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Foreign experience in implementing and applying innovations in transport logistics

Abstract. *The purpose of the paper is to study the foreign experience in applying the latest technologies and developments in the field of logistics in modern realities. To achieve this purpose the following tasks were set in this research: to do a comparative analysis of the Logistics Performance Index and reveal the leading countries; to study experience of using the logistic innovations in the leading country (Germany); to formulate directions and ways of adapting foreign experience in Kazakhstan. The author uses system functional, statistical analyses, comparison, and rating assessment as a methodological basis of the study. Analysis of rating indicators of the logistics efficiency index LPI was also used in the paper. From the point of view of geographical division, we identified the countries of Europe as the main leaders in the development and application of new technologies in transport. Thus, research the international experience of forming the innovation transport and logistics system gives the opportunity to identify and formulate "new" approaches to modernizing the current area, and consider them when developing strategic documents according to regional features. The author reveals that various innovations aimed at reducing transport and logistics costs, improving production efficiency, implementing information and energy-saving technologies, and protecting the environment are being actively introduced in foreign logistics.*

Keywords: *innovations transport logistics, logistics efficiency Index, information technologies in logistics, Big Data, block chain, artificial intelligence.*

Introduction. In today's global economy, transport and logistics play a key, and in some cases a defining role in the industrial development of countries. In Kazakhstan, transport and logistics are also one of the priority areas according to the national strategy «Kazakhstan-2050». In our country, this tool can also bring a significant economic effect on the industrial breakthrough. Kazakhstan, as we know, is the ninth largest country in the world and is located in the heart of the Eurasian continent at the junction of the borders of Europe and Asia, as a result, has a high transit potential. Currently, Kazakhstan, developing trade and relations with many countries of the world, is also developing its transport system, i.e. railway, air, road, sea, and pipeline transport. By developing the transport system, the country can successfully enter the world community. The development of the entire transport industry and the economy is inseparably linked with the development of the logistics services market. Moreover, the transport system in a market economy requires new and modern approaches. Those new approaches to improving transport and logistic systems are based on innovative and high-tech solutions. Especially today, there is a question of innovative logistics in the context of the global crisis or the Covid-19 pandemic when it is necessary to solve many production issues quickly and remotely. Foreign experience shows that today there are many modern technological solutions for improving and improving logistics processes. Analyzing the experience of leading countries in

the development of transport and logistic system based on an innovative path is very important to define ways and prospects for Kazakhstan.

The object of the research is the innovations in logistics; the subject is applying the innovations in the development of transport logistics in different countries. It is necessary to identify the role and trends of innovations for the development of transport logistics. In this regard, the purpose of the paper is to study foreign experience in applying the latest technologies and developments in the field of logistics in modern realities. To achieve this purpose the following tasks were set in this research: to do a comparative analysis of the Logistics Performance Index and reveal the leading countries; to study the experience of using the logistic innovations in Germany; to formulate directions and ways of adapting foreign experience in Kazakhstan.

Literature review. The literature review shows that the question of developing and implementing innovations in transport and logistics is devoted to the works of many scientists and has interest among foreign scientists during the past 10 years. However, there has been a limited amount of theory-based research conducted on the topic of logistics innovation. While antecedents and outcomes of logistics innovation have been identified within the leading logistics journals, very little empirical testing has been done. The diffusion of logistics innovation has also received attention in the logistics literature [1].

Goloskokov V. describes innovative logistics as a set of scientific knowledge, methods, and skills for studying and rational optimal organization of any flow processes to increase the efficiency of their results by identifying and using additional, usually hidden management reserves [2]. The development of logistics technologies has become possible due to the active introduction of information technologies that allow processing large amounts of data and open up prospects for the use of information and analytical centers of logistics providers. The main factor in the development of supply chains has been investment in logistics technologies. Such investment provides not only the economic advantages of deliveries by various modes of

transport but also can give a significant boost to the economy. A large share of investments in the development of information technologies in the field of supply chain development corresponds to a global trend: investments in the field of information systems and technologies that are used in logistics and supply chain management are growing.

Technological advances in the field of informatization and data processing have contributed to the development of logistics, reducing its costs, and coordinating transport costs. The development of logistics technologies has become possible due to the active introduction of information technologies that allow processing large amounts of data and open up prospects for the use of information and analytical centers of logistics providers. Logistics automation and cloud technologies allow you to reduce the costs associated with attracting labor resources, optimize delivery processes, search for partners and customers, participate in electronic auctions and carry out online monitoring of cargo levels. We can assume that in the future the share of investments in the development of information technologies in logistics will increase [3].

