automation.

Fig. 1. Rating of advantages of the introduction of digital technologies in the transport sector.



An important trend is that artificial intelligence (AI) is becoming a universal technology for transportation. In addition, people themselves, including ordinary citizens, are increasingly equipped with various technologies, mainly thanks to smartphones. Mobile devices and their widespread use make it possible to rethink the interaction of the transport sector with users. The emergence of services such as Uber and the concepts of "uberization" have radically changed the basic principles of providing services in the transport industry.

Robotization in the transport sector is characterized by its specificity, which distinguishes it from other sectors of economic activity. In particular, robotics is often seen as the process of creating and using physical machines capable of simulating human actions. However, autonomous systems actually cover a much wider range of areas. A more precise definition of robotics is the development and application of self-controlled adaptive intelligent systems capable of performing their production functions regardless of the degree of human intervention. In the transport sector, robotization includes both the introduction of autonomous vehicles, as well as the automation of production and the use of equipment operating without human intervention. The following types of robotic equipment

stand out in the transportation industry: 1) robots operating in a human environment; 2) robotic production systems that do not require human intervention; 3) autonomous vehicles [12].

With regard to specific examples, it can be noted that autonomous systems have long been used at service stations, both in road and rail transport. The accumulated experience makes it possible in the future to expand the use of such technologies to all components of the transport sector, especially given the increasing involvement of artificial intelligence (AI) technologies. For example, in the railway industry, 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, and also allows you to carry out control work at any time of the day with the same efficiency. The railway infrastructure provides favorable conditions for the introduction of robotic systems. With their help, routine maintenance can be carried out, such as cleaning, salt distribution and embankment strengthening. Autonomous stations also provide convenient placement of scanning devices and other equipment for testing the condition of the trackbed, rails and track infrastructure [9]. This allows for more accurate and systematic testing, as well as collecting data for analysis and decision-making on maintenance and repair.

The use of unmanned aerial vehicles, known as drones, is a separate issue that does not yet have a clear legal basis in most countries and is limited in its application. Nevertheless, the potential for the use of drones in the transport sector is huge. They can be effectively used to perform various tasks such as aerial photography, constant monitoring and cargo tracking. With the development of technology, the power of drones is constantly increasing, which will soon allow them to be used to transport people and goods to remote areas. The ability to control a large number of drones, forming "swarm robots", i.e. coordination of their actions by one operator or artificial intelligence, opens up prospects for performing repair work and other complex tasks. Currently, drones are mainly

used for external surveillance. For example, in Germany, patrol drones are used to monitor sections of the railway track in order to identify violators and vandals. However, the potential of drones is expanding so much that they can become a new type of transport.

The use of new digital technologies, such as drones and robotic suits (exoskeletons) for workers, has practical benefits and allows solving more urgent and important tasks. The use of such devices allows workers to perform heavy tasks and reduce the risk to their health when working in high-voltage or hazardous environments, for example, when laying tunnels.

Reducing crime and risks in transport is an important task. The use of facial recognition and remote identification technologies allows you to create complete security zones around key transport facilities. International airports are already using such approaches, including comprehensive video recording, the use of drones and a single information system that processes the data received and allows you to identify almost every person in the crowd of passengers. This not only reduces potential threats at transport facilities, but also helps to solve more mundane tasks, such as tracking unscrupulous passengers who can damage property and create problems.

Conclusion. The processes of robotization and implementation of automatic systems in the transport sector have significant potential to cover almost all aspects of it, including logistics and customer service. Digital technologies, in turn, provide the opportunity to create autonomous vehicles for various types of transport. At the moment, automation of the port infrastructure is already being observed, especially in the field of container handling, where terminals operate operating practically without human intervention. Thus, all components of the logistics chain, including the consolidation of information flows and control, can be automated using automated systems. Despite the fact that fully autonomous naval vessels are still in the distant future, it is already possible to talk about the

potential of creating a "virtual logistician" - a program capable of organizing the work of transport hubs.

In the Republic of Uzbekistan, the processes of digitalization have not gone unnoticed by either state authorities or the private sector. The country is implementing a number of measures aimed at preparing the economy and society for the processes of digitalization. One such initiative is the "Strategy for the Development of the Information Society in the Republic of Uzbekistan", approved by the President of Uzbekistan Shavkat Mirziyoyev in January 2019, which recognizes digital technologies as an important factor for the global leadership of Uzbek companies. This strategy provides for specific measures aimed at the dissemination of digital technologies, such as regulatory regulation, training and reorganization of the education system, as well as the development of the scientific and technical sphere. The State also plays a role in facilitating the penetration of digital technologies, developing infrastructure and ensuring the information security of citizens. [7, p. 121]

In the process of digitalization of the economy, digital information platforms (DIP) play a significant role. They are designed to integrate all participants in the value chain, provide communication channels, distribution paths, and build a community of potential customers. EDS have such a scope of work that they can cover entire sectors of the economy. Examples of such digital platforms are abundant in e-commerce. Moreover, it can be expected that such technologies will be increasingly used in the transport sector.

At the moment, digital platforms are already being used in the transport sector, although they are not yet as universal as electronic platforms. Logistics already uses specialized local digital platforms for planning the transportation process and organizing cooperation between various modes of transport and logistics centers. Digital platforms facilitate the coordination of cargo handling in warehouses and ensure effective communication with end users. In the transport sector, digital platforms combine all intermediary functions. With their help, end

consumers can interact directly with suppliers, and the platform will provide them with the necessary tools to manage 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 with manufacturers and take over the management of all additional functions.

Digitalization of the logistics sector is both a challenge and a challenge for its participants. The process of digitalization can lead to changes in the market that all its participants will face. One of the most serious challenges is the emergence of a market controlled by a single monopolist, known as the winner-takes-all model. This means that integration in each market segment reaches such a level that one large monopolist emerges. An example of such a monopolist in the e-commerce market is Amazon. The emergence of such a monopolist makes the rest of the market participants extremely dependent on his leadership. Similar processes can also be observed in the transport sector, where logistics companies are increasingly dependent on the e-commerce sector, such as online exchanges and online stores.

Most scientists dealing with this issue believe that in the future, the delivery of goods, including all types of goods, will be carried out directly from the warehouse belonging to the largest online store, the customer, bypassing the retail network. Traditional "convenience stores" will be replaced by pick-up points for pre-ordered goods. An important aspect of this process is that online stores will sell not only goods, but also delivery services. Thus, only those companies that will be integrated with the largest sales platforms will remain in the logistics services market. It is the largest participants in the e-commerce market that will determine who will remain in the market and what profit they will receive. At the same time, such companies may not even have their own physical assets.

In conclusion, we can say that digitalization is the main process in the transport sector among all manifestations of scientific and technological progress. It is happening faster than previous technological revolutions and is leading to profound transformations in the industry. The results of these transformations are

difficult to predict, but two key components can be identified. On the one hand, the effective use of digital technologies in the transport sector determines the competitiveness of companies. Those who do not follow modern changes risk dropping out of the market. Digital innovations make it possible to increase efficiency, improve logistics process management, optimize delivery and provide a higher level of customer service. On the other hand, digitalization processes also carry increased risks, both in terms of economic development and social progress. There are questions about the concentration of the market in the hands of several large players, about dependence on monopolists and data protection and privacy. It is necessary to develop appropriate legal and regulatory mechanisms to ensure fair competition, consumer protection and public safety.

In general, the digitalization of the logistics sector provides significant opportunities for the development and improvement of the industry, however, it requires attention to the problems associated with market concentration and risks in order to ensure sustainable and effective progress.

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