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DIRECTIONS OF DEVELOPMENT OF DIGITALIZATION IN LOGISTICS

V. KULIK, O. MESHCHERYAKOVA
Polotsk State University, Belarus

The research is devoted to the study of directions for the development of digitalization in logistics in the Republic of Belarus. The world technologies of digital logistics are considered and the latest trends in this area are presented. The results of the introduction of innovative technologies into logistics activities are analyzed, a conclusion is made about the positive and negative consequences of this implementation. Conditions for the further development of digital logistics in Belarus are outlined.

Manifestations of digital transformations in Belarus cover all aspects of society's existence: economic, social, political. Conditions for the development of entire areas of the economy are changing, new business models are being created; the smart home system and e-government are applied.

The relevance of digitalization for Belarus lies in the use of new opportunities to change the life of mankind for the better. The transformation of social structures leads to the development of new social norms and behavioral models, there is a virtualization of the life of society, a person, a transition from the introduction of individual technologies to the integrated construction of digital ecosystems. The introduction of electronic technologies will lead to an increase in the provision of quality services and goods. The shift to e-commerce will drive potential business growth and expansion. The implementation of digital platforms, following the example of the best world practices, will lead to the economic growth, transformation of public administration, GDP growth, an increase in the country's investment attractiveness, and an increase in employment of the population in the field of IT technologies.

The development of transparent and operational mechanisms for the work of public services, the possibility of increasing the export, transit and freight attractiveness of Belarus is seen as relevant. The creation of a single information space using digital technologies will open up new opportunities for managing logistics business processes. Digital technologies create advantages over competitors in the management of transport and logistics processes by integrating different target groups of shippers and consignees for all types of transport.

An important condition for the development of digitalization is the use of the end-to-end digital technologies based on the Internet of Things, radio frequency tags (RFID) and the implementation of robotization of warehouse and transport business processes.

The Concept for the Development of the Logistics System of the Republic of Belarus until 2030 provides for the phased development of the logistics infrastructure, acceleration of goods movement and reduction of total costs in the supply chain, the integration of Belarusian enterprises into international logistics chains.

The National Sustainable Development Strategy 2030 on the China-Europe railway route provides for an increase in freight turnover by 1.2 times and passenger turnover by 1.4 times due to delivery, the average transit time of the route is 12-17 days instead of 35-40 days for sea shipment.

The presence of a large number of tasks in the logistics process implies the presence of artificial intelligence in the field of IT technologies. The distribution of the use of artificial intelligence in the leading areas of the economy is shown in Figure 1.

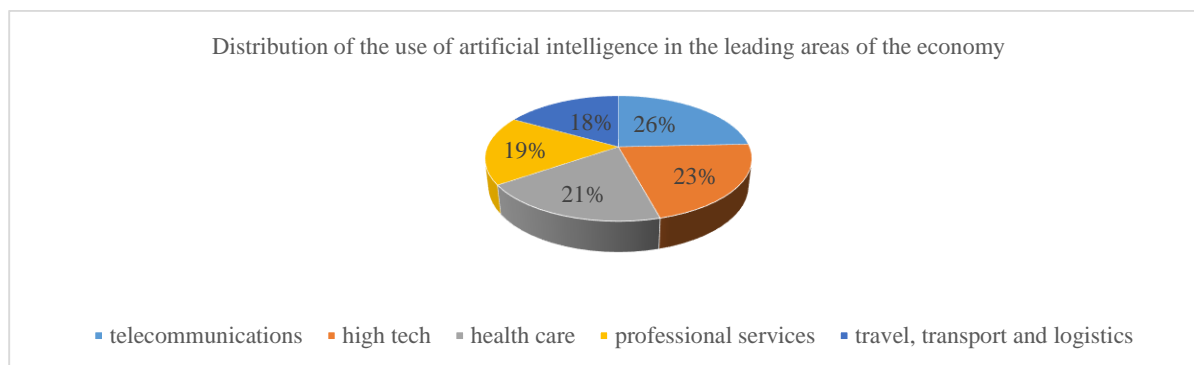


Figure 1. – Distribution of the use of artificial intelligence in the leading areas of the economy

Note: compiled by the author

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Only 18% is using artificial intelligence in supply chains in transport and logistics at the beginning of 2020. However, this lowers conversion costs by up to 20% and increases labor productivity by up to 70%. Reducing costs and increasing sales will occur due to the delivery of products in a shorter time frame [1].

