Received on: 29 December 2022 Revised on: 18 February 2023 Accepted: 30 March 2023

RESEARCH ARTICLE
DOI: 10.47703/ejebs.v1i67.255

Digital Technologies in the Transport and Logistics Industry: Barriers and Implementation Problems

Elmira E. Baimukhanbetova[1] | **Rashid O. Tazhiyev**[1]* | **Urikkul D. Sandykbayeva**[1] | **Aruzhan K. Jussibaliyeva**[2]

[1] al-Farabi Kazakh National university, Almaty, Kazakhstan

[2] LLP Scientific and Production Enterprise Innovator, Astana, Kazakhstan

Corresponding author:
*** Rashid O. Tazhiyev -** Phd candidate, Al-Farabi Kazakh National University, Almaty, Kazakhstan. Email: rashidpostt@gmail.com

For citation: Baimukhanbetova, E.E., Tazhiyev, R.O., Sandykbayeva, U.D. & Jussibaliyeva, A.K. (2023). Digital Technologies in the Transport and Logistics Industry: Barriers and Implementation Problems. Eurasian Journal of Economic and Business Studies, 67(1), 82-96.

Conflict of interest: author(s) declare that there is no conflict of interest.

Abstract

This article is devoted to identifying the positive and negative sides and difficulties in transport and logistics companies during digital technologies implementation in their activities Developing a digital ecosystem in logistics and distribution of goods is becoming the key to efficient transport operations. Digitalization increases the efficiency of the main processes of transport and logistics services, improves the accuracy of planning and forecasting, and processes incoming requests for goods delivered at high speed. This study used a qualitative research method, and interviews were conducted with experts in the transport and logistics field. The data was coded according to the following indicators: the digital mode, barriers and challenges for implementing digital systems in logistics, benefits of using digital technologies. The MAXQDA software was used to analyze the interviews. It was revealed that the lack of qualified personnel, lack of funding and external factors (political situation, business environment, government support, etc.) have a significant negative impact. Additionally, digital technologies used by some foreign and local organizations are determined. Additionally, statistical data on strategic planning and reforms of the Republic of Kazakhstan 2016-2021 were used. The study results can be used by logistics companies and companies involved in cargo transportation and state bodies, the Ministry of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan, to further develop the digitalization process in the country.

Keywords: Digitalization, Logistics, Digital Technologies, Innovations, Strategy, Cargo Transportation, Economics, Transport, Transportation Economics

SCSTI: 73.31.75
JEL Code: L91, O32, O33

Financial support: The study was not sponsored

1. INTRODUCTION

In the 21st century, businesses mostly rely on digitalization. Especially if it relates to international communication and strives for the status of the client-oriented industry, it is essential to explore how IT has changed the sphere of cargo transportation and what principles help move the industry forward using the example of Kazakhstan.

The Kazakhstani sphere of cargo transportation begins an active transformation. Companies need to reduce logistics costs and ensure fast and uninterrupted delivery. In addition, almost all modern cargo transportation is based on IT and the widespread digitalization of processes, from communication with the client to the direct implementation of orders.

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 retail or banking. However, looking back at the experience of other countries, business is beginning to experiment cautiously with IT technologies. So far, projects are limited to the automation of individual processes. However, the fact that implemented cases appear on the market and there are more of them is a positive signal. For example, Kazpost JSC is piloting an ecosystem of digital services, allowing 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.

According to the Global Market Vision, the global digital logistics market will grow by 10.3% annually until 2028. In order to come to digital logistics, it is necessary to unite all participants in one place, i.e. a platform is needed, in other words, a single digital platform. What many developed countries are striving for. In order to come to digital logistics, we need to start with basic things, such as electronic document management, robotization of business processes, organization of transport monitoring and the use of digital services.

Today, essential digitalization tools are already being used in Kazakhstan, and the following trends have been outlined that affect the sphere of cargo transportation in Kazakhstan in five directions.

Transitioning to electronic document management requires the practical introduction of digital tools, and preparations must be made in advance to implement a digital ecosystem. Therefore, it is necessary to follow several steps to carry out basic automation. The introduction of electronic document management (EDM) is among the essential steps towards automation, which also reduces the cost of printing and sending documents and the time for their creation and processing by 1.5 times. This changes the document exchange and delivery structure and speeds up the delivery and payment process for carrier services.

According to the level of e-government development UN rating, Kazakhstan is in 29th place, allowing a transition towards paperless interaction with the state. This active transition to electronic document management involves all industries, including logistics (Ghosh, 2015).

The next is the automation of the working process, which excludes manual work of data entering, for example, reports or notifications generation. It reduces labor costs or expenses on logistics and functions as another solution on the market to perform human actions that can be algorithmized automatically. It is expected that by 2027 automation system segment of the global IT market will be increasing annually by 40% (e.g. artificial intelligence, platforms that do not require writing code to create IT solutions etc.)

Monitoring the delivery process makes logistics chains more complex by setting the requirements of counterparties to the speed and quality of delivery, making it more challenging. The transportation process must be uninterrupted. Human factors often cause delays. Consequently, companies with a fleet of vehicles are beginning to implement vehicle-monitoring systems using GPS trackers. Internet of things technologies is one of the essential tools for the digitalization of logistics in the world. They allow to build of optimal routes and monitor cargo

movement in real time.

