DIGITAL LOGISTICS AS A TOOL FOR MINIMIZING LOGISTICS RISKS IN THE ACTIVITIES OF PHARMACEUTICAL ENTERPRISES

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Introduction. The rapid development of global digitalization and the unstable economic situation in the country in recent years have affected all spheres of the national economy, including the pharmaceutical industry. In the modern economic landscape, what is decisive is not so much the right to ownership of resources but rather the availability of information regarding the possibility of their swift and effective utilization. In this way, the digital economy makes changes in the activities of pharmaceutical market entities, which concern, first of all, the logistics system, in particular, in the formation of relations for the processing, storage, transmission, and use of the growing volume of data on pharmaceutical products and channels for its promotion and distribution, which are owned and in which other pharmaceutical market entities are interested [1].

The above factors led to an increase in the risks of logistics activity, that is, an increase in deviations from the expected results due to a violation of the stability of the logistics systems of pharmaceutical enterprises and pharmaceutical supply chains. Under such conditions, the implementation and development of digital technologies, which have significant potential to minimize and prevent risks, in particular in logistics activities, take priority for pharmaceutical enterprises.

In scientific works devoted to the study of the digitalization of the economy and the problem of applying digital technologies, attention is mainly paid to the opportunities that are opened for economic entities from their implementation. However, the introduction of digital technologies brings with it not only opportunities but also real threats and risks. The risk management system of economic entities in such conditions should take into account the new risks that arise in the process of digital transformation. In view of the novelty of the concept of digitalization, there are not so many works that reflect the results of thorough research on the barriers and risks of introducing digital technologies, especially in domestic scientific schools. Foreign scholars such as Patel S., Schröder M., Indorf M., Wolfgang K., and Vollmar F. have conducted research on the aforementioned aspects. Study [2] was one of the first domestic scientific works dedicated to digital risks. Other studies, including [3–5], also focus on researching this scientific direction. Despite significant progress in investigating the relevant topic, some aspects remain insufficiently explored, namely the question of the possibilities of using digital technologies to minimize and prevent logistical risks in pharmacy.

The aim. The aim of the study was to analyze the prospects of digitalization of logistic processes at pharmaceutical enterprises to minimize and eliminate logistic risks in an unstable external environment for the timely provision of necessary and high-quality pharmaceutical products to the population.

Materials and methods of the research. The study was conducted utilizing databases on the Internet: data from the website of the State Statistics Service of Ukraine [6], data from the website of the educational center "Danko" [7], data from the website of the research company "Strategic Market Research" [8], data from the website of the research company "McKinsey & Company" [9], data from the website of the research company "Strategy &" [10], data from the website of the research company "Deloitte" [11]; scientific-metric databases: Scopus, Web of Science. Information retrieval, systematization, comparison, and summarization methods were employed in the research, along with graphical methods to enhance the clarity of the material presentation.

Results and discussion. Pharmaceutical logistics is an important area of activity that not only ensures the continuity and efficiency of the pharmaceutical business but also creates conditions for the implementation of the social function of the pharmaceutical industry—proper pharmaceutical provision to the population. In 2021, pharmaceutical logistics had undergone significant changes and challenges related to the COVID-19 pandemic, commodity and container crises, geopolitical tensions, and other factors. But the awareness of many domestic leaders of the need to invest in pharmaceutical logistics and the importance of introducing modern logistics technologies made it possible to preserve the potential of Ukrainian pharmacy to some extent and prevent crisis events in the industry. In 2024, it is expected that pharmaceutical logistics will continue to adapt to new conditions and use new opportunities for development. It will be forced to evolve and implement the latest technologies and solutions to ensure the sustainability and uninterrupted functioning of pharmaceutical supply chains.