The introduction of digitalization in international cargo transportation will allow the use of sensors and sensors to track the quality and speed of cargo movement; apply routing, navigation, automatization on vehicles, as well as change the inventory management system, introduce electronic data exchange, blockchain.

G.G. Golovenchik in the monograph "Digitalization of the Belarusian economy in modern conditions of globalization" states: "The share of digital transactions in the total number of acquisitions in the transport and logistics services sector increased from 3.9% in 2010 to 14.8% in 2018" [2].

In the next 5 years in the field of logistics, there will be an increase in the scale of digitalization. Until recently, transportation innovation has been associated with cargo tracking. However, with the emergence of new companies and logistics firms collaborating with tech startups, the development of logistics has accelerated dozens of times.

Consortium of Modern Trade Technologies LLC (a certified EDI operator in Belarus, a member of the European EDI-EEDIN network), TRANSINET GmbH (a European provider of transport and logistics services) and TRANSRAIL BC (the largest rail freight forwarder in Belarus) the concept of creating a unified Digital European-Eurasian Transport and Logistics Platform (DTLP) was developed. It is aimed at combining information resources of participants in international multimodal freight transport with the aim of reengineering and digitizing business processes, optimizing the use of transport infrastructure and providing a package of information, analytical and management services to all operators of supply chains. The concept is based on the principles of building a regional network of national eLogistics platforms that can form a "data conveyor" along the EU-EAEU transport routes and acts as a "corridor" of a service solution (CaaS) for multimodal transportation of goods by sea, rail, road and air.

From August 2024, operators of road, rail, sea and air transport of the EU member states will provide electronic information on freight traffic (eFTI) according to uniform technical standards, which are planned to be developed over the next two years. This will increase the efficiency of deliveries by all modes of transport in the single market of the European Union, reduce the costs of participants in supply chains, simplify law enforcement, eliminate language barriers, and reduce waiting times during inspections [3].

Let's list the technologies of global digital logistics that make supply chains more customer-centric:

1.e-AWB. It is an electronic air waybill that improves the efficiency of tracking and processing cargo data, ensures transparency and safety of cargo in transit, and reduces costs and delays in the transportation of goods;

2. Big Data simplified demand forecasting, optimized routes, allowed risk management and predictive analytics in logistics;

3. Cloud logistics. Data is transferred to the cloud, logistics services are made available as a pay-on-demand basis. Shipwire and Freightly provide cloud-based real-time transport management systems. They cover all logistics processes from procurement to invoicing, making the whole process easier and cheaper for companies. Cloud logistics is rapidly gaining popularity: 50% of logistics service providers are already using cloud services, 20% are planning to do so;

4. Blockchain. Tracking schemes will ensure complete transparency and traceability of products along the entire route of the goods. Blockchain enables automatic billing and payment of invoices, with the payment being processed as soon as the goods arrive at their destination;

5. Digital twin. This is a software analogue of a physical device that simulates internal processes, technical characteristics and behavior of a real object under conditions of interference and the environment, identifying anomalies and the causes of their occurrence. The main purpose of using digital twins is to accurately predict, prevent problems before they arise, and plan effectively for the future. Digital twins enable logistics providers and other companies in the supply chain to provide partners with increased transparency and increase consumer demand. Digital twins can have a significant impact on the design, operation and optimization of logistics infrastructure: warehouses, distribution centers and transfer facilities. Warehouses and distribution centers make up a small part of the entire logistics infrastructure. The flow of goods to their destination depends on the organization of many elements of the supply chain, including ships, trucks and airplanes, ordering and information systems, and people. This complex multi-stakeholder system is most clearly visible in the world's major logistics hubs such as airports and container ports. In logistics, the digital twin can be a model of the entire network: logistics assets, oceans, railways, highways, streets, homes, and customer workplaces. The idea of a digital twin is now largely an aspiration for logistics activities;

6. "Mobile carriers". Cargo owners and passengers need a full range of services with access from their mobile device. The client gets the opportunity to order transportation on a digital logistics platform by pressing a button in the mobile application. This allows you to simplify and reduce the time and money spent on ordering.

We will also characterize other newest areas of digital logistics. Their use will allow solving problems with the end users of products and the throughput of goods circulation in supply chains.