Among the key factors of sustainable economic development of the state, an important role is played by an established system of physical distribution of inventory items between suppliers and consumers. Apart from that, digitalization increases the efficiency of the main processes of transport and logistics services, improving the accuracy of planning and forecasting and processing incoming requests for the delivery of goods with high speed. Moreover, it allows the selection of the most appropriate type of vehicle concerning the characteristics of the goods, analyzing and determining rational transportation routes, etc.

The work of Moldabekova et al. (2020) showed that interest in the study of digitalization in the field of logistics began in 2018. In the works of some scientists, a conceptual justification for the use of modern technologies in the development of logistics is carried out, where they explored the theoretical basis for the application of innovation in logistics (Barreto, 2017; Hofmann, 2017; Asdecker, 2018). Others studied the formation and development of Logistics 4.0 (Schmidtke et al., 2018; Oleskow-szlapka, 2018). There have also been studies aimed at studying the impact of digital technologies on improving the efficiency of logistics operations and services (Revindran, 2020; Sun et al.,2020; Gölzer,2017). In addition, different research methods were used, such as regression analysis based on panel data (Liu et al., 2018), different indicators were considered. The issue of digitalization in the transport and logistics industry is certainly important, so there is a need to consider expert opinion for the further development of this industry, identifying and overcoming the problems and barriers faced by companies and the state. Today, the development of e-commerce in road freight transportation is of particular importance. This process is based on the fact that there is an optimization of information transmission through electronic mechanisms. The development of a digital ecosystem in the logistics and distribution of goods is becoming the key to efficient transport operations. Therefore, it is important to study the impact of digital ecosystems of transport and logistics services on the management of road freight transport. There is an extreme need to expand the potential of logistics as part of the process of developing modern digital ecosystems of transport and logistics services. Therefore, the current study is aimed at what transporting and logistics companies face during the introduction of digital technologies in their activities. The question of the study is what are the difficulties, negative and positive aspects of the introduction of digital technologies in transport and logistics companies. This study attempts to answer this question through an expert interview.

2. LITERATURE REVIEW

In order to understand the process of digitalization, three terms were developed: digitization, digitalization and digital transformation. According to Unruh, et al (2016), the process begins with digitization - the transfer of products to digital form and the emergence of inventions. Thus, representatives of the music and financial industries were the first to digitize products (Unruh et al., 2016)

Distributed ledger systems, better known as blockchains, are decentralized digital databases (DBs) that record every data transfer on their network. When connected to the network, each participant's computer becomes its node and works with its copy of the database, synchronizing it. Every transaction is confirmed by all users, eliminating the need for a third-party approver (Konstantinidis et al. 2018).

Deeveloping a “digital twin” creates the possibility of developing, testing, manufacturing and using a product in a virtual environment (Grieves et al., 2017). This includes simulating various processes that occur with the product. Some scientists define this technology as an integrated multi-physics, multi-scale probabilistic simulation of a finished product, system or process that can reflect the life of its “twin” using physical models, historical data, real-time data, and more (Glaessgen et al., 2012).

NASA was the first to talk about the problem of big data processing in 1997 when scientists faced the difficulty of managing large amounts of information (Aryal et al., 2018). However, a well-established term that defines "big data" meaning has not yet emerged, which is why interpretations vary. Despite the lack of a single term, one of the first analysts to talk about big data, Laney (2001), identified three dimensions characteristic of big data: volume, speed and variety. Volume refers to the increase in indicators collected from sources. Speed means minimizing the time interval between information collection and its entry into processing. Diversity implies differences in data formats, interpretations, and lack of structure (Laney, 2001). Thus, "big data" does not mean technology but a particular data characteristic. Big data technologies refer to the methods of their collection, storage and analysis (Watson, 2014).

There are a vast number of applications of big data analytics both in business and in other areas of activity. Three areas can be distinguished in business. First, operational efficiency: with the help of big data processing, it is possible to increase the level of transparency, quality and efficiency of processes and optimize the use of resources. Secondly, improving customer experience: processing big data increases customer loyalty, more clearly segments consumers and improves their interaction quality. Third, big data opens opportunities to change business models, increasing revenue streams and creating new ones (Gosh, 2015).

Within supply chain management, potential applications include supplier risk management, demand forecasting, logistics activity planning, transport and inventory management, and return logistics. The following possible effects from the introduction of big data analytics are distinguished: an increase in chain transparency, an increase in operational efficiency and productivity, an increase in elasticity, flexibility and responsiveness, sustainability and innovative potential of the supply chain (Tiwari et al., 2018; Nguyen et al., 2018).

Discussions about this technology have been going on for a long time, and the essence is clear from the name. In its simplest form, it is one or more means of moving people or goods, operating on the basis of the readings of various sensors. Despite the general essence, these mechanisms are called differently depending on the purpose. For example, the automated guided vehicle usually refers to the means used in production (Dotoli et al., 2004), although in some works, warehouses are also added (deKoster 2018).

