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Key aspects of digital transformation of logistics companies in Kazakhstan

Abstract

Object: Identification of key aspects of using digital technologies by logistics companies in Kazakhstan.

Methods: the method of content analysis, the features of using the ICT in logistics, an analysis method, a method of graphical interpretation.

Results: The features of digitalization of business processes of logistics companies in Kazakhstan at the present stage were studied. The degree of application of digital technologies by transport and warehousing organizations and cost structure for ICT logistics companies were analyzed. The prospects and problems of using digital technologies such as blockchain, the IoT, cloud services, big data analysis technologies, robots, RFID, 3D printing in logistics and SCM were identified. The global trends in the development of digital logistics were outlined.

Conclusions: The results obtained made it possible to assess the level of digitalization of logistics processes in Kazakhstan, to identify the breadth and frequency of using ICT in logistics, to identify certain problems in the field of digital logistics of transport and warehousing enterprises.

Keywords: digitalization of logistics processes, digital technologies, ICT, Big data, RFID, Cloud logistics, Blockchain, Internet of Things.

Introduction

Recently, digital solutions have already gone beyond ICT and contributed to the emergence of new business models, types of operations, and services. The digital transformation of manufacturing and e-commerce has affected many industries, including logistics. The COVID-19 pandemic has demonstrated many challenges in transport logistics and has accelerated the automation of logistics processes.

The global digital logistics market will grow at 10.3% annually until 2028, according to the Global Market Vision report. As a result, the transition to digital logistics involves the unification of market participants within the framework of end-to-end solutions - platforms that will allow companies to link together all logistics processes on one digital platform. All developed markets are moving along this path with greater or lesser success. However, to come to digital logistics in Kazakhstan, it is important to start right now with the basic things - electronic document management, robotization of business processes, organization of transport monitoring and using of digital services.

The main research question is to identify the features of the digitalization of logistics activities in the Republic of Kazakhstan, as well as the specifics of its transformation in the context of widespread globalization and the construction of digital economies.

Literature Review

Currently, the world academic and business community pays great attention to the issues of digitalization of logistics. The use of digital technologies in the supply chain allows companies to achieve strategic competitive advantages, resulting in improved sales system efficiency (Facchini et al., 2020; Mikl et al., 2020; Szymczak, 2019; Yang & Wu, 2007; Bag et al., 2020; Edirisuriya et al., 2018). However, the introduction of digital technologies is associated not only with positive effects but also with risks (Bekmurzaev et al., 2019; Domanski, 2019; Kodym et al., 2020).

Many studies are devoted to the prospects and problems of using digital technologies such as blockchain, the IoT, big data analysis technologies, robotics, drones, self-driving cars, 3D printing in logis-

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tics and supply chain management (Barreto et al., 2017; Capocasale et al. 2021; Cimini et al. 2020; Efthymiou & Ponis 2021; Jagtap et al. 2021; Kozma et al., 2019; Saniuk et al., 2018; Silva et al., 2021).

A key role in the digitalization of certain processes in logistics companies is occupied not only by digital technologies but also by the level of competence of its employees. Often, the capabilities of the applied digital technologies are far from being fully used, which is due either to an insufficient level of knowledge and competencies of the personnel or the complexity of the technical implementation. Of interest is the study conducted by Gupta A., the purpose of which was to identify factors and calculate the index of readiness of employees for the digitalization of logistics processes in an enterprise based on the matrix approach of graph theory. The study showed that organizational factors, in contrast to behavioral and technological ones, have a strong influence on the digitalization readiness index. Sub-factors such as providing proper training for the development of functional skills, support from top management, as well as organizational culture, are the most important for the formation of employee competencies in the field of logistics (Gupta et al., 2022). The need to transform e-learning approaches, taking into account the new requirements of the labor market for training specialists in the field of digital logistics and acquiring relevant skills, such as active learning, coordination, negotiation skills, information literacy, and others, is evidenced by the results of a study by Korepin V.N. Dorozhkin E.M. Mikhaylova A.V., Davydova N.N. (Korepin et al., 2020).