Akkaya and Kaya examined the latest innovations and smart technologies in logistics. They defined logistics innovation as the ability to apply or create new ideas about logistics activities. Each of the logistics processes is being restructured with technological innovations triggering Industry 4.0. In other words, Industry 4.0 has started to shape the future of the logistics sector with the applications of Logistics 4.0. Logistics 4.0 is the development of labor-saving and standardization with the evolution of the Internet of Things technology in logistics [4].

PwC has identified five main factors that affect the development of the transport and logistics industry, including urban transport:

- Digitalization;
- Changes in processes due to the introduction of new software;
- The change in the dynamics of domestic markets;
- Changes in international trade;
- Changes in processes due to the introduction of new equipment [5].

Intelligent transport systems can also be separated into a separate sector of the transport sector of the economy. These solutions include the development of information and communication technologies and electronic equipment designed to meet the challenges of the transport sector. Intelligent transport systems have already become the basis for innovation for vehicle manufacturers, and therefore for the entire automotive industry. At the same time, smart technologies have a huge potential to improve the efficiency of the entire transport complex, including existing infrastructure and services for both passengers, so for cargo transportation [6].

Research methods. The present study uses data from multiple sources. The theoretical basis of the article consists of the works of scientists of Kazakhstan, CIS, and foreign countries on the formation and development of innovations in transport and logistics systems. The information bases are state programs, analytical reviews, information from official websites, statistical reports, data of the World Bank, and periodical scientific publications. The author uses system functional, statistical analyses, comparison, and rating assessment as a methodological basis of the study.

The method of analysis of rating indicators of the logistics efficiency index LPI was also used in the paper.

Results and discussion. Analysis of foreign experience shows that the innovative development of each country is individual due to economic, cultural, historical, social, and other factors. Accordingly, there is no single model that would suit all countries without exception, and attempts to copy the successful experience of other countries will probably not achieve the desired result without adapting to local conditions. However, there are certain prospects for studying approaches to innovation management in countries that have high LPI.

According to the World Bank Group, most countries are well aware of the importance of logistics performance for growth and integration. It is indicated in *Trade Logistics in the Global Economy* that the crosscutting nature of logistics as a policy area is widely recognized: logistics

is not just about connecting infrastructure but encompasses regulation of services, sustainability, and resilience, or trade facilitation.

The World Bank Logistics Performance Index is a unique benchmarking tool, which measures the convenience of logistics systems for more than 160 countries. The World Bank Group uses the Logistics Performance Index as the most important starting point of dialogue with member countries on the drivers of logistics performance. The index has six components – customs, infrastructure, ease of arranging shipments, quality of logistics services, timeliness, and tracking and tracing [7]. The World Bank has identified countries with the best trade logistics every two years since 2007. Table 1 shows the top ten countries with the highest rank on the Logistics Performance Index in 2018.

Logistics Efficiency Index Global Ranking 2018 shows that Kazakhstan is 71st among 160 countries, rising by six positions compared to 2016. As we can see from the statistical data, in ranking top 10, European countries are leading the way in terms of indicators: Germany (1), Sweden (2), Belgium (3), Austria (4), Netherlands (6), Denmark (8), UK (9), and Finland (10). From Asian countries, there are Japan (5) and Singapore (7). The largest countries are strong in manufacturing because of the high technology level and experience. It is worth noting that Germany has been leading in this indicator since 2012. This country is actively working towards innovative development using modern information technologies. They were at the origin of the concept of Industry 4.0 aimed at implementing the "Internet of things" (IoT).

German companies plan to achieve full internalization of the industry by 2030.