This group includes developments that automate the management of handling equipment, trucks and other means of movement that play a vital role in the logistics business. A study by Moldabekova et al. (2021) showed that the digital transformation of logistics services is just beginning. In this regard, it is difficult to assess the aspects of the impact of modern technology on the development of transport and logistics in Kazakhstan, identified on the basis of the analysis of scientific literature. Transport and warehousing companies should invest more heavily in digitalization.

Satybaldin et al. (2022) conducted a cluster analysis of the transport and logistics potential of the regions of Kazakhstan on 11 indicators. An analysis of the transport and logistics potential of the regions in terms of transport infrastructure showed that Almaty, Karaganda, Aktobe, Akmola regions, and Almaty have good indicators; according to logistical indicators: Karaganda, Atyrau, Pavlodar, East Kazakhstan regions, Almaty city; by economic indicators: Atyrau, Almaty, Turkestan regions, Almaty city. Karaganda, East Kazakhstan, Almaty, Atyrau regions and the city of Almaty are leading in the ranking of the transport and logistics potential. In addition, the transport and logistics infrastructure of the regions of Kazakhstan requires comprehensive modernization.

Summing up the literature review results, logistics companies are actively implementing the five areas: the internet of things, cloud technologies, artificial intelligence, automated systems and information security.

Internet of things controls, analyzes and optimizes processes at all stages of the supply chain

and the effectiveness of operations. Cloud technologies scale the entire infrastructure and services without a fundamental resource increase. Artificial intelligence optimizes internal processes and helps build new models of customer interaction. Also, with the help of data analysis technologies and Big Data, artificial intelligence quickly analyzes and predicts many indicators based on a large amount of data. Automated systems allow employees to unload routine operations and accounting information and increase the efficiency and motivation of manual labor in the office. For many operations, it is possible to introduce physical robots in warehouses. The development of unmanned vehicles or delivery by drones can also be called promising. Information security is one of the main directions. The high level of automation and digitalization in the company requires special attention to the stability of the service and the safety of company and customer data. All these technologies are used at every stage of the logistics process, in warehouse management systems, in the process of goods movement, for monitoring and tracking shipments.

3. METHODOLOGY

Conducted literature review showed that digital ecosystem introduction in logistics is undergoing significant changes. Different stages of digitalization implementation provide different obstacles and advantages. Therefore, it is essential to explore Kazakhstan's current situation and analyze it. Statistical data analysis on the logistics digitalization process in Kazakhstan will be conducted. Data will be collected from open sources.

The second part of the research includes semi-structured expert interviews. A semi-structured one-on-one interview is a type of individual in-depth interview. This is a semi-structured interview to know an individual's opinion about a particular situation. Eight interviews were conducted, and the and the interview duration was from 20 minutes to 1 hour. The qualitative research method will include interviews or questionnaires among logistics company management staff. The interview/questionnaire will be developed based on the studied works of foreign and local scientists Malhene (2012) and Kraoyci (2018). There were five main questions, but during the interview they were supplemented by other questions. The questionnaire focused on analyzing logistics' digitalization characteristics and covered three main directions: digital mode of the infrastructure of logistics ecosystems, barriers and challenges to implementing digital systems in logistics, and the advantage of digital technologies usage. MAXQDA software for qualitative research analysis will be used for the interview analysis.

Following the ethical issues, individual interviews were conducted as experts might share private information about their companies' management systems. The experts were informed that they could stop the interview if they felt uncomfortable or missed questions they accepted as unappropriated. During the interview, there were made notes which were later processed with MAXQDA software.

The interview results will be analyzed in four main digital logistics ecosystem development directions: automated control, digitalization impact, digitalization barriers and current logistic disadvantages (Figure 1).

The automated control will be analyzed in two directions. First, there will be an analysis of the digital technologies application advantage. Second, there will be analyzed the utility of various software applied in the system of management.

Digitalization impact is focused on analyzing the advantages of logistic ecosystem digitalization, mainly in management, interaction, and optimization processes.

Digitalization barriers and disadvantages will include issues the digitalization of the logistics ecosystem is facing.