The analysis of scientific sources [12–16] allows us to determine certain trends in the development of logistics that will shape the future of the pharmaceutical industry:

1. Further digitalization of pharmaceutical logistics is a prerequisite for increasing transparency, monitoring, and optimizing the functioning of pharmaceutical supply chains. Digital technologies such as cloud computing, artificial intelligence, blockchain, the Internet of Things, and robotic processes allow you to collect, analyze, and exchange data in real time, as well as automate and improve various operations such as planning, selection, delivery, cargo tracking, inventory, etc. Digitalization also contributes to the creation of digital doubles, which are virtual models of real objects or processes that allow simulation, prediction, and optimization of their behavior. The digitalization of pharmaceutical logistics also contributes to the implementation of electronic document management, which reduces paperwork, ensures the speed and accuracy of information exchange, and also reduces the risks of errors, fraud, and data loss.

2. Sustainable development of pharmaceutical logistics is a response to the growing demands and expectations of customers, regulators, and society regarding environmental responsibility and social justice. Logistics is one of the most polluting industries, responsible for about

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8% of global greenhouse gas emissions [13]. Therefore, pharmaceutical enterprises are looking for ways to reduce their negative impact on the environment and increase their own energy efficiency. Such measures include: use of alternative energy sources, such as solar, wind, hydroelectric, and biomass; use of electric or hybrid vehicles; optimization of vehicle traffic routes and their load; application of environmental materials for packaging and recycling; reduction of waste and losses; promotion of the circular economy; and social inclusion.

3. The last-mile delivery, which is one of the most challenging and crucial stages of the logistic process, involves delivering pharmaceutical products from the nearest distribution center to the end consumer. This stage requires high speed, quality, accuracy, and flexibility of operations, as well as consideration of various factors such as traffic, weather, security, regulations, etc. Last-mile delivery is also one of the most competitive and innovative segments of pharmaceutical logistics, constantly evolving and adapting to changing customer needs and expectations. New trends in last-mile delivery include the use of emerging technologies such as drones, robots, autonomous vehicles, artificial intelligence, blockchain, the Internet of Things, augmented reality, and so on..

However, it should be noted that active digitization will be the defining trend in pharmaceutical logistics for the next decade.

According to research from the Global Industry Report in 2021, the forecasted volume of the global digital logistics market was $18.10 billion USD, and it is expected to reach $77.52 billion USD by 2030, with a compound annual growth rate (CAGR) of 17.54% during the forecast period from 2021 to 2030 [17].

As evidenced by global practice, digital technologies in the management of pharmaceutical supply chains are an effective process of creating added value, utilizing innovative approaches through technological and analytical methods, and generating new forms of profit by rationalizing logistical processes, reducing the time required for these processes, and minimizing the costs necessary for processing, exchanging, and analyzing information [14].

It is worth noting that digital pharmaceutical supply chains represent an enhanced version of traditional pharmaceutical supply chains, incorporating various digital technologies. Digital pharmaceutical supply chains involve the use of innovative technologies for processing and analyzing data flows both within pharmaceutical enterprises and beyond (among other pharmaceutical enterprises). Thanks to digital technologies, it is possible to identify new potential opportunities and general trends in the development of pharmaceutical supply chains. By combining and integrating new technologies, pharmaceutical enterprises have the opportunity to gain a broader understanding of internal and external data, thereby eliminating unnecessary departments that may exist within pharmaceutical enterprises without compromising the overall quality of their work.

According to the findings of McKinsey research, an international consulting company specializing in strategic management, the impact of the digital supply chain on enterprise operations has been assessed (Figure 1).