According to expert estimates, Germany is a leading country in the development and implementation of logistics technologies. Today in Germany, several logistic centers are located in the following cities - Berlin Hamburg; Bremen, Dusseldorf, Frankfurt, Stuttgart, Munich, and Nuremberg. All of them are mainly located in the Western part of the country and tend to the largest economic centers of the region. Transportation activities are carried out by 11 major logistics

Logistics Performance Index, Top 10 countries and Kazakhstan, 2018

| Country	Rank	LPI	Country	Rank	LPI
Germany	1	4.20	Singapore	7	4.00
Sweden	2	4.05	Denmark	8	3.99
Belgium	3	4.04	United Kingdom	9	3.99
Austria	4	4.03	Finland	10	3.97
Japan	5	4.03	…	…	…
Netherlands	6	4.02	Kazakhstan	71	2.81
Source: The World Bank Group					

operators: Maneuverability logistics, Conceptum Logistics, CS4 Logistics, Interglobal Shipping, Intropa Speditionsqesellschaft, Kopf & Lubben, Leschaco group, Maurice ward UG, Monnard expedition, Morrison Express, and NNR + Dachser [8].

Logistics 4.0 was created in relation to the term Industry 4.0, first used in Hanover (Germany) at the IAA Commercial Vehicles trade fair in 2011, which means that we are currently experiencing the peak of the fourth industrial revolution. Logistics 4.0 continues this trend by combining modern information and communication technologies. The technologies within Logistics 4.0 are shown in Picture 1.

Logistics 4.0 continues this trend by combining modern information and communication technologies. Intelligent and digital network systems are designed to allow people, machines, factories, logistics, and products to communicate directly with each other.

In this study, we set out to determine how Germany witch has the highest logistics efficiency index applies innovations in logistics and how they use them. Today, Germany ranks second in the world in the number of patents in the field of autonomous driving. Innovation in transport logistics in Germany is coordinated around four areas: 1. Digitalization of transport infrastructure and logistics chains (warehouses, logistics centers, railways, etc.). 2. Robotization of production.3. Automation of control systems. 4. Autopilot systems [9]. In Germany, 2019 has been declared as the year of artificial intelligence. Germany plans to become a leader in the field of artificial intelligence and overtake the United
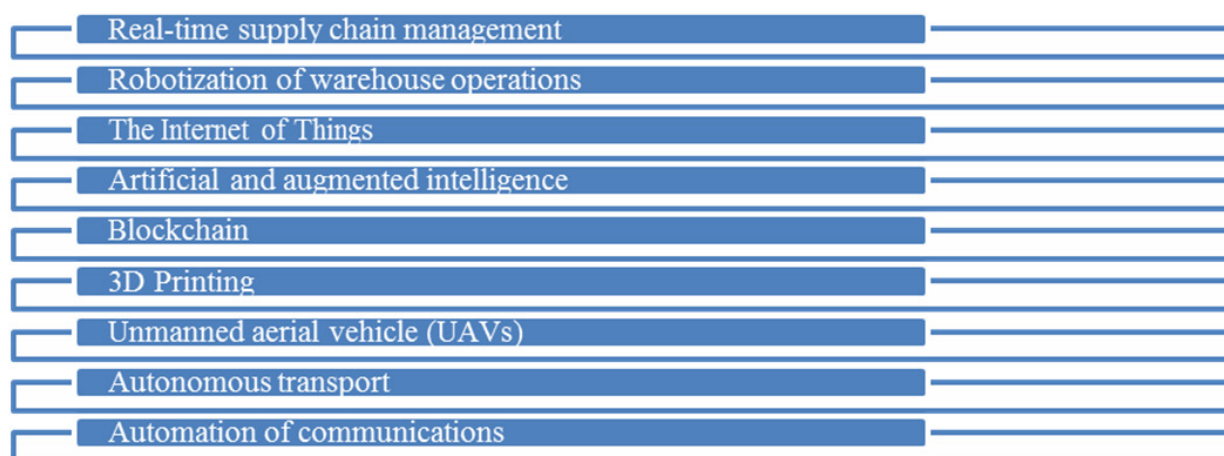
Note: Own elaboration.

Picture 1 - The technologies within Logistics 4.0

States and China, attracting the world's leading experts.

1. Artificial intelligence (AI). A trend that has much greater impact on logistics than expected in the past is Artificial Intelligence. The development of Artificial intelligence technologies is a driver of the transport industry. Monitoring the state of roads, detecting pedestrians or objects in the wrong places, autonomous driving, and cloud services in the automotive industry are just a several samples of using AI in transport.

1. Artificial intelligence capabilities allow companies to more effectively forecast demand and build supply chains with minimal costs. AI helps reduce the quantity of vehicles needed for transportation, optimize delivery times, and reduce operating costs of transport and storage facilities. It is rapidly transforming the way logistics providers operate because of the ongoing trend towards automation and continued improvements in computing. AI will increase human mastery through frameworks that help generate novel insights from big data and dispose of troublesome assignments. In logistics, AI will empower back office computerization, prescient operations, intelligent logistics assets, and new customer experience models [10].