Methods

The research used general scientific methods, including the content analysis method, which made it possible to reveal and structure the main scientific research related to the research of digitalization of logistics processes, the features of using the ICT in logistics; an analysis method that made it possible to assess the current state of digitalization of business processes of logistics companies in Kazakhstan; a generalization method aimed at establishing the existing relationships between the considered economic objects and phenomena; a method of graphical interpretation, which made it possible to visualize the results obtained: the main directions and systems of using ICT by organizations in the field of transport and warehousing, etc.

Results

According to statistics, the number of enterprises in the field of transport and warehousing in Kazakhstan with access to the Internet in 2021 amounted to 5333 units, an increase of 30 units compared to the previous year. It should be noted the low level of manufacturability of logistics organizations, as evidenced by the data below: only 9 enterprises use robotics, 84 organizations use digital technologies in the production process.

The analysis and accounting of big data are necessary for logistics, as it allows us to have better supply chain management, plan competently, and have a real, factual picture of the current situation at any given time. Considering the research conducted by Big Data Executive, the use of Big Data in logistics will lead to new knowledge in the field of demand forecasting, route optimization, risk management, and predictive logistics, which will reduce enterprise costs by 49.2% and stimulate innovation by 44.3%. However, in Kazakhstan, the use and analysis of big data are still at a low level. As of 2021, less than 1% of transport and warehousing enterprises (51 organizations) conduct big data analysis.

Against the backdrop of economic recovery after lockdowns and growing customer confidence, companies have become more active in entering long-term contracts with cloud providers. Thus, over the past year, the use of cloud IT services by domestic companies has increased; in 2021, 864 transport organizations used them (Figure 1).

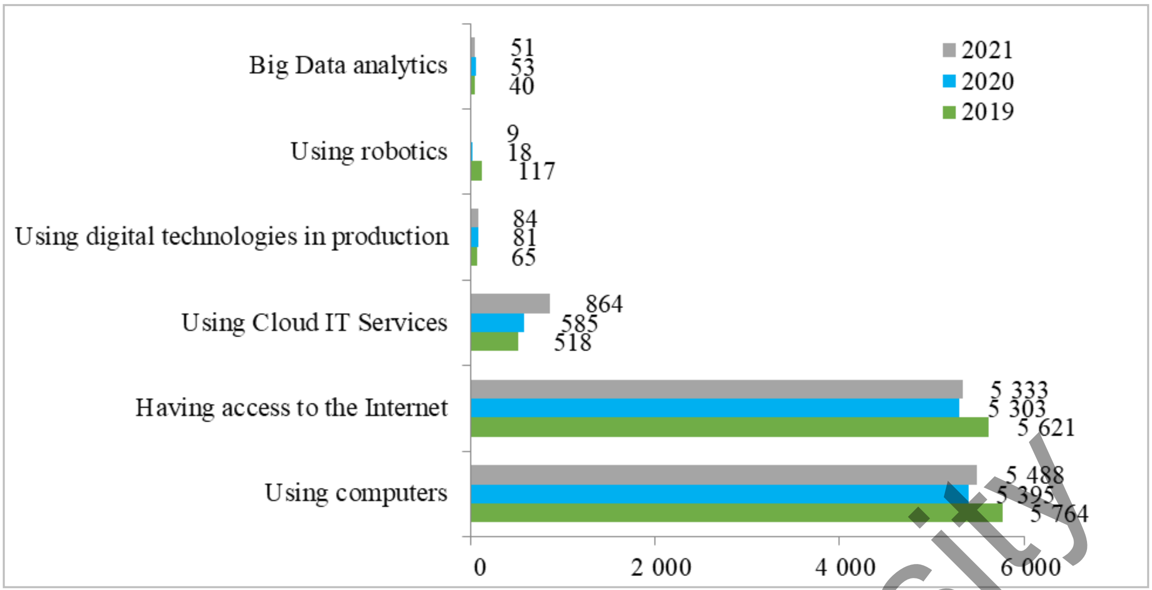

Figure 1. Main areas of ICT using by transport and warehousing organizations, units

Note – Compiled by the authors on the basis of the Bureau of National Statistics[*]

The increase in demand for cloud services is not accidental: cloud technologies allow any business, regardless of its size, to quickly deploy the necessary IT infrastructure and use their resources efficiently. Among the numerous advantages of using cloud solutions, the following can be noted: they do not require capital expenditures; allow to increase the speed and accuracy of the implementation of logistics business processes; it is possible to create a single platform for carriers and cargo owners; availability of complete, reliable and up-to-date information on all commodity and material flows in the supply chain. Thus, domestic companies are increasingly moving to a service model and moving their workspaces to the cloud.