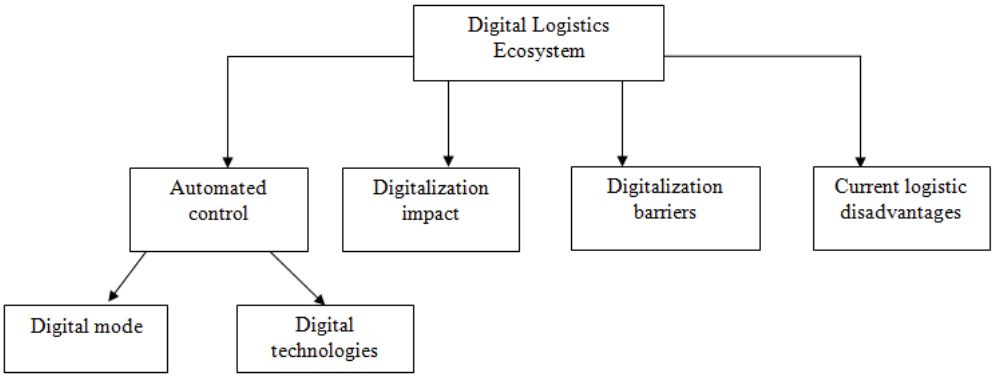

FIGURE 1. Digital logistics ecosystem in Kazakhstan

Note: compiled by the authors

4. FINDINGS AND DISCUSSION

The growing adoption of the internet of things (IoT) and artificial intelligence (AI) in the automotive logistics sector is expected to drive market growth. Benefits associated with automation in the logistics sector, such as increased accuracy and reduced errors in product handling, real-time freight rates, accurate real-time freight data analysis, improved customer experience, growth in retail, e-commerce, and healthcare, as well as growth in investment and product launches in the logistics automation sector. Further, demand in the logistics automation market is expected to increase during the forecast period. For example, Swan Leap Inc. offers a transportation management system that uses artificial intelligence to provide real-time visibility into the supply chain to optimize the entire logistics process.

However, the high initial cost of hardware and software components used in logistics automation is expected to hold back the growth of the global logistics automation market during the forecast period.

In figure 2, there is presented data on the logistic automation market.

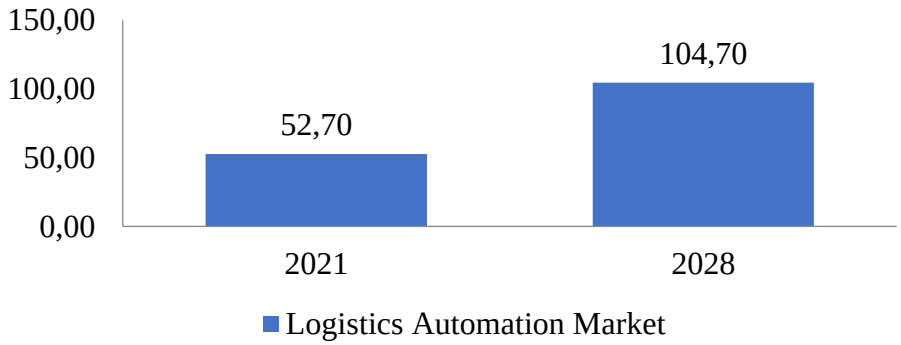

FIGURE 2. Logistic automation market, billion USD

Note: compiled according to source Research and market (2022)

According to Global Market Vision forecasts, the global digital logistics market will grow by 10.3% annually until 2028 amounting to $104.7 billion. (Fig.2). This suggests that the market is overgrowing. As a result of the process of digitalization of logistics, all participants in this industry will unite in the transition to a single digital platform. Digital logistics involves the unification of market participants within the framework of end-to-end.

Figure 3 presented information on cargo transportation by all modes of transport in Kazakhstan

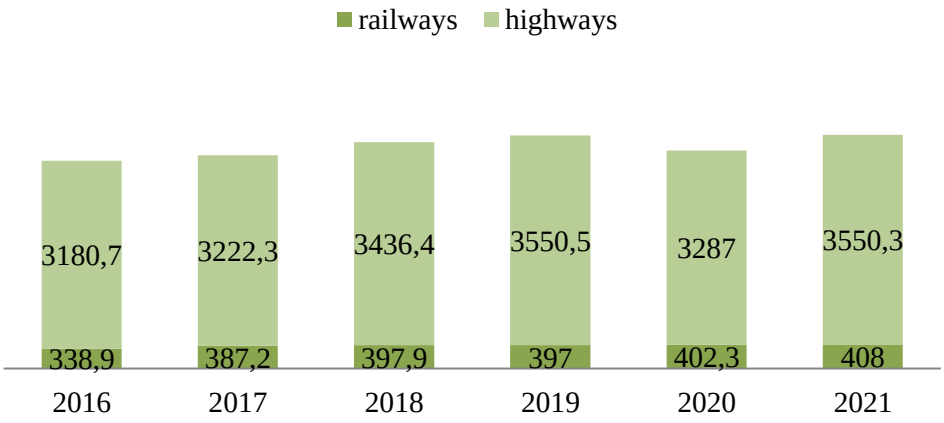

FIGURE 3. Cargo transportation by all modes of transport in Kazakhstan, million tons

Note: compiled according to source Bureau of National Statistics (2022)

The volume of cargo transportation in Kazakhstan is growing yearly; according to the results of 2021, freight transportation by all modes of transport (excluding pipelines) amounted to 4.2 billion tons. The average growth rate over the past five years was 1.4% CAGR despite the pandemic, supported by the development of e-commerce and the country's transit potential. Revenues from transportation by all modes of transport (excluding pipelines) in the Republic of Kazakhstan at the end of 2020 amounted to 1.4 trillion. KZT, of which 1.1 trillion (78%) was received through the transportation of goods.

Regarding the structure of domestic transportation of goods by mode of transport, the lion's share (83%) is accounted for by road transport, also due to the rapid development of online commerce and delivery services and the growth in demand for 3PL services. Next, digital tools used by large companies in the transport and logistics industry in the world and Kazakhstan will be considered (Table 1).

TABLE 1. Used digital tools in foreign and domestic companies

No.	Company name	Digital tools
1	Amazon	Amazon Logistics Amazon is also steadily improving the quality of the service it provides to its customers and moving to pickup to speed up delivery. In 2016, the company leased 20 Boeings to ensure uninterrupted supplies. Amazon is also at the forefront of introducing new automation technologies: in warehouses, in delivery, and in customer service.