2. Artificial intelligence is not essentially a robot, but it can be a complex program combined with machine learning. The best case with artificial intelligence usage would be a regular software for a freight loading system. There may be numerous providers and customers in an enterprise, and employees could have difficulties optimize the process, a computerized software can help do the job [11].

In 2018, the government of Germany published its Artificial intelligence Strategy Paper and established the Enquete Commission on Artificial Intelligence. As part of the Fourth industrial revolution, they set a goal to create and produce new products and services of the highest quality in sectors that are important for the economy starting with industry. It is the transport and logistics complex and directly related sub-sectors for the production of specialized equipment, complex automated, embedded and cyber physical production systems, sensors (including intelligent pneumatic control systems, actuators that rely on inter-machine interaction machine – to-Machine, M2M1) and the use of active semantic memory. Then, it is the sphere of information and communication technologies. Already, many German firms are world leaders (often hidden champions) in various niches of these industries [12]. From Munich to Bremen, new chairs have been created in recent years for machine learning, computer vision and robotics. For instance, the country has created such research and innovation centers as The Karlsruhe Institute of Technology, The German Research Center for Artificial Intelligence and research cooperation such as the Cyber Valley in Tübingen.

Taking the example of the largest artificial intelligence region in the world, Silicon Valley, a consortium of universities in the Stuttgart-Tubingen region announced the Cyber Valley initiative in 2016. It brings together industrial and academic institutions in the region to accelerate the development and commercialization of artificial intelligence technologies for use in the automotive, healthcare and manufacturing industries, etc. Partnerships between academia and industry are crucial for promoting innovations from the laboratory to the market, as well as for developing a culture of entrepreneurship.

2. The Internet of Things (IoT). The Internet of Things is a new paradigm shift in IT arena. The phrase "Internet of Things", which is also shortly well known as IoT is made up of two words, the first word is "Internet" and the second word is "Things" [13]. A British entrepreneur and founder of start-ups named Kevin Ashton created the concept of the Internet of Things in 1999. The idea was formulated to describe a system in which the material world communicates with computers (exchanges data) with ubiquitous sensors [14]. The logistics industry uses IoT during a type of ways from temperature and humidity sensors that monitor supply chain internal control to testing with IoT technologies that may observe once a package is preventing. With the presence of the correct IoT solutions, corporations will connect their devices to a central cloud platform, share crucial information and gain period forward vision

in their operations [4]. IoT has the potential to connect virtually anything to the internet and accelerate data-driven logistics. Everyday objects can now send, receive process, store information, and thus actively participate in self-steering, event-driven logistics processes. IoT promises far-reaching payoffs for logistics providers that can use the data from connected objects to generate actionable insights that drive change and new solutions [10]. The system currently consists of three complementary modules, aimed at tracking containers and planning intermodal operations, automating train accessibility and scheduling vessel navigation, but is open to the integration of new applications developed by the port authority or by the shippers or the stakeholders in the inter modal chain. This flexibility and modularity, together with the low costs involved, are the main strengths of the system. The design follows a low-cost assumption, using ICTs to optimize the use of the existing resources and designing them for minimum investment requirements and operational costs. The innovative aspects provided by the system can be summarized as follows:

- From the logistics point of view, the system allows shippers to monitor individual containers and to respond to unexpected events like an increase in the temperature of the container or the opening of the door. Thus, the system provides the basis for the development of new value-added services, like geofencing or cold chain management.

- From the technological point of view, it is supported by the integration in the FIWARE environment of a common platform based on web technologies and open standards, which allows for the development and integration of new services and open standard applications.

- From the implementation point of view, the system is very easy to implementon new corridors, linking all the stages in the transport chain [15].

IoT technologies are most actively used in Germany and America: for example, 15% of German companies already use Industry 4.0 solutions.A great potential for development related to IoT was pointed out in "Digital Strategy 2025": according to government estimates, IoT can be a source of economic growth of USD11 billion, with most of this amount going to industrial production. In addition, the document emphasizes that technology programs will be constantly improved and expanded to include new topics in the field of the Internet of things. For instance, DHL Supply Chain is implementing Internet of Things technology in warehouses to optimize operational efficiency and lay the foundation for safer working methods. Together with Cisco and Conduit, DHL is testing the technology at three pilot sites in Germany, the Netherlands and Poland.