Almost all transport and warehousing companies in Kazakhstan use electronic invoices (Figure 2).

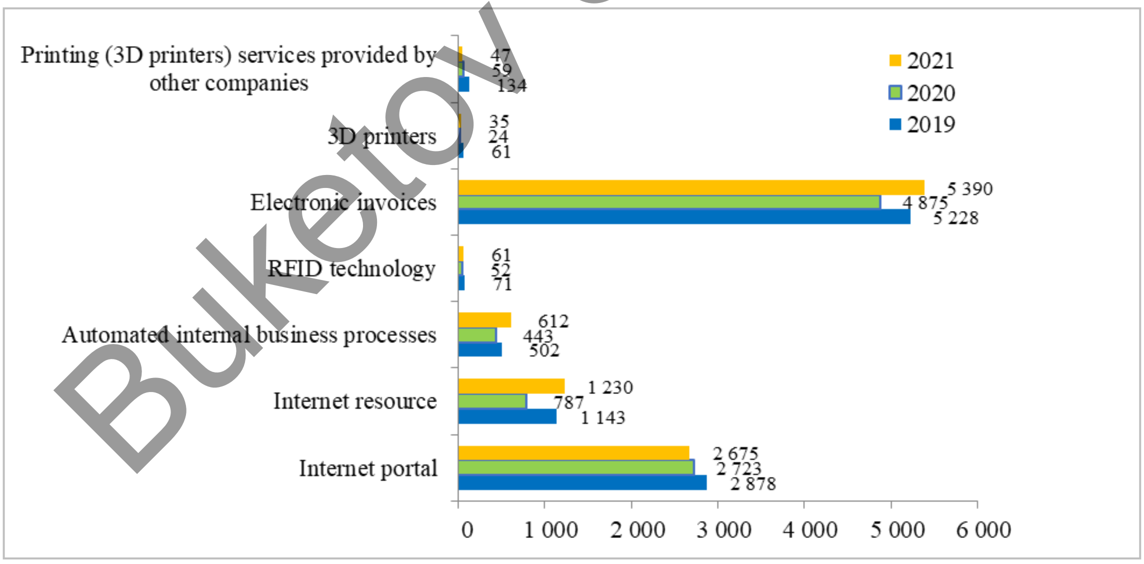

Figure 2. Use of information technology systems by transport and warehousing organizations, units (number of organizations)

Note – Compiled by the authors on the basis of the Bureau of National Statistics[†]

According to experts, the traditional supply chain will be significantly reformatted in the future due to the development of 3D Printing. Currently, about 80 logistics companies use 3D Printing technology in Kazakhstan.

[*] https://stat.gov.kz/
[†] https://stat.gov.kz/

There are many tools and technologies for managing and optimizing inventory control. One such technology is radio frequency identification technology or RFID (Radio Frequency Identification). Owing to fundamentally new possibilities for identifying and tracking cargo using RFID technology, the entire life cycle of cargo can be significantly optimized. Unfortunately, despite such benefits from the use of RFID technology in supply chains as increased transparency of the supply chain, reduced costs and increased speed of turnover, improved data collection process, improved supply chain, in Kazakhstan so far only a small proportion of logistics companies use this technology – no more than 70 companies.

Even though companies are aware of the need to use digital technologies in supply chains, the level of digitalization of logistics remains at a consistently low level. As statistics show, most domestic companies use the usual channels of communication with customers and business partners: social networks. A low share of companies integrated into international Internet booking systems (Figure 3).

