

## **ЦИФРОВАЯ ТРАНСФОРМАЦИЯ ЛОГИСТИКИ И УПРАВЛЕНИЕ ЦЕПЯМИ ПОСТАВОК: ТЕНДЕНЦИИ РАЗВИТИЯ И ВОЗМОЖНОСТИ**

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***Abstract.** The article is devoted to the strategic directions for the development of digital transformation of logistics and supply chain management in the prime of the fourth industrial revolution. The main driving forces in the process of accelerating the digitalization of logistics and supply chain management are described, which include artificial intelligence, augmented reality, blockchain, Internet of things, 3D-printing, virtual reality, robots and drones. The importance of these strategic directions for the sustainable development of digitalization as a key driver of economic growth was noted.*

***Keywords:** digital transformation, logistics, supply chain management, sustainable development.*

It is not for nothing that the 21st century is called the age of information technology. After all, the development of information and digital technologies leads to the most large-

scale and profound changes in human life, which are rapidly spreading to the economy. It is the digital transformation of the economy that is one of the key priority areas for the development of any country. We live in the era of the still third industrial (or digital) revolution, which began in the second half of the last century, and is characterized by the spread of information and communication technologies, i.e. which began in the second half of the last century. The first industrial revolution began in the second half of the 18th century, when it became possible to switch from manual labor to machine labor with the help of water and steam. The second industrial revolution was characterized by the development of mass conveyor production associated with the development of electricity. The third industrial revolution began with the creation of digital computers and the subsequent evolution of information technology. Today it is gradually transforming into the fourth industrial revolution, which is characterized by the fusion of technologies and the blurring of the lines between the physical, digital and biological spheres. The concept of the fourth industrial revolution (or "Industry 4.0") is defined as the introduction of "cyber-physical systems" into production. These systems will integrate into one network, communicate with each other in real time, self-adjust and learn new behaviors. Such networks will be able to build production with fewer errors, interact with manufactured goods, and, if necessary, adapt to new consumer needs.

If the automation of production, which began in the middle of the 20th century, had a narrow specialization, in which control systems were developed for each sphere and enterprise separately and were not scaled, then the development of global industrial networks will underlie the new technological revolution [1].

At the heart of the fourth industrial revolution lies the digital transformation of business, which involves the revision of business strategies, models, operations, products, marketing approach, goals, through the adoption of digital technologies to accelerate sales and business growth [2].

Digitalization is a key driver of economic growth. The digital economy refers to activities in which the efficiency of production, the use of technology, the operation of equipment, storage, sale, delivery of goods and services, is significantly increased by processing large amounts of data and using the results of their analysis. In turn, the digitalization of logistics and supply chain management is the driver of the digital economy.

The logistics is a science of procurement, supply, control, and organization of transportation. It is based on the rule of law and the laws of the functioning of the market. Logistics services are an extensive set of operations, processes that are aimed at implementing the organization's client's request, implying storage, transportation, purchase, delivery, planning, optimization of transportation, order processing, certification, documentary support and others. The main functions of logistics are optimization, control and efficiency improvement [3].

The supply chain management can be defined as the management of the flow of goods and services, which begins with the origin of the goods and ends with its consumption. It also includes the movement and storage of raw materials that are involved in work in progress, inventory and fully supplied goods. The main purpose of supply chain management is to monitor and interconnect the production, distribution and shipment of products and services. This can be done by organizations with very good and tight control over internal inventory, production, distribution, internal production and sales. Supply chain management mainly integrates supply and demand management. It uses various strategies and approaches to view the entire chain and work effectively at every stage [4].

The digitalization is a key driver of economic growth. The digital economy refers to activities in which the efficiency of production, application of technologies, equipment operation, storage, sale, delivery of goods and services is significantly increased due to the processing of large amounts of data and the use of the results of their analysis [1].

The digitalization of logistics and supply chain management is the driver of the digital economy.

According to PwC (Price waterhouse Coopers), the international network of companies offering consulting and audit services, the basic eight technologies that are changing all of humanity include the artificial intelligence, the augmented reality, the

blockchain, the Internet of things, the 3D-printing, the virtual reality, the robots and the drones [5, 6].

The convergence of these technologies is unlocking the next wave of innovation, yielding new business solutions that are greater than the sum of their parts. The convergence of emerging technologies will multiply a person's capacity to work better, smarter and more seamlessly through these technologies. It is these basic eight technologies that are most important today for business and the economy as a whole.