3. Big Data. Logistics 4.0 permits integration and optimum alignment of processes at intervals company boundaries; once it is thriving, logistical problems regarding input and output streams of materials, will be considerably simplified. Once it involves transport, smart trucks, containers and pallets are opening up for new approaches to monitoring. IoT and big data are the basis of Industry 4.0 development. To make full use of Logistics 4.0 and Industry 4.0, it is necessary to apply big data approach. The term "big data" encompasses the massive volume of structured and unstructured data, which is growing exponentially and is analyzed using data analytics and warehousing [16].

Big data is a term used to describe data sets beyond the storage, management, and processing capacity of commonly used programs. The combination of the enormous dimensions of big data and the complexity of the analysis needed to benefit from it has led to the development of new class technologies and tools to manage them [4]. Logistics is being transformed through the power of data driven insights. Thanks to the vast degree of digitalization, unprecedented amounts of data can be captured from various sources along the supply chain. Investing in big data offers large potential to stream line capacity utilization, improving the quality of customer service, minimize risk, and develop new business models in logistics [10]. The Netherlands is strong in the big data analysis field [17].

A good example for studying the project of optimizing cargo nodes can be the port

of Hamburg in Germany, where the Big Data solution "pilots" trucks. In order to avoid traffic jams and chaos in the port, the team of top managers decided to implement the Smart Port Logistics cloud system. This software solution allows you to control the entire flow of goods transported on 40,000 machines per day. Using to Smart Port Logistics, employees of the control center can monitor the movement of trucks around the clock, which the system suggests the best routes, depending on the congestion of the tracks and the availability of parking spaces.

4. Blockchain. Blockchain technology has the potential to initiate a new era characterized by global payment systems, digital assets, decentralized management and even decentralized legal systems. Blockchain technology relies on a decentralized book structure and on the idea of mutual agreement of the parties. This technology allows the creation and sharing of a distributed digital account book among computers on a network [4]. Although blockchain is in its early days and achievements are yet to be proven, it may theoretically add value by promoting greater confidence and accountability amongst stakeholders in the supply chain and by enabling the automation of administrative and commercial processes in the logistics field [14]. Generally, blockchain is described as an instrument that provides the foundation of a new form of the Internet; - an incorruptible digital economic transaction log; - a centralized database; - a peer-to-peer network; and - a system that takes us to the highest level of transparency. For the aims of logistics (the logistics is a science and technology of managing all forms of flows (materials, information, finance and services), the subsequent semi definition is more applicable – blockchain is an instrument for special kind of management of digital business (transaction) flows. Such definition along with IoT opportunities and Smart directions could create a brand new generation of logistics and supply chain information technologies and systems within the future [16]. Blockchain technology can ensure data security, reliability, traceability, and authenticity, which is able to increase trust between supply chain actors and end consumer,

by providing reliable information about the shared products through a public blockchain. The blockchain integration in smart logistics allows the development of logistics processes, which positively affects the management, and will make the chains even more agile. Additionally, data collecting and its transmitting in near real-time gives managers clear visibility of the operating status of the whole processes and allows them to make timely decisions based on reliable data [9].

The study showed that today Germany is beginning to use blockchain technologies in various types of transport and logistics. For instance, Deutsche Bahn, one of the leaders in the global railway industry, is currently following in developing blockchain applications on Germany's digital railway to alleviate overcrowding at train stations using fast solutions.

German startups Quantoz, Ahrma, along with BASF (Chemical Corporation), are putting into production an intelligent pallet that not only informs about its position and movement, but also about the loading status, as well as about a possible impact or fall. This way, missing or damaged parts can be automatically reordered. Using the blockchain technology, companies can further increase security and trust in data integrity. This combination provides prospects for a secure and transparent materials and data flow in the future.

German logistics partner companies are jointly creating a platform for tracking blockchain. According to the report, the project involves logistics firms LKW Walter, GS1 Austria and its subsidiary EDITEL Austria, Bundesvereinigung Logistik & Ouml; Deutsche Bahn, DB Schenker and WU Vienna. The system will see the digitization of cargo documents on the blockchain in order to reduce costs and resource consumption, ensure higher standards of transparency and protect against forgery. The project will be developed in accordance with the international standard of electronic consignment note e-CMR [18].