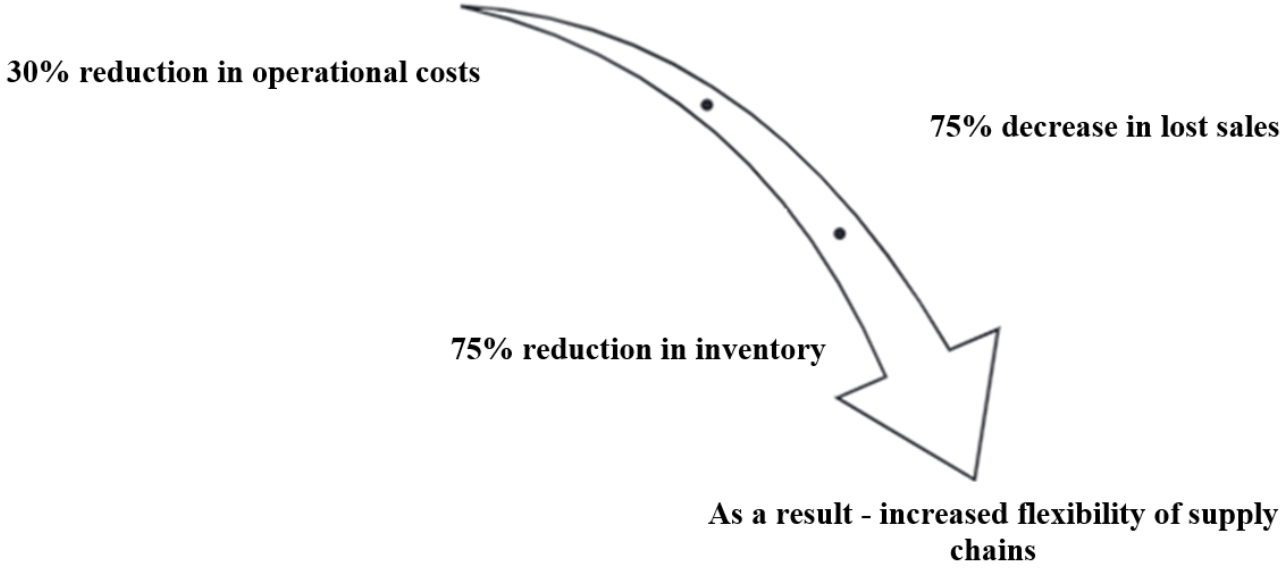

Figure 1. Results of McKinsey research on the impact of the digital supply chain [14]

There is a trend that, in the next three years, the potential impact of digitizing pharmaceutical supply chains on the efficiency of pharmaceutical enterprises will increase. This will enhance their operational flexibility, contribute to reducing operational costs, decrease lost sales volumes, and significantly reduce inventory levels.

It is pertinent to mention the key components of digital pharmaceutical supply chains that enable pharmaceutical enterprises to function transparently and efficiently, creating added value for potential clients and enhancing their own investment attractiveness. These components include integrated planning, digital procurement, intelligent storage, efficient inventory management, autonomous pharmaceutical logistics, comprehensive analytics of pharmaceutical supply chains, digital tools for pharmaceutical supply chains, etc. [18].

However, the spontaneity and lack of preparedness in the implementation processes of individual digitalization tools, without deliberate and systematic conceptualization of business processes and preparation of an appropriate foundational

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software platform, can lead to the emergence of certain problems and risks associated with the implementation of digital technologies and even to the escalation of "digital chaos," threatening the controllability of the logistic system. The fact that the threat of such risks in pharmaceutical supply chains is quite high is indicated by over 60% of top managers of manufacturing and trading companies, according to data from the report of the international consulting company Deloitte [19].

Based on the analysis conducted, we have identified potential risks associated with the implementation of digital technologies in the logistical activities of pharmaceutical enterprises (Table 1) [4-5; 15; 20].

Therefore, as mentioned above, the field of digital technologies, which is related to logistic business processes, is characterized by a very high level of uncertainty. This applies to the technological basis of the main directions of the logistics activities of pharmaceutical enterprises: internal business processes and management of relations with suppliers and customers. Therefore, the responsibility of logistics managers for the correct assessment of strategic risk, control over its level, and monitoring of related changes to it is very large.