		Amazon Drones Using mobile aerial drones to deliver goods to customers. Amazon has patented building lantern-mounted drone docking stations and is lobbying to allow drone delivery outside of the US.
		Amazon Robotics Robotic systems - loaders Kiva, which fully automated the process of storage, picking and packaging in warehouses. With their help, operating expenses were reduced by 20%, which in monetary terms is $ 22 million per warehouse.
2	Honeywell Intelligrated	Intelligrated Integrator of mobile and stationary robotic solutions and systems for production, warehousing, material handling and automated storage and retrieval. The company has a large IP portfolio in warehouse automation, order fulfilment and software solutions.
3	FedEx	FedEx Sensaware A business area of sensory logistics, which is a service for monitoring the supply chain in real time - not only from the point of departure to the point of destination, but in constant monitoring mode. That is, even before the parcel leaves the place of departure, it is possible to find out whether it is kept in the correct temperature regime, whether the required marking is affixed to the package.
4	DHL	DHL Smart Sensor DHL equips containers with a Smart Sensor device that uses ultra-high frequency RFID tags and built-in temperature sensors. This will allow the company's customers to track the temperature regimes of transportation and receive a warning signal in case of their violation. The SmartSensor tag is read at several points: at the station of origin, at the moment when the object leaves the station and when it leaves this station for delivery to the appropriate address.
5	DB Schenker	Drive4Schenker An online platform for carriers called Drive for Schenker (Drive4Schenker).
6	Delta Cargo	Delta Cargo Online Online booking platform for air travel.
		System of electronic contracts and exchange of electronic documents. 77% of all paperwork is done online.
7	CB Robinson	CB Robinson Freightquote The platform for instant calculation of shipping rates and cargo transportation
		E-commerce The platform aggregates delivery services, instantly calculates the cost and helps to quickly order delivery.
8	Kuehne+Nagel a leading player in sea and air transportation	KN FreightNet Platform for online booking of cargo transportation for the delivery of groupage cargo (transportation of cargo of several customers by one aircraft / car in one direction).
9	Global Ports	Global Ports,

		Electronic coordination of applications for a pass to the border control zone.
10	JSC “NC KTZ”	Information Systems AMS CCW, SC IPRB, AS"Payment system" - systems for paperless workflow. Eliminates numerous approvals, unproductive losses, increases the efficiency and effectiveness of the work of railway workers in servicing consignors and recipients of goods.
11	JSC "Kazpost"	post.kz A mobile application that allows you to track parcels by track number, use e-mail with the @post.kz domain, pay for mobile operators, pay utility bills, save templates for quick payments and book a queue at Kazpost branches.
		GoPost Home The ability to order the delivery of parcels and small packages from the supermarket to your home without leaving your home.
Note: compiled by the authors		

The digital tools used in the logistics of cargo transportation were considered and studied on the examples of large international companies such as Amazon, Honeywell, DHL, DB Schenker, Delta Cargo, Kuehne + Nagel and others. In the table 1, there are given national and foreign companies operating in Kazakhstan. From Table 1 it follows that digitalization in the field of logistics and cargo transportation gives many positive aspects, such as:

- reducing the cost of maintaining transport equipment;
- improving the accuracy of planning;
- increased cost control;
- compliance with storage conditions, facilitating settlements;
- supply chain transparency;
- reduced costs and production cycle;
- reducing waste, improving the quality of planning, reducing time losses;
- increase warehouse productivity
- reducing the need for human staff by an order of magnitude;
- reduced labour and maintenance costs.

In order to provide a deep analysis of logistics digital ecosystem development, an expert interview was conducted among four logistics experts following the offered scheme of the digital logistics ecosystem. Kazakhstan's logistics ecosystem was undergoing digitalization, including automated control subdivided into digital mode and digital technologies applications. Digital more is the process of digital logistics functioning, while digital technologies are the application of digital tools and software. The process of digitalization also has an impact on the evolution of delivery processes. Any system introduction goes through failures and faces barriers and obstacles in development, which is included in the analysis.

The table 2 provides the list of codes on digital mode of logistic ecosystem development.

TABLE 2. Digital logistics ecosystem development: digital mode and digital technologies

No.	Code	Comments
1	Distributing and routing deliveries and returns	Receiving and processing orders
2	Access to information	see current balance get necessary information final results of the work
3	Digital documentation	Digital documentation

4	Interaction with customers and carriers	reduce the time of interaction with carriers by 35%
5	Ware houses interaction	optimized the time of interaction between the warehouse and transport divisions by 4%, and the cost of transportation decreased by 2%
6	Management systems	warehouse management, transport management and delivery management subsystems
7	Payment system digitalization	online payment, access to information, automated waybill
8	Process optimization	optimizes the costs of warehouse processing
9	Big data tools	they allow interpreting information in various sections for the rational use of resources and risk management
10	Transparency	transparency of operations is increased
11	Equipment downtime is minimized	Equipment downtime is minimized
12	Data security	ensure the availability and the proper level of security when working with data
13	Focus on manual service	save time and focus on those tasks that are not yet automated or cannot be fully automated
14	Errors identification	imperfect interaction of multiple IT systems, our company was underperforming for a long time
Note: compiled by the authors		