Conclusion. Under the current conditions, for Kazakhstan, the strategic benchmark for innovative development is the implementation of a technological breakthrough and the

creation of a national innovation system that will anticipate the identification of priorities of innovation activity and the formation and implementation of innovative development programs and stimulation of innovation activity. The technological level of existing transport systems and their management in Kazakhstan is insufficient. Innovations are slowly being introduced into the industry, and progressive foreign experience is being spread. The transport infrastructure at this stage is characterized by a lag in the application of modern organization and management of cargo and passenger transportation, advanced technologies for the construction and repair of transport networks, as well as in the Informatisation of management and control processes [19]. Consequently, for Kazakhstan, the experience of developed countries in the field of all types of transport management and the study of global trends in the implementation of innovative strategies for the development of national transport systems is relevant.

From the point of view of geographical division, we identified the countries of Europe (Germany, Sweden, and Belgium), Japan and Singapore as the main leaders in the development and application of new technologies in transport. Thus, research the international experience of forming the innovation transport and logistics system gives the opportunity to identify and formulate "new" approaches to modernizing of the current area, and consider them when developing strategic documents according to regional features.

For logistics, technological development and the appearance of the fourth industrial revolution contributed to the generation of several challenges. This can speed up the integration of technologies into all logistics processes. This led to a new concept called "smart logistics" or "logistics 4.0" [20]. Digital transport, or intelligent transport systems, are becoming increasingly widespread in various countries of the world. The centers of its development are the USA, Japan, and the European Union. In Europe, the role of the locomotive in the development of information systems in transport belongs to Germany, where

the concept of digital transport is considered as an element of the fourth industrial revolution, which imposes high requirements on systems for transmitting, identifying, processing and storing data. The aim of implementing intelligent transport systems in Kazakhstan was set only in 2018. It is planned that an intelligent transport system will allow country to effectively manage traffic flows and determine the needs for further infrastructure development.

In the world and in Kazakhstan, innovative technologies in logistics are developing rapidly. Experts expect that investment in this area will grow due to the need to increase the competitiveness of companies in the market by optimizing logistics costs. The main directions of investment activity in the field of logistics innovations are: activation of public-private partnership, development of investment assessment methodology for infrastructure and transport projects, development of the regulatory framework for logistics innovations. It is known that Kazakhstan is a country with a complex logistics system. Long distances sometimes do not allow entrepreneurs to develop their business in different regions of the country due to high logistics costs. Logistics companies should solve this problem by reducing costs and increasing the speed of cargo delivery.

The aim of the present study was to show the introduction and using the innovations in transport logistic in the countries with high logistic effectiveness index. The literature review has proven that this issue still has a research gap in terms of management theory, including in the area of logistics. Research and analysis of the research results have shown that countries that have set certain goals and adopted national strategies and invest in new innovative technologies show significant development in this area. The partnership of science and industry plays an important role here. For Kazakhstan, this issue has been on the agenda for many years. There is a great need for funding such projects. The following mechanisms can be used to solve this problem:

- Develop a generally agreed strategy with clear goals that would allow the implementation of elements of Industry 4.0 and then Logistics 4.0;

- Improving research, development and innovation in the field of digital technologies in logistics and transport;

- Formation of stable platforms and mechanisms for co-operation between public and private sectors, research and scientific units.

- Promoting new business models for small and medium sized businesses in the field of transport and logistics services;

- Close cooperation and strategic partnership with Germany at both the governmental and technical levels;these platforms may be in the form of clusters, which affect in synergy in establishing competitive edge. Clusters may constitute the strength of a region or a country;

- Co-operation between private and public sectors within public-private partnership;

- Comprehensive information activities, which will support innovative behavior. Set-up of the innovation cult as the drive for the development of businesses and the country.

Future research should concentrate on developing new tools that will be incorporated into the application layer, as well as further exploring the dynamic planning capabilities offered by this new system. Due to the growing prospects of the logistics services market in Kazakhstan, specialists are already thinking about how to raise the service of transport and logistic companies to the highest professional level that meets all international standards.