Table 1. Potential risks associated with the implementation of digital technologies in the logistical activities of pharmaceutical enterprises

Risk	Characteristic
Technological	Inefficiency of the information logistics system. In the event of a failure of the information system, a complete collapse of the logistics system may occur, since all processes in the conditions of digital logistics are not only interconnected but also depend on the information system. This also includes possible leaks, unauthorized access to it, etc.
Financial	Digitalization of logistics can "absorb" a significant budget of pharmaceutical enterprises without guaranteeing the desired result. Certain quite promising ideas may "fail" simply because they will "overtake" the market; others, on the contrary, will become morally obsolete by the time of launch; and still others simply will not be able to provide the expected economic effect.
Personnel	Due to the high rate of changes in logistics (especially in digital), personnel shortages of certain qualifications, rapid aging of knowledge, etc. are possible. Insufficient motivation among IT team participants to achieve a positive result is also possible.
Uncertainty of the future	In the face of uncertainty about the subsequent trajectory of the technical and economic wave, it is necessary to determine the mechanisms and models that will allow all participants in the digital pharmaceutical supply chains to work effectively.
Problems in synchronizing the work of various participants in digital pharmaceutical supply chains	Reaching consensus among large pharmaceutical enterprises, which are often direct competitors, is a certain problem that needs to be solved during the transition to the digital economy.
Use of blockchain technology in logistics	Digital blockchain technology will lead to the fact that even if the transaction was incorrect or was caused by a failure, error, or fraudulent interference but was confirmed, it cannot be fixed.
Use of cloud technologies in logistics	The use of cloud technologies entails a number of risks for the logistics activities of the enterprise, associated with the need for a stable and high-speed Internet connection, the vulnerability of clouds to various unauthorized attacks, and ensuring information security (for which third parties, rather than the enterprise itself, are responsible). Additionally, there is dependency on cloud service provider services, complexity in planning (due to changes in the terms of cloud service provision: transition from the availability of cloud services on a free basis or at an acceptable price to full payment of their cost), and the and the absence of relevant national standards establishing proper requirements for the quality and reliability of cloud technologies and services in Ukraine.
Lack of balance in the development of elements of the logistics system of pharmaceutical enterprises during the transition to the digital economy	If one of the elements of the logistics system is significantly improved and can work quickly and efficiently, and the other remains unchanged, the result may be unsatisfactory operation of the system as a whole.
Resistance to the implementation of digital technologies in logistics	At the stage of implementation of digital technologies, it is necessary to timely identify and stop sources of unreasonable resistance from various categories of personnel. Rationale and effective motivation can greatly contribute to preventing or minimizing the occurrence of such a risk.