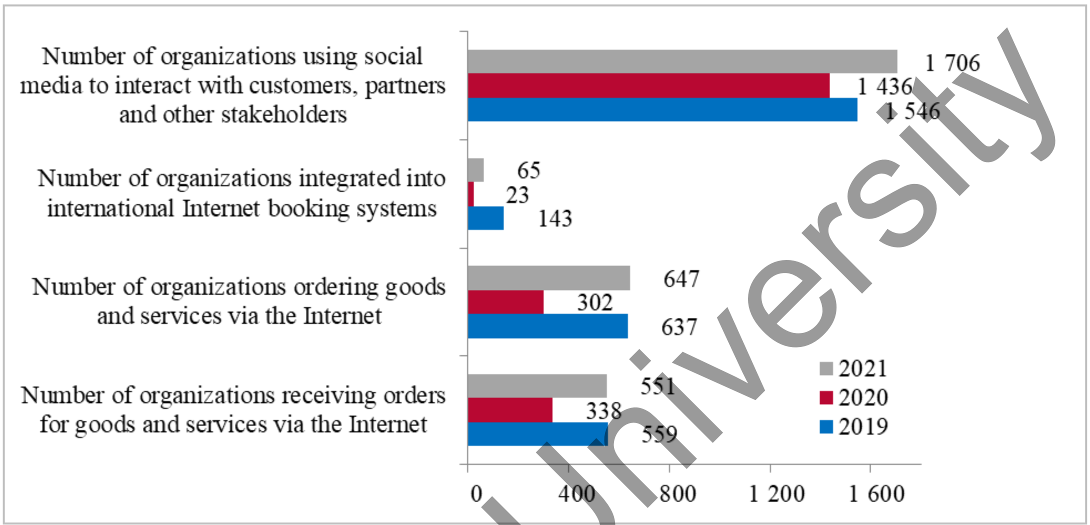

Figure 3. Using of the Internet by transport and warehouse organizations, units

*Note – Compiled by the authors on the basis of the Bureau of National Statistics**

In general, transport and warehousing enterprises in the Republic of Kazakhstan annually spend about 28–37 billion tenge on the digitalization of business processes (in 2019 – 37 billion tenge, in 2020 – 32 billion tenge, in 2021 – 28.5 billion tenge). The cost structure for ICT of logistics companies is as follows: acquisition of software used based on a license agreement – 21.4%; independent software development within the organization – 0.5%; employee training related to the development and use of ICT – 0.4%; payment for services of third-party organizations and specialists related to information technology (except for communication and training services) – 44.9%; other expenses – 32.8%. It should be noted that companies spend almost half of their total costs on attracting third-party organizations and IT specialists. There is a shortage of qualified IT personnel in logistics. Thus, according to statistics, Kazakhstani transport and warehousing companies are in constant need of IT specialists: in 2021 the companies needed 254 specialists.

In the near future, the logistics industry is expected to experience a huge increase in digitalization with the following new technologies:

1. e-AWB is a standardized digital version of the existing paper air waybill that follows the shipment from the shipper until delivery. e-AWB significantly improves the efficiency of cargo tracking and processing, as well as increases transparency, improves security, reduces costs and delays. Figure 4 shows the percentage of countries using e-AWB.

* https://stat.gov.kz/

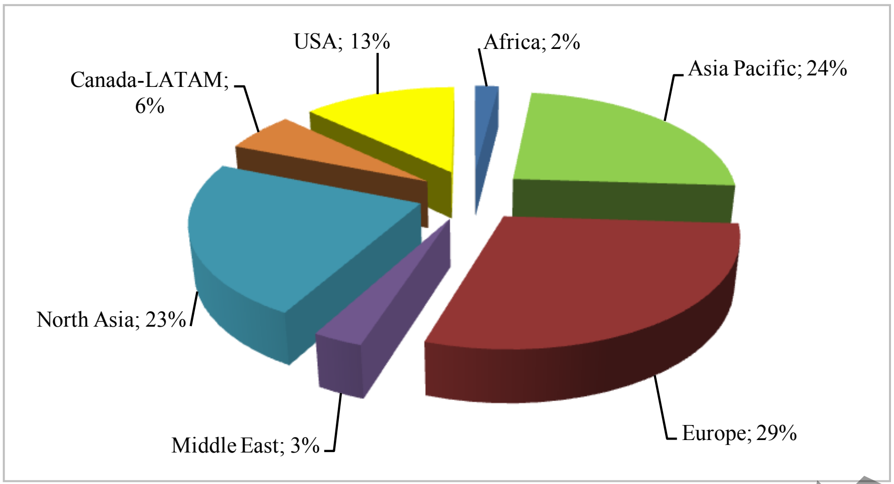

Figure 4. Users of electronic air waybills*

IATA announced the e-AWB as its default transportation contract in early 2020. Major airlines, such as Lufthansa and Emirates, Delta Airlines, and United Airlines, have already implemented it.