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Көлік логистикасында инновацияларды енгізу мен қолданудың шетелдік тәжірибесі

Аңдатпа. Мақала қазіргі замандағы көлік логистикасы саласындағы жаңа технологиялар мен әзірлемелерді енгізу мен қолданудың шетелдік тәжірибесін зерделеуге бағытталған. Осы мақсатқа жету үшін зерттеуде мынадай міндеттер қойылды: логистика тиімділігінің индексіне салыстырмалы талдау жүргізу және жетекші елдерді анықтау; жетекші елде (Германия) логистикалық инновацияларды пайдалану тәжірибесін зерттеу; Қазақстанда шетелдік тәжірибені бейімдеу бағыттары мен жолдарын ұсыну. Зерттеудің әдіснамалық негізі ретінде автор жүйелік функционалдық, статистикалық талдауды, салыстыру мен рейтингтік бағалауды пайдаланады. Жұмыста LPI - логистика тиімділігі индексінің рейтингтік көрсеткіштерін талдау қолданылды. Авторлар Еуропа елдерін осы аталған салада инновациялық технологияларды әзірлеу және қолдану саласындағы негізгі көшбасшы ретінде бөліп көрсетеді. Осылайша, инновациялық көлік-логистикалық жүйені қалыптастырудың халықаралық тәжірибесін зерттеу қолданыстағы бағытты жаңғыртудың «жаңа» тәсілдерін анықтауға және қалыптастыруға, сондай-ақ, өңірлік ерекшеліктерді ескере отырып, стратегиялық құжаттарды әзірлеу кезінде оларды есепке алуға мүмкіндік береді. Автор шетелдік логистикада көлік-логистикалық шығындарды азайтуға, өндіріс тиімділігін арттыруға, ақпараттық және энергия үнемдеуші технологияларды енгізуге, қоршаған ортаны қорғауға бағытталған түрлі инновациялар белсенді енгізілуде екендігін көрсетеді. Әсіресе, бүгінде жаһандық дағдарыс жағдайында немесе болған кезде Covid-19 пандемиясы сияқты көптеген өндірістік мәселелерді қашықтықтан шешуді қажет ететін жағдайларда инновациялық логистиканы дамыту мәселесі туындайды. Шетелдік тәжірибе көрсетіп отырғандай, бүгінде логистикалық үдерістерді жетілдіру және дамыту үшін көптеген заманауи технологиялық шешімдер бар. Инновациялық жол негізінде көлік-логистикалық жүйені дамытудағы жетекші елдердің тәжірибесін талдау Қазақстанның даму жолдары мен перспективаларын анықтау үшін өте маңызды.

Түйін сөздер: инновациялар, көлік логистикасы, логистика тиімділігінің индексі, логистикадағы ақпараттық технологиялар, Big Data, блокчейн, жасанды интеллект.

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Зарубежный опыт внедрения и применения инноваций в транспортной логистике

Аннотация. Работа направлена на изучение зарубежного опыта применения новейших технологий и разработок в области логистики в современных реалиях. Для достижения этой цели в данном исследовании были поставлены следующие задачи: провести сравнительный анализ индекса эффектив-

ности логистики и выявить ведущие страны; изучить опыт использования логистических инноваций в лидирующей стране (Германия); сформулировать направления и пути адаптации зарубежного опыта в Казахстане. В качестве методологической основы исследования автор использует системный функциональный, статистический анализ, сравнение и рейтинговую оценку. В работе был использован анализ рейтинговых показателей индекса эффективности логистики LPI. С точки зрения географического деления мы выделили страны Европы в качестве основных лидеров в области разработки и применения новых технологий на транспорте. Таким образом, исследование международного опыта формирования инновационной транспортно-логистической системы дает возможность выявить и сформулировать «новые» подходы к модернизации действующего направления, а также учесть их при разработке стратегических документов с учетом региональных особенностей. Автор показывает, что в зарубежной логистике активно внедряются различные инновации, направленные на снижение транспортно-логистических издержек, повышение эффективности производства, внедрение информационных и энергосберегающих технологий, защиту окружающей среды. Особенно остро сегодня встает вопрос инновационной логистики в условиях глобального кризиса или в таких ситуациях, как пандемия Covid-19, когда необходимо быстро и дистанционно решать многие производственные вопросы. Зарубежный опыт показывает, что сегодня существует множество современных технологических решений для совершенствования логистических процессов.

Ключевые слова: инновации, транспортная логистика, Индекс эффективности логистики, информационные технологии в логистике, Big Data, блокчейн, искусственный интеллект.

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