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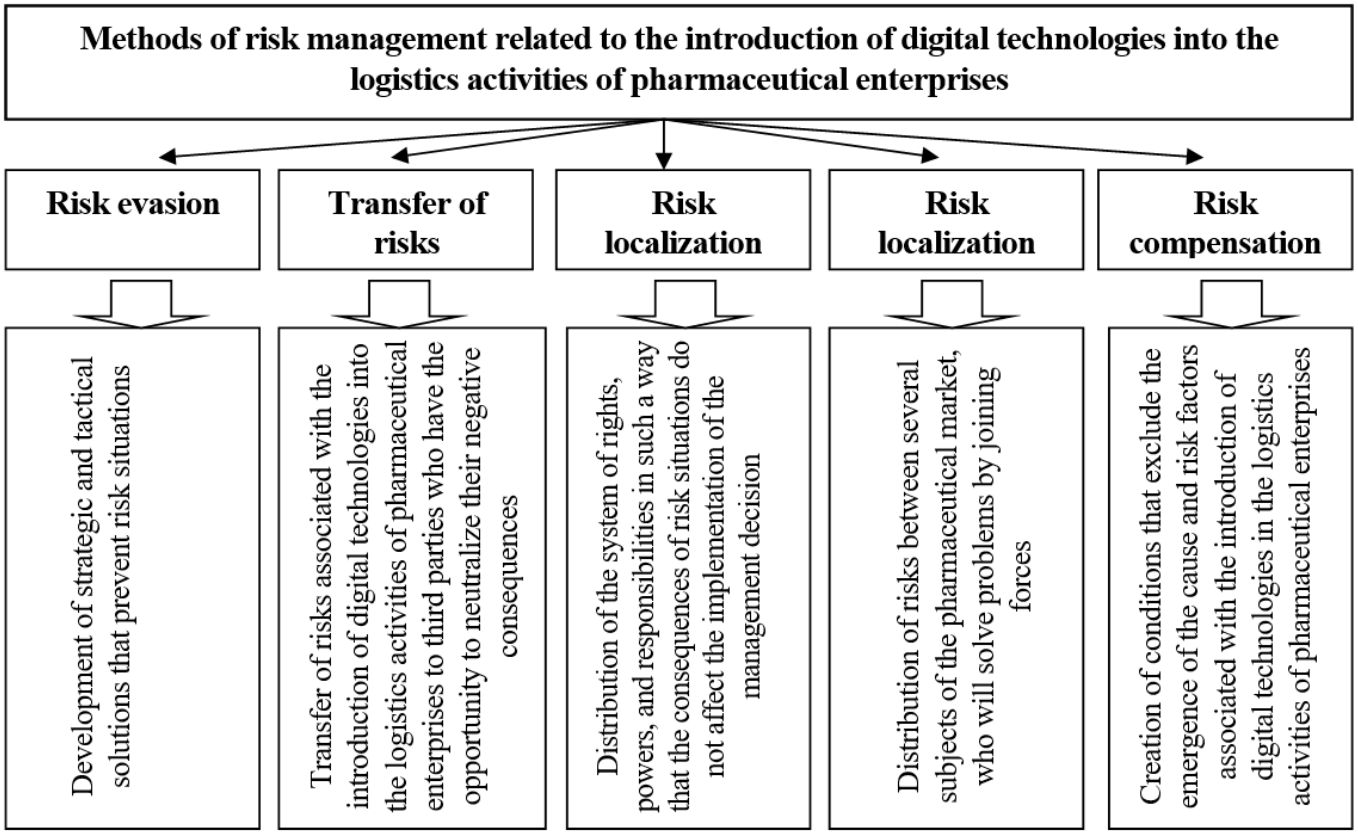

Figure 2: Methods of risk management associated with the implementation of digital technologies in the logistics activities of pharmaceutical enterprises