Kazakhstan demonstrates progress in implementing e-AWB among the EAEU countries. The e-Freight implementation project was included in the Digital Kazakhstan 2020 program to speed up the process of handling air cargo. The e-Freight information system is designed to replace the currently existing paper documents with the corresponding electronic documents and messages in the preparation, processing, and execution of the carriage of goods by air. The implementation of the project will improve the efficiency of documentation for air cargo transportation, reduce the processing time for cargo operations and increase the attractiveness of air cargo transportation, and transit through the territory of the Republic of Kazakhstan. The international standard for air cargo transportation e-Freight is currently being successfully applied at the International Airport of Almaty, Nur-Sultan with the connection of Turkish Airlines and Air Astana, the freight forwarder Asia-freight. In 2020, 84738 electronic air waybills were processed in the system, 17 airlines and 15 airports were connected, work was carried out to add new and update the existing functionality of the system†.

The information system according to the e-Freight standard unites all airlines, airports, freight forwarders into a single process of air cargo transportation in the Republic of Kazakhstan, which includes import, export, transit operations, and all domestic flights to the EAEU. The air waybill confirms the contract between the carrier and the consignor for the carriage of goods and confirms the acceptance of the goods by the air carrier. Naturally, in this process, problems such as the loss of documents, confusion in copies (their number reaches from 8 to 30, the first 3 of them are originals) may arise. To prevent losses in case of loss of documents, search for the necessary cargo, and to prevent the suspension of the work of carriers and ground services, it was decided to transfer air waybills to electronic form. The benefits of e-AWB include paper savings; acceleration of cargo handling processes due to single data entry; improving the quality of transmitted information; improving the quality of the cargo tracking service.

2. Big data and machine learning will make a huge contribution to the development of logistics. Big data technology allows us to efficiently receive, integrate, store, and use data generated by supply chain agents. Modern big data analytics technology can be divided into four important elements: 1) data storage; 2) data processing; 3) data visualization; 4) data analytics for decision-making.

Big Data models reveal new opportunities for improving the efficiency of decision-making, for example, improving relationships with suppliers and preventing possible supply problems, their active use in modeling new autonomous business models to increase the level of integration of business processes throughout the supply chain, while managing risks in supply chains, and to accelerate and improve decision making across all business processes in the supply chain. At the same time, more attention is paid to barriers to the availability and processing of data, which are becoming key for the further development of companies. It is also worth noting that a significant proportion of research concerns route optimization using large data-

* Angel Mitev. Five key technologies for immediate digital transformation in logistics /Электронный ресурс /URL: https://www.itproportal.com/features/five-key-technologies-for-immediate-digital-transformation-in-logistics/

† https://www.gov.kz/memleket/entities/miid/press/news/details/153034?lang=ru

base analytics technology. In this case, traffic data, weather conditions, geolocation, etc. are analyzed. Finally, the analytics of large databases has a positive effect on the resilience of supply chains.

3. Cloud logistics. Cloud logistics technology is being implemented quickly, already 50% of logistics service providers use cloud services, and another 20% plan to implement it. Cloud technologies make it possible to conduct a tender among contractors; build optimal routes; plan and manage delivery; store and process all transportation data in the cloud.

All supply chain information will be stored in the cloud, creating a single integrated global overview. All enterprises and transport companies are united in a single system that allows us to find each other, control the delivery process and evaluate work efficiency. The use of cloud solutions in transport (WMS-systems) and warehouse (YMS-systems) logistics is promising, which allowed Amazon (AWS) to increase its revenues by 43%.