3D printing (additive manufacturing) is a manufacturing process in which a 3D printer creates three-dimensional objects by applying material in layers, in accordance with the digital 3D model of the object. 3D printing can be used in different areas of the economy. The technology is available on a mass scale, helping to reduce costs when manufacturing mixed materials products.

The Internet of Things (IoT) is the connection of physical objects to the World Wide Web and the ability to receive valuable data from a wide variety of devices. The introduction of IoT technologies in the field of logistics makes it possible to optimize the entire logistics system, including warehouse operations, transportation and delivery. IoT provides an opportunity to improve process efficiency, security and quality of service. Tracks individual consignments and their status using radio frequency identification (RFID) chips via cloud-based GPS systems.

The use of drones for commercial delivery of goods also has a positive result, thanks to the fast delivery of small goods, high speed and accuracy of delivery. The use of unmanned vehicles will reduce the overall shipping costs by 25-40%. At the same time, fuel costs will be reduced by at least 10%, and delivery time – by 30-40%. The labor cost will eventually be reduced by 90%. However, the delivery of goods by drones also has a negative side, as a result of the automation of technological processes in industry and logistics, up to 70% of jobs can be reduced.

Self-driving cars can change the world globally. Rapid adaptation in the environment, orientation without human intervention and a rigid software algorithm will help reduce the number of accidents. According to AT Kearney, autonomous vehicles reduce the likelihood of accidents by 70%.

Augmented reality (AR) is a tool that is actively used in modern realities, which has a number of significant advantages. The ability to provide a direct or indirect view of the real world through additional elements of the perception of reality by a computer, an expanded view of the world in real time opens up new possibilities that were previously not available.

Consider the results of the implementation of innovative technologies in logistics activities in Table 1.

Table 1. – Results of the introduction of innovative technologies in logistics and supply chain management

Technology	Result after technology implementation	Final result +/-
3D printing	Additive manufacturing expands the manufacturing process. Shorten the supply chain by “printing” products to order and reducing finished product inventories. Supply of raw materials by logistics companies instead of finished products. 3D printing at delivery locations.	Additional profit.
Internet of Things (IoT)	High potential for use. No losses during transportation and storage of goods. Prompt prevention of damage or theft of cargo. Climate control in storage areas. Identification of traffic parameters.	Benefit. Customer satisfaction. Additional profit.
Delivery of goods by drones	Use by 3PL operators. Shortening the supply chain. Reduced transportation costs.	Disadvantages: lack of rules and regulations related to government regulation, air traffic safety. Drone dimensions and weights. Job cuts.
Unmanned vehicles	Reduced waiting time for loading and unloading. Reducing the risk of accidents.	Reducing the cost of transporting goods and passengers. Reduction of overhead costs.
Augmented reality, (AR)	Detailed acquaintance with the external environment of the logistics operator (obtaining detailed information about the cargo).	Improved cargo handling. Increase in the speed of cargo delivery. Reduced overall costs.

Note: compiled by the author

Thus, the development of digital logistics in Belarus is possible subject to certain conditions:

1. At the country level, macroeconomic conditions should be taken into account:
 - a) the location of the state in the international and interstate division of labor (EAEU, EU);
 - b) the level of specialization and cooperation of companies in foreign and domestic markets;

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2. At the enterprise level:

- a) introduction of digital marking of products, IoT sensors;
- b) the complex application of end-to-end digital technologies that allow you to create an information (digital) "twin" of an enterprise or business process using BIM tools.

This is how traditional supply chain management (SCM) technology is transformed into digital and seamless SCM, i.e. business process management will be carried out automatically in real time based on digital signals [4].

Digitalization in Belarus provides new opportunities in the use of logistics services, which have a positive effect on reducing the costs of selling and storing products. Will facilitate the ability to trace goods and expand insurance services, as well as optimize routes and take-over. The introduction of innovative technologies will have a positive effect on the Belarusian society, on the development of the country's economy.

Digitalization should be considered as a trend of effective global development, since digital transformation should cover production, business, science, the social sphere and the life of citizens. Digitalization of logistics leads to the transformation of existing business models, pricing systems, management style of an organization, attitude to corporate culture, etc. There are various scenarios for the development of the logistics sector based on the introduction of elements of the digital economy, associated both with the emergence of new participants on the market who are ready to introduce modern technologies in all areas of activity, and based on the provision that organizations already on the market will follow the path of digital transformation.

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