Digital mode of system control gives advantages in several ways easing the working process. First of all, it has a significant impact on the supply chain. It has shaped the process and monitoring of distributing and routing deliveries and returns, as well as order management. At the same time, the digital mode allows the provision of digital reporting and exchange of documentation which saves time and provides access to necessary information. Tracking a company's current balance has become easier because the digitalization process also aims to optimize in various directions. For instance, payment systems and management of the warehouse. The financial part is optimized, and the interaction process is also. Interaction between customers, employers, and departments saves time and reduces costs for such categories as transportation and order processing.

The process of digitalization is only possible with digital technologies and tools. For instance, using a digital tool as big data provides access to information, allows rational use and distribution of resources, and improves security. Digital tools ensure the transparency of all processes, especially financial operations. Automated processing allows focusing companies on actions or services that are difficult to transform into digital modes, such as equipment maintenance.

According to the expert interview, companies usually develop or modify the software to the needs and requirements of companies. This transition process to digital mode helps to identify existing errors or, in some cases, predict errors.

The impact of digital ecosystem development in logistics has dramatically impacted the transformation of the working process, which is reflected in the optimization of costs reducing expenses of a company and thus reducing expenses for clients. Digitalization helps to reduce the human factor, and companies reduce costs on personnel. Orders processing has improved as well as procedures for working with clients have been improved as well. Consequently, the productivity of a company is increasing in line as well. The digital mode provides transparency as access to information works both for personnel and clients.

Table 3 provides the list of codes on automated control of logistic ecosystem development.

TABLE 3. Digital logistics ecosystem: automated control and automated system

No.	Code	Sub-codes	Comments
1	Transportation control center	Customized delivery parametrs	ability for the recipient to change the delivery parameters on their own without involving customer service employees
		delivery monitoring, control, loading/unloading	delivery monitoring, control, loading/unloading
2	GPS tracker	GPS tracker	analyze the driving style of the driver and the condition of the vehicles. Based on the analysis, recommendations are formed for safer and more economical movement
3	Sunrise BPMS platform	Sunrise BPMS platform	the platform is able to work under high loads, supporting the simultaneous work of more than 2 thousand users, which allowed the group of companies to implement several projects
4	Mobile application	Customized orders management	management by phone number simplifies interaction
		Carries tasks receiving	drivers receive tasks and mark them
5	CRM	CRM	customer relationship management makes it easier for the commercial department to interact with customers - everything is stored in a single database, it is possible to track customer interests and create relevant marketing campaigns
Note: compiled by the authors			

Automated control is a sufficient component of digital ecosystem development in logistics. Automated infrastructure ensures the automated processing of almost all aspects of transportation. The delivery process, which is controlling, monitoring and management, overall, has become flexible and allows customers self-management of parameters not involving the staff. This is especially important at critical situations when quick decisions or payments monitoring must be made etc.

Such improvements in logistics are achieved through the introduction of various automated systems. It must be mentioned that companies develop their own or adapt existing software to transition to digital mode. This is because large organizations have much information to process and store. Such programs allow the development of a total characteristic of drivers' service provision as driving the style or vehicle condition.

However, experts underline that customers-oriented industries prefer mobile applications as it eliminates other supply chain interactions between customers and employees. Moreover, mobile applications make the process flexible for customers and drivers and provide access to information.

Table 4 provides the list of codes on current disadvantages and barriers of logistic ecosystem development.

TABLE 4. Digital logistics ecosystem: logistics digitalization barriers and disadvantages.

No.	Code	Comments
1	Transparency	Fear of transparency for small businesses
2	Insufficient funding	Insufficient funding for automation of logistics within the company
3	Resistance to innovation among employees	Sabotage the use of mobile applications and suggested routes
4	Low level of automation	Low level of automation
5	Financial stability	Financial stability in order to be able to purchase this or that solution or equipment
6	Need in third party solutions	Highlights the need to integrate and further support third-party solutions on their own IT infrastructure, which requires certain competencies from the company and the availability of time and human resources
7	Political situation	Political conjuncture greatly affects the availability of a resource base for automation
8	Availability of technology, equipment shortage	Digitalization of logistics is hindered by the same factors as those of large companies in retail, distribution, and industry. In the current realities, more factors of a possible shortage of equipment will probably be added
9	Business environment	Constantly adjusting to the realities of the market, forming new products, and, as a result, the need for digitalization
10	Government regulation	Government regulation
11	Human capital	Lack of qualified employees
12	Price increase for maintenance service	Prices of spare parts for vehicles have increased by 15-100%
13	Maintenance and transportation costs increase	Cost of maintenance of equipment by 60%
Note: compiled by the authors		

Despite optimising costs and working processes, digitalization of the logistics ecosystem has one major disadvantage - expensive maintenance of the equipment and vehicles and transportation costs. Moreover, experts state that this is significantly related to small organizations. In addition, the majority of organizations need more financing for technology implementation.