4. The Internet of Things (IoT) will allow almost any object to be connected to the Internet, wherever it is, which means complete transparency from sender to delivery. Intelligent connected trucks will collect data on their movements and downtime for dynamic route planning and maximum fleet utilization, as well as reducing maintenance costs by monitoring the condition of vehicles.

5. Blockchain. Blockchain technology has huge potential. Distributed database technology decentralizes data, increasing transparency and traceability, providing each participant in the chain with keys to vital information about the product journey. By reducing complexity and removing trade barriers, this could lead to a 5 percent increase in global GDP and a 15 percent increase in world trade.

According to the research by Deloitte, 59% of surveyed companies believe that blockchain technology can transform the economy and business processes of an organization. 52% of respondents are ready to implement this technology in their activities*.

Discussions

Logistics is one of the most conservative sectors of the Republic of Kazakhstan, and the level of digitalization here is significantly lower than, for example, in the banking sector. However, in the opinion of many analysts, Kazakhstani business is beginning to cautiously experiment with IT technologies. While the projects are limited to the automation of individual processes, the fact that implemented cases appear on the market and there are more of them is a positive thing. For example, Kazpost JSC is piloting an ecosystem of digital services, which will allow in the future to digitize all the company's services - from parcel delivery to payment acceptance. Digitalization departments appear in large logistics companies. There are startups developing solutions for logistics. Further research will be aimed at studying the ecosystems of digital services of large logistics companies in Kazakhstan.

Conclusions

The study results made it possible to assess the level of digitalization of logistics processes in Kazakhstan, to identify the breadth and frequency of using the information and communication technologies in logistics and certain problems in the field of digital logistics of transport and warehousing enterprises. In general, the changes caused by IT technologies dictate the inevitable digitalization of logistics processes, and this, in turn, and creates strategic importance for the development of the infrastructure of the digital economy of our country. However, the country has a low level of technological effectiveness of logistics organizations, a small proportion of companies use digital technologies such as Big Data, RFID, Blockchain, 3D Printing, there is a clear lack of qualified IT personnel in logistics.

References

Bag, S., Gupta, S., & Luo, Z.W. (2020). Examining the role of logistics 4.0 enabled dynamic capabilities on firm performance. *International Journal of Logistics Management*, *31*(3), 607–628. https://doi.org/10.1108/ijlm-11–2019–0311

Barreto, L., Amaral, A., & Pereira, T. (2017, Jun 28–30). Industry 4.0 implications in logistics: an overview. *Procedia Manufacturing*. *7th Manufacturing-Engineering-Society International Conference (MESIC),* Vigo, Spain.

Bekmurzaev, I., Kurbanov, A., Kurbanov, T., Plotnikov, V., Ushakova, E., & Publishing, I.O.P. (2019, Nov 21–22). Digital technologies of marketing logistics and risks of their implementation in supply chain. *IOP Conference Series-Materials Science and Engineering*. *International Scientific Conference on Digital Transformation on Manufacturing, Infrastructure and Service (DTMIS),* St. Petersburg, Russia.

* Top 5 blockchain projects in the field of logistics. Analytical material Digital forest blog / Electronic resource /URL: https://digiforest.io/blog/blockchain-in-logistics

Capocasale, V., Gotta, D., Musso, S., & Perboli, G. (2021, Jul 12–16). A Blockchain, 5G and IoT-based transaction management system for Smart Logistics: an Hyperledger framework. *Proceedings International Computer Software and Applications Conference. 45th Annual International IEEE-Computer-Society Computers, Software, and Applications Conference (COMPSAC),* Electr Network.

Cimini, C., Lagorio, A., Romero, D., Cavalieri, S., & Stahre, J. (2020, Jul 11–17). Smart Logistics and The Logistics Operator 4.0. *21st IFAC World Congress on Automatic Control — Meeting Societal Challenges,* Electr Network.

Domanski, R. (2019, Oct 10–11). logistics 4.0 in Warehousing — current state and trends. *Proceedings of International Scientific Conference Business Logistics in Modern Management. 19th International Scientific Conference on Business Logistics in Modern Management,* Osijek, Croatia.