With artificial intelligence, software algorithms are automating complex decision-making tasks to mimic human thought processes and senses. The artificial intelligence is not a monolithic technology. A subset of the artificial intelligence, machine learning, focuses on the development of computer programs that can teach themselves to learn, understand, reason, plan and act when blasted with data. Machine learning carries enormous potential for the creation of meaningful products and services. In logistics and supply chain management, the artificial intelligence is designed to facilitate the selection and formation of pallets, loading (unloading), automatic formation of prefabricated pallets, forecasting, product lifecycle management, creation of meaningful products and services. Examples include hospitals using a library of scanned images to quickly and accurately detect and diagnose cancer; insurance companies digitally and automatically recognizing and assessing car damage; security companies trading clunky typed passwords for voice recognition.

The augmented reality is a visual or audio overlay on the physical world that uses contextualized digital information to expand the user's view of the real world. The augmented reality helps warehouse workers to accurately fulfill orders, airline manufacturers to assemble planes, and electrical engineers to carry out repairs. The ability to convey information to the scene flawlessly and unobtrusively is undeniable. This fusion of the physical and virtual worlds opens up new opportunities for companies from around the world to explore.

The predictive production planning, the planning the utilization of production capacities, the optimization of vehicle traffic routes, the procurement management based on adjustable models, the selection of goods in warehouses, the packaging of goods, the saturation with data of real logistics facilities, the management of data about goods from all participants in the supply chain - these are some of the areas augmented reality in logistics and supply chain management.

The blockchain is a distributed digital database or, more broadly, a digital ledger that uses software algorithms to record and confirm transactions with reliability and anonymity. The record of events is shared between many parties and information once entered cannot be altered. The blockchain has the potential to usher in an era of autonomous digital commerce in logistics and supply chain management through control over the origin of information, logistics transactions, supply chain finances, material flows of supply chains.

The Internet of things is also a network of physical objects (devices, vehicles, home appliances), with built-in sensors, software, network connectivity and computing capabilities that allow them to collect, exchange and act with data, usually without human intervention. The industrial Internet of things refers to its use in the manufacturing and industrial sectors. The industrial Internet of things is known as "Industry 4.0", which means it is an integral part of the fourth industrial revolution.

In logistics and supply chain management, the Internet of things will help ensure transparency and tracking using cloud technologies, improve the quality and accuracy of forecasting, and obtain up-to-date supply chain data in real time without the need to synchronize data between the logistics systems of chain partners. In addition, the Internet of things technology will play the role of a video analyst, monitor labor safety and ensure human life, perform the functions of QR-stickers for temporary sensitivity.

Three-dimensional printing (3D-printing) creates three-dimensional objects from digital models by overlaying or printing successive layers of materials. 3D-printing uses innovative inks including plastic, metal, and more recently glass and wood. 3D-printing can

transform any large enterprise, small business or living room into a factory.

With regard to the logistics and supply chain management, 3D-printing technology will be able to create new production areas, a new configuration of suppliers of raw materials and materials to ensure production, data visibility, interaction and communication with all participants of the supply chain.

In the computer simulation of a 3D image or environment, viewers can use special equipment to interact realistically with the simulation. The gaming and entertainment industries are obvious testing grounds for the virtual reality. However, the virtual reality has the potential to transform many other industries, especially in hands-on learning, where workers can find themselves in dangerous, complex or costly situations without the serious risks associated with these activities in the physical world.

The virtual reality removes logistic constraints. They facilitate integrated business planning, design, shaping, supply chain modeling and management visibility.

The robots are machines with enhanced sensing, control and intelligence used to automate, augment or assist human activities. The robot market is poised for growth in a broad range of services applications. These applications are transforming manufacturing and non-manufacturing operations with new capabilities that address the challenges of working in changing, uncertain and uncontrolled environments, such as alongside humans without being a danger to them. The robotization is designed to ensure interaction with all participants of the supply chains.

Unmanned aerial vehicles – the drones, depending on their design, vary greatly in their capacity (power). Some drones need wide spaces to take off, while quadcopters can squeeze into a column of space. Some drones are water based, others can operate and navigate semi-autonomously (via remote control) or fully autonomously (via onboard computers). One of the most notable trends is the use of drones for logistics purposes. The main such areas are warehouse drones for reading barcodes on packages and drones for the future of the delivery industry.

Thus, logistics and supply chain management are an integral part of the digital transformation of the entire world economy and its globalization. The basic eight technologies that are changing the whole of humanity are artificial intelligence, augmented reality, blockchain, Internet of things, 3D printing, virtual reality, robots and drones are a tool that determines the trends in the development of digital transformation of logistics and supply chain management in the era of the fourth industrial revolution and allows them to identify their opportunities to get the most out of them as a result of fully meeting the needs of consumers of goods and services.

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