As for internal factors, experts highlight technology availability as one of the crucial factors. Next, the human factor also plays a significant role, as there need to be more specialists in the information and technology field. Moreover, some employees need more skills to be ready for innovations.

Experts recommend attracting third-party organizations that contribute to a company's transition to digital mode. In the process of road transport, there are involved: the consignor (customer and owner of the cargo), the forwarder (responsible for organizing the process) and the contractor (carrier). However, intermediaries are sometimes built into this scheme - companies with no fleet. However, they participate in the auction and transfer the received orders to real

carriers, laying their percentage in the cost. In an environment where it is critically important for businesses to reduce logistics costs, companies strive to make selecting a contractor transparent.

The peculiarities of third-parties involvement diggers from industry to industry. For example, in healthcare, telemedicine implementation also attracts third parties. They provide personnel training, technical support and implementation of suitable software based on the business environment.

External factors initially act as barriers as they set requirements, restrictions or limitations. For instance, political situations disturb the international supply chain process or resource availability. A low level of automation among organizations limits the possibility of cooperation or services widening.

5. CONCLUSIONS

The studies identified the positive and negative sides and the difficulties logistics and transport companies face while implementing digital technologies. Automated control is a sufficient component of the development of a digital ecosystem in logistics. Automated infrastructure provides automated processing of almost all aspects of transportation. Problems and barriers in the digitalization of the logistics industry are the need for qualified employees, government regulation, the availability of technology and the business environment.

The need for more specialists has a crucial impact on implementing the digital ecosystem in logistics. First, the results showed that insufficient funding is one of the main reasons for the low application of digital platforms or online programs. This is caused by the fact that business owners need more time to be ready for digital transformation and are not ready to invest in information technologies. Low qualifications or lack of skills among specialists result in their resistance to innovations and the use of digital technologies.

The analysis of automated systems showed that most logistics companies, being customer-oriented industries, mainly focus on managing employees' interaction with clients. They dismiss the digitalization of the system of companies functioning, which includes document exchange, easy access to information, staff management, working process management, etc. Therefore, their process of transition to digital mode takes time to complete.

One of the solutions offered by the experts involved third-party organizations, usually in charge of several actions. They are program adaptation to the business environment, personnel training and the digital development infrastructure of the company. This way of digitalization implementation has been used in telemedicine. They develop the automated system of an organization's functioning, starting from the number of employees needed for company functioning to the development of the work timetable for the whole organization.

The main limitation of this study was the need for more access to information on the productivity of automated systems implementation in a logistics company. Future studies may conduct case study research and provide questionnaires among employees to analyze the impact of digitalization on a company’s productivity.

References

1. Aryal, A., Liao, Y., Nattuthurai, P., & Li, B. (2020). The emerging big data analytics and IoT in supply chain management: a systematic review. *Supply Chain Management: An International Journal, 25*(2), 141-156. https://doi.org/10.1108/SCM-03-2018-0149
2. Dotoli M., & Fanti, M. P. (2004). Coloured timed Petri net model for real-time control of automated guided vehicle systems. International *Journal of Production Research, 42*(9), 1787-1814.

3. Gölzer, P., & Fritzsche, A. (2017). Data-driven operations management: organisational implications of the digital transformation in industrial practice. *Production Planning & Control*, *28*(16), 1332-1343. https://doi.org/10.1080/09537287.2017.1375148
4. Grieves, M., & Vickers, J. (2017). Digital twin: Mitigating unpredictable, undesirable emergent behavior in complex systems. *Transdisciplinary perspectives on complex systems: New findings and approaches*. Springer, Cham. https://doi.org/10.1007/978-3-319-38756-7_4
5. Ghosh, D. (2015). Big Data in Logistics and Supply Chain management-a rethinking step. In 2015 International Symposium on Advanced Computing and Communication (ISACC) (pp. 168-173). IEEE.
6. de Koster, R. B. (2018). Automated and robotic warehouses: developments and research opportunities. *Logistics and Transport*, *38*(2), 33-40.
7. Lin, J. T., Chang, C. C. K., & Liu, W. C. (1994). A load-routeing problem in a tandem-configuration automated guided-vehicle system. *The international journal of production research*, *32*(2), 411-427.
8. Konstantinidis, I., Siaminos, G., Timplalexis, C., Zervas, P., Peristeras, V., & Decker, S. (2018). Blockchain for business applications: A systematic literature review. *In Business Information Systems: 21st International Conference, BIS 2018, Berlin, Germany, July 18-20, 2018, Proceedings 21* (pp. 384-399). Springer International Publishing.
9. Laney, D. Application Delivery Strategies / D. Laney // META Group - 2001.
10. Moldabekova A.T., Philipp R., Akhmetova Z.B.&Asanova T.A. (2021) The role of digital technologies in the development of logistics in Kazakhstan in the formation of Industry 4.0. *Economics: the strategy and practice*, *16*(2), 164-177. https://doi.org/10.51176/1997-9967-2021-2-164-177 (In Russ.)
11. Moldabekova A., Zhidebekkyzy A., Akhmetkaliyeva S., & Baimukhanbetova E. (2020). Advanced technologies in improving the management of logistics services: Bibliometric network analysis. *Polish Journal of Management Studies, 21*(1), 211–223. https://doi.org/10.17512/pjms.2020.21.1.16
12. Nguyen, T., Li, Z. H. O. U., Spiegler, V., Ieromonachou, P., & Lin, Y. (2018). Big data analytics in supply chain management: A state-of-the-art literature review. *Computers & Operations Research*, *98*, 254-264. https://doi.org/10.1016/j.cor.2017.07.004
13. Oleśków-Szłapka, J., & Stachowiak, A. (2019). The framework of logistics 4.0 maturity model. *In Intelligent systems in production engineering and maintenance* (pp. 771-781). Springer International Publishing. https://doi.org/10.1007/978-3-319-97490-3_73
14. Tiwari, S., Wee, H. M., & Daryanto, Y. (2018). Big data analytics in supply chain management between 2010 and 2016: Insights to industries. *Computers & Industrial Engineering*, *115*, 319-330. https://doi.org/10.1016/j.cie.2017.11.017
15. Satybaldin A.A., Sadykov B.E., Moldabekova A.T.&Akhmetova Z.B. (2022) Cluster Analysis of the Transport and Logistics Potential of the Regions of Kazakhstan. *Economics: the strategy and practice*, *17*(4), 41-57. https://doi.org/10.51176/1997-9967-2022-4-41-57
16. Sun, L., Li, Z., Cao, N., & Zhou, L. (2018). Research on application of logistics service quality management based on blockchain. In Algorithms and Architectures for Parallel Processing: ICA3PP 2018 International Workshops, Guangzhou, China, November 15-17, 2018, Proceedings 18 (pp. 151-157). Springer International Publishing. https://doi.org/10.1007/978-3-030-05234-8_19
17. Watson, H. J. (2014). Tutorial: Big data analytics: Concepts, technologies, and applications. *Communications of the Association for Information Systems*, *34*(1), 65. https://doi.org/10.17705/1CAIS.03462
18. Unruh, G., Kiron, D., Kruschwitz, N., Reeves, M., Rubel, H., & Zum Felde, A. M. (2016).