Edirisuriya, A., Weerabahu, S., Wickramarachchi, R., & Ieee. (2018). Applicability of Lean and Green Concepts in Logistics 4.0: A Systematic Review of Literature. *2018 International Conference on Production and Operations Management Society (Poms).*

Efthymiou, O. K., & Ponis, S. T. (2021). Industry 4.0 Technologies and Their Impact in Contemporary Logistics: A Systematic Literature Review. *Sustainability*, *13*(21), Article 11643. https://doi.org/10.3390/su132111643

Facchini, F., Oleskow-Szlapka, J., Ranieri, L., & Urbinati, A. (2020). A Maturity Model for Logistics 4.0: An Empirical Analysis and a Roadmap for Future Research. *Sustainability*, *12*(1), 18, Article 86. https://doi.org/10.3390/su12010086

Gupta, A., Singh, R. K., & Gupta, S. Developing human resource for the digitization of logistics operations: readiness index framework. *International Journal of Manpower*, 25. https://doi.org/10.1108/ijm-03–2021–0175

Jagtap, S., Bader, F., Garcia-Garcia, G., Trollman, H., Fadiji, T., & Salonitis, K. (2021). Food Logistics 4.0: Opportunities and Challenges. *Logistics-Basel*, *5*(1), Article 2. https://doi.org/10.3390/logistics5010002

Kodym, O., Kubac, L., & Kavka, L. (2020). Risks associated with Logistics 4.0 and their minimization using Blockchain. *Open Engineering*, *10*(1), 74–85. https://doi.org/10.1515/eng-2020–0017

Korepin, V. N., Dorozhkin, E. M., Mikhaylova, A. V., & Davydova, N. N. (2020). Digital Economy and Digital Logistics as New Area of Study in Higher Education. *International Journal of Emerging Technologies in Learning*, *15*(13), 137–154. https://doi.org/10.3991/ijet.v15i13.14885

Kozma, D., Varga, P., Hegedus, C., & Ieee. (2019, Mar 02–04). Supply Chain Management and Logistics 4.0-A Study on Arrowhead Framework Integration. *8th International Conference on Industrial Technology and Management (ICITM),* Cambridge, England.

Mikl, J., Herold, D. M., Cwiklicki, M., & Kummer, S. (2020). The impact of digital logistics start-ups on incumbent firms: a business model perspective. *International Journal of Logistics Management*, *32*(4), 1461–1480. https://doi.org/10.1108/ijlm-04–2020–0155

Oran, I. B., & Cezayirlioglu, H. R. (2021). AI — robotic applications in logistics industry and savings calculation. *Journal of Organizational Behavior Research*, *6*(1), 148–165. https://doi.org/10.51847/jUXQmvCvqf

Radivojevic, G., & Milosavljevic, L. (2019, May 23–25). The concept of Logistics 4.0. *4th Logistics International Conference (LOGIC)*, Belgrade, Serbia.

Samir, T., Abdelsamad, C., ElAlami, J., & Acm. (2019, Oct 02–04). Big Data analysis from the Smart-Logistics for Smart-Cities. *4th International Conference on Smart City Applications (SCA),* Casablanca, Morocco.

Saniuk, S., Graczyk, M., Kulyk, P., & Ltd, T. (2018, Dec 03–05). Challenges of logistics in the concept of industry 4.0. *8th Carpathian Logistics Congress on Logistics, Distribution, Transport and Management (CLC),* Prague, Czech Republic.

Silva, N., Barros, J., Santos, M. Y., Costa, C., Cortez, P., Carvalho, M. S., & Goncalves, J. N. C. (2021). Advancing Logistics 4.0 with the Implementation of a Big Data Warehouse: A Demonstration Case for the Automotive Industry. *Electronics*, *10*(18), Article 2221. https://doi.org/10.3390/electronics10182221

Szymczak, M. (2019, Jun 27–29). Digital smart logistics. Managing supply chain 4.0: concepts, components and strategic perspective. *European Proceedings of Social and Behavioural Sciences. 15th International Strategic Management Conference (ISMC),* Poznan, Poland.