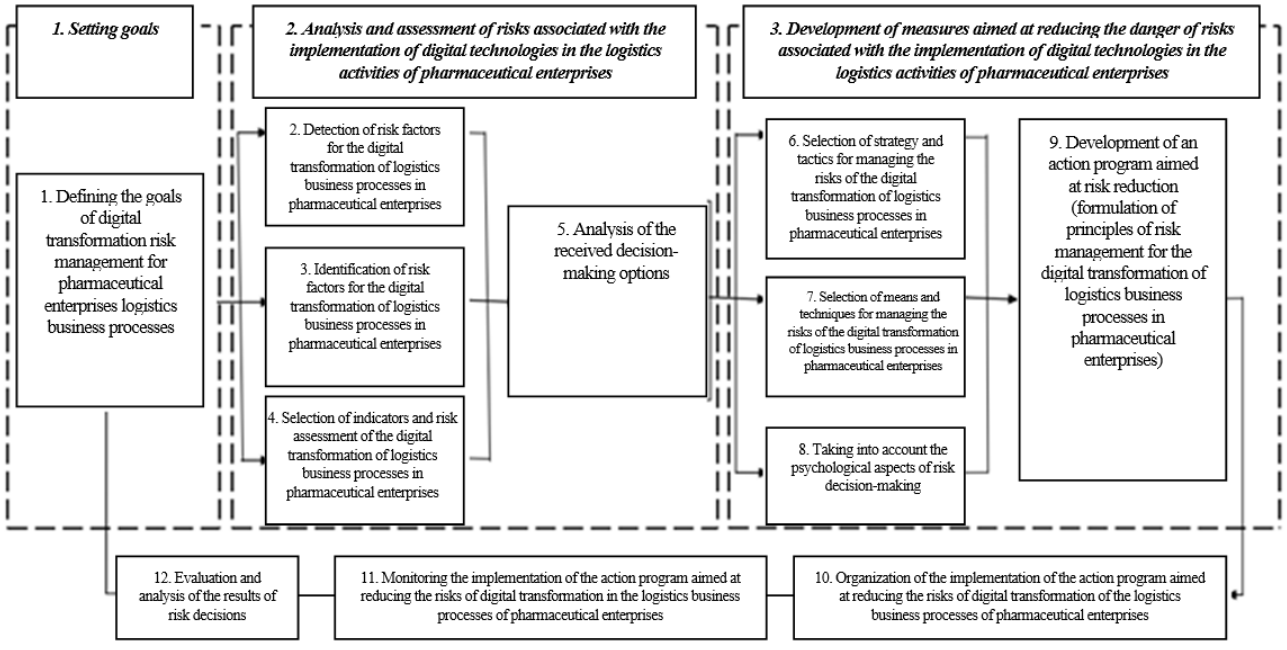

Figure 3. Technology of risk management associated with the introduction of digital technologies into the logistics activities of pharmaceutical enterprises

The use of this or that method of risk management associated with the introduction of digital technologies in the logistics activities of pharmaceutical enterprises is largely determined by the goals and objectives that the logistics manager sets himself, as well as the situation in the pharmaceutical market and in the pharmaceutical enterprises themselves. At the same time, the logistics manager should have a certain set of risk management methods necessary for pharmaceutical enterprises in this situation.

The main methods of risk management associated with the introduction of digital technologies into the logistics activities of pharmaceutical enterprises include (Figure 2): risk avoidance; transfer of risks (transfer to other participants of

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pharmaceutical supply chains); localization (limiting) of risks; risk distribution; risk compensation.

In general, it is advisable to present the process of risk management associated with the implementation of digital technologies in the form of three stages of procedures (Figure 3): determining the goals of risk management; risk analysis and assessment; and the and the development of risk mitigation measures during the implementation of the decision.

Based on our experience managing the risks of digital transformation of business processes in the logistics activities of pharmaceutical enterprises [4; 20–21], we formulated the following principles of logistic risk management in pharmacy:

1. Supervision by TOP management of pharmaceutical enterprises (creation of an effective system for monitoring logistics operations carried out digitally; implementation of a comprehensive control procedure for maintaining the required level of information and technological safety; organization of monitoring of partners involved in supporting the digital transformation of individual logistics business processes of pharmaceutical enterprises).

2. Security in the field of digital technologies (authentication of customers using electronic logistic service channels; non-disclaimer and strict liability for online transactions; differentiation of functions performed by employees of other pharmaceutical enterprises in the process of working in electronic logistics services systems with databases and applications; ensuring the integrity of data on operations and records in the field of online logistics services; timely, complete, and reliable accounting of electronic transactions; confidentiality of key logistic information).

3. Management of legal and reputational risk (disclosure of the necessary information about the electronic logistics service on the website of pharmaceutical enterprises; prevention of unauthorized access to client information; creation of an effective mechanism for responding to unexpected incidents—external and internal attacks on systems of electronic logistics business processes of pharmaceutical enterprises).

Summarizing the results of this scientific study, we can conclude that the digitalization of pharmaceutical supply chains allows pharmaceutical enterprises to successfully withstand the challenges of today, the new requirements of potential customers, as well as expectations for improving the efficiency of activities and the quality and continuity of pharmaceutical supply to the population. Digital pharmaceutical supply chain is an innovative trend of sustainable development, improving the image of pharmaceutical enterprises and increasing investment attractiveness in the long term. using advanced digital technology, digital pharmaceutical supply chain integrates and programs logistics processes and analyzes the end result of each process to increase pharmaceutical production, productivity, meet potential customers, and create added value for them. At the same time, it is necessary to consider that each type of digital technology has its own advantages, disadvantages, and limitations regarding usage. The process of implementing and utilizing digital technologies may be accompanied by risks capable of causing losses, especially in conditions of unsystematic and unqualified implementation. Therefore, it is important to develop effective risk management mechanisms that arise during the implementation and use of digital technologies in the activities of pharmaceutical supply chains, which should be the subject of further scientific research.