Investing for a sustainable future: Investors care more about sustainability than many executives believe. Research report, Massachusetts Institute of Technology, Sloan Management Review.
19. Asdecker, B., & Felch, V. (2018). Development of an Industry 4.0 maturity model for the delivery process in supply chains. *Journal of Modelling in Management*, *13*(4), 840–883. https://doi.org/10.1108/jm2-03-2018-0042
20. Barreto, L., Amaral, A., & Pereira, T. (2017). Industry 4.0 implications in logistics: an overview. *Procedia manufacturing*, *13*, 1245-1252. https://doi.org/10.1016/j.promfg.2017.09.045
21. Hofmann, E., & Rüsch, M. (2017). Industry 4.0 and the current status as well as future prospects on logistics. *Computers in industry*, *89*, 23-34. https://doi.org/10.1016/j.compind.2017.04.002
22. Glaessgen, E., & Stargel, D. (2012, April). The digital twin paradigm for future NASA and US Air Force vehicles. In 53rd AIAA/ASME/ASCE/AHS/ASC structures, structural dynamics and materials conference 20th AIAA/ASME/AHS adaptive structures conference 14th AIAA (p. 1818).
23. Schmidtke, N., Behrendt, F., Thater, L., & Meixner, S. (2018). Technical potentials and challenges within internal logistics 4.0. In 2018 4th International Conference on Logistics Operations Management (GOL) (pp. 1-10). IEEE. https://doi.org/10.1109/gol.2018.8378072
24. Revindran, M., Ragen, P. N., & Mahmud, B. (2020, March). A study on logistics service quality in e-retailing amongst online shoppers in Kuala Lumpur. *In IOP Conference Series: Materials Science and Engineering* (Vol. 780, No. 6, p. 062016). IOP Publishing. https://doi.org/10.1088/1757-899x/780/6/062016
25. Research and Market, (2022) [Cited February 2, 2022]. Available: https://www.researchandmarkets.com/

AUTHOR BIOGRAPHIES

Elmira E. Baimukhanbetova – professor, Al-Farabi Kazakh National University, Almaty, Kazakhstan. Email: ela.68@mail.ru, ORCID ID: https://orcid.org/0000-0002-2306-7107

***Rashid O. Tazhiyev** – PhD candidate, Department of Business Technologies, High school of economics and business, Al-Farabi Kazakh National University, Almaty, Kazakhstan. Email: rashidpostt@gmail.com, ORCID ID: https://orcid.org/0000-0003-0794-0348

Urikkul D. Sandykbayeva – Cand. of Philos. Sciences, Senior Lecturer, Faculty of Pre-University Education, Al-Farabi Kazakh National University, Almaty, Kazakhstan. Email: sandykbaeva@mail.ru, ORCID ID: https://orcid.org/0000-0002-7339-4966

Aruzhan K. Jussibaliyeva – Candidate of Economic Sciences, Associate professor, senior researcher (project manager), LLP Scientific and Production Enterprise Innovator, Astana, Kazakhstan. Email: d_aruzhan2011@mail.ru, ORCID ID: https://orcid.org/0000-0002-4841-4742