Yang, A. M., & Wu, J. P. (2007). The study and design of digital logistics system. *Proceedings of the 4th International Conference on Innovation & Management, Vols I and Ii*, 1584–1587.

Д.Г. Мамраева, А.В. Бабкин, Л.В. Ташенова, Б.Ш. Кульжамбекова

Қазақстандағы логистикалық компаниялардың цифрлық трансформациясының негізгі аспектілері

Аңдатпа

Мақсаты: Қазақстандағы логистикалық компаниялардың цифрлық технологияларды қолдануының негізгі аспектілерін анықтау.

Әдісі: Зерттеу мақсатына жету үшін мына әдістер қолданылды: логистикалық процестерді цифрландыруды, логистикадағы ақпараттық-коммуникациялық технологияларды пайдалану ерекшеліктерін зерттеуге байланысты негізгі ғылыми зерттеулерді ұйымдастыруға және құрылымдауға мүмкіндік берген мазмұнды–талдау әдісі; Қазақстандағы логистикалық компаниялардың бизнес-процестерін цифрландырудың ағымдағы жағдайын бағалауға мүмкіндік берген талдау әдісі; алынған нәтижелерді визуализациялауға мүмкіндік беретін графикалық интерпретация әдісі.

Қорытынды: Қазіргі кезеңдегі Қазақстандағы логистикалық компаниялардың бизнес-процестерін цифрландырудың ерекшеліктері зерттелді. Көлік және қойма ұйымдарының цифрлық технологияларды қолдану дәрежесі; логистикалық компаниялардың АКТ үшін шығындар құрылымы талданды. Логистикада және жеткізу тізбегін басқаруда блокчейн, интернет заттары, бұлттық сервистер, үлкен деректерді талдау технологиялары, роботтар, RFID, 3D басып шығару сияқты цифрлық технологияларды қолданудың келешегі мен мәселелері айқындалды. Цифрлық логистиканы дамытудың жаһандық тенденциялары көрсетілген.

Тұжырымдама: Алынған нәтижелер Қазақстандағы логистикалық процестерді цифрландыру деңгейін бағалауға, логистикада ақпараттық-коммуникациялық технологияларды қолданудың ауқымы мен жиілігін анықтауға, көлік және қойма кәсіпорындарының цифрлық логистикасы саласындағы жекелеген проблемаларды анықтауға мүмкіндік берді.

Кілт сөздер: логистикалық процестерді цифрландыру, цифрлық технологиялар, АКТ, Big data, RFID, Cloud logistics, Blockchain, интернет заттары.

Д.Г. Мамраева, А.В. Бабкин, Л.В. Ташенова, Б.Ш. Кульжамбекова

Ключевые аспекты цифровой трансформации логистических компаний Казахстана

Аннотация:

Цель: Выявление ключевых аспектов применения цифровых технологий логистическими компаниями Казахстана.

Методы: Для достижения цели исследования использованы следующие методы: метод контент-анализа, который раскрыл и структурировал основные научные исследования, связанные с изучением цифровизации логистических процессов, особенностей применения информационно-коммуникационных технологий в логистике; метод анализа, давший возможность оценить современное состояние цифровизации бизнес-процессов логистических компаний в Казахстане; метод графической интерпретации, позволивший наглядно представить получаемые результаты.

Результаты: Рассмотрены особенности цифровизации бизнес-процессов логистических компаний в Казахстане на современном этапе. Проанализирована степень применения цифровых технологий организациями транспорта и складирования; структура затрат на ИКТ логистических компаний. Выявлены перспективы и проблемы применения в логистике и управлении цепями поставок таких цифровых технологий, как блокчейн, Интернет вещей, облачные сервисы, технологии анализа больших данных, роботы, RFID, 3D-печать. Обозначены глобальные тренды развития цифровой логистики.

Выводы: Полученные результаты позволили дать оценку уровню цифровизации логистических процессов в Казахстане, выявить широту и частоту применения информационно-коммуникационных технологий в логистике, обозначить те или иные проблемы в сфере цифровой логистики предприятий транспорта и складирования.

Ключевые слова: цифровизация логистических процессов, цифровые технологии, ИКТ, Big data, RFID, Cloud logistics, Blockchain, Интернет вещей.