Conclusion

Thus, based on the research results, the identification of digital risks has been carried out, and measures to prevent or mitigate risks associated with the implementation of digital technologies in the logistical activities of pharmaceutical enterprises have been substantiated. Investigating methods, technologies, and principles of risk management associated with the implementation of digital technologies in the logistical activities of pharmaceutical enterprises, further steps are required: to conduct a scientific analysis of theoretical and practical approaches to forming a mechanism for managing the risks of digital transformation of logistical business processes of pharmaceutical enterprises; to identify the specifics of the main stages and reveal the fundamental patterns of the genesis of digital transformation of logistical business processes of pharmaceutical enterprises; to develop a methodology for assessing effectiveness and formulate specific recommendations for enhancing efficiency in the field of risk management of digital transformation of logistical business processes of pharmaceutical enterprises.

Digital logistics as a tool for minimizing logistics risks in the activities of pharmaceutical enterprises

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Introduction. Today, pharmaceutical supply chains form the basis of the pharmaceutical market, fueling trade, consumption, and economic growth. Trends such as digitalization, saving processes, and the geographical concentration of pharmaceutical production have made pharmaceutical supply chains more efficient but also changed their risk profile. Most pharmaceutical companies currently use risk management strategies that address local violations. Nevertheless, global experience in pharmaceutical supply chain management and strategic planning suggests that risks beyond the control of individual enterprises can have unpredictable consequences that cannot be mitigated by the efforts of one enterprise. That is why the introduction and development of digital technologies that have significant potential to minimize and prevent risks, in particular in the logistics activities of pharmaceutical enterprises, is an urgent topic of our time. **Aim.** The aim of the study was to analyze the prospects of digitalization of logistic processes at pharmaceutical enterprises to minimize and eliminate logistic risks in an unstable external environment for the timely provision of necessary and high-quality pharmaceutical products to the population. **Materials and methods.** To achieve the aim of the study, foreign and domestic scientific literature on pharmaceutical logistics was analyzed. Research methods are informational, retrospective, graphic, statistical, and logical. **Results and discussion.** The relevance of digitalizing the logistics activities of pharmaceutical

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enterprises and pharmaceutical supply chains to improve their reliability and safety has been substantiated. Trends in the development of logistics that will shape the future of the pharmaceutical industry have been identified. The risks associated with the introduction of digital technologies into the logistics activities of pharmaceutical enterprises are identified. A review of methods of managing digital risks in the logistics activities of pharmaceutical enterprises was conducted. An algorithm for risk management in the digital transformation of business processes in the logistics activity of pharmaceutical enterprises is proposed. **Conclusion.** It is proven that a certain potential and experience of using digital technologies have already been accumulated in domestic pharmacy, which opens up serious innovative prospects for minimizing and preventing risks, in particular in the logistics activities of pharmaceutical enterprises. The COVID epidemic and military action highlighted the weaknesses of domestic pharmaceutical logistics. And it is the active introduction of digital technologies into the logistics activities of pharmaceutical enterprises that will contribute to their successful solution. Undoubtedly, the issue raised in this study does not fully address the complex array of questions related to the implementation of scientific and practical approaches to risk management resulting from the application of digital technologies in the logistical activities of pharmaceutical enterprises and pharmaceutical supply chains. Unresolved are a set of issues associated with substantiating the mechanism for managing the risks of digital transformation of logistical business processes, developing a methodology for assessing the effectiveness of managing digital risks in the logistical activities of pharmaceutical enterprises, and others, which will define the prospects for our further research.
Keywords: pharmaceutical enterprise, pharmaceutical supply chain, pharmaceutical market entities, digitalization, digital risks.

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