STRATEGIES FOR OPTIMIZING GLOBAL SUPPLY CHAINS IN THE CONTEXT OF DIGITAL TRANSFORMATION

СТРАТЕГІЇ ОПТИМІЗАЦІЇ ГЛОБАЛЬНИХ ЛАНЦЮГІВ ПОСТАЧАННЯ В УМОВАХ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ

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The research is devoted to the analysis of the challenges facing the world economy in connection with dynamic changes in global trade relations. It is proved that in order to ensure the continuity and sustainability of logistics processes in conditions of constant geopolitical uncertainty, logistics companies must move from reactive to proactive management, which will require them to have the ability to constantly and deeply analyze the current market situation, regularly evaluate all operations and immediately implement improvements to make the best use of resources. The article substantiates the need to integrate advanced digital technology tools directly into logistics processes. Such implementation of digital solutions can provide much more accurate tracking of goods at all stages of movement, significantly increase the transparency of all logistics operations, which, in turn, leads to a reduction in the risks of counterfeiting and fraud, as well as an overall increase in the security and reliability of global supply chains.
Key words: *global supply chains, technological development, digitalization, supply chain optimization strategies, uncertainty.*

Дослідження присвячене аналізу викликів, що постають перед світовою економікою у зв'язку з динамічними змінами в глобальних торговельних відносинах. Особлива увага приділяється факторам, які спровокували ці трансформації, включаючи наявність геополітичних військових та торгівельних конфліктів, що суттєво впливають на стабільність та передбачуваність функціонування логістичних систем. У статті обґрунтовано ключові критерії оптимізації, а також пропонуються базові стратегії, спрямовані на ефективне управління глобальними ланцюгами постачання, з урахуванням необхідності адаптації до непередбачуваних факторів та раптових змін на ринку, що є критично важливим для забезпечення стійкості бізнесу в сучасних реаліях. Дослідження доводить, що для забезпечення неперервності та стійкості логістичних процесів в умовах постійної геополітичної невизначеності логістичні компанії повинні перейти від реактивного до проактивного управління, що вимагатиме від них здатності до постійного та глибокого аналізу поточної ринкової ситуації, систематичної оцінки ефективності всіх своїх операцій, а також невідкладного впровадження заходів, спрямованих на оптимізацію використання наявних ресурсів. Такий підхід дозволить не лише мінімізувати ризики, але й виявляти нові можливості для підвищення операційної гнучкості та конкурентоспроможності. Ключовим результатом проведеного дослідження є визначення шляхів оптимізації глобальних ланцюгів постачання, що є особливо актуальним в контексті широкомасштабної цифрової трансформації. У статті обґрунтована необхідність інтеграції передових інструментів цифрових технологій безпосередньо в логістичні процеси. Цифрові інструменти забезпечать суттєво точніший моніторинг товарів протягом усього ланцюга постачання, суттєво підвищать прозорість усіх логістичних операцій, що, у свою чергу, призведе до зниження ризиків підробок та шахрайства, а також загального підвищення безпеки та надійності глобальних ланцюгів постачання. В наявному контексті, цифровізація розглядається не просто як тренд, а як фундаментальна умова для створення більш стійких, ефективних та безпечних глобальних логістичних систем.
Ключові слова: *глобальні ланцюги постачання, технологічний розвиток, цифровізація, стратегії оптимізації ланцюгів постачання, невизначеність.*

Statement of the problem. The modern global economy is characterized by unprecedented dynamics and constant transformations, which imposes new, more complex requirements on the management of production and logistics processes. Because of rising competition, unpredictable markets, and geopolitical shifts, how well global supply chains operate is now a key determinant of a company's competitive edge. Traditional management methods, based on linear models and manual operations, are insufficient to respond to rapid changes and ensure the necessary level of flexibility and resilience, which makes the search for new strategic approaches vital.

In today's fast-paced world, managing global supply chains effectively is impossible without digital solutions. These advanced technologies are no longer an option; they're a necessity. They give businesses complete control over their supply chains, allowing for real-time tracking of goods and the ability to rapidly adjust to market shifts. Digital tools are the key to achieving full transparency across all business processes. This means companies can precisely monitor every stage of the supply chain. This includes tracking the movement of goods, keeping a close eye on inventory levels in warehouses, and quickly spotting potential bottlenecks that could slow things

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down. Such a streamlined approach to logistics leads to a significant boost in overall business efficiency. It also helps to substantially cut down the costs of products or services, all while improving the service experience for the end consumer. Ultimately, digital solutions are transforming how businesses operate, making them more agile, cost-effective, and customer-focused.

Despite the obvious advantages of digital transformation, the formation and implementation of effective strategies for optimizing global supply chains in this new digital landscape remains a significant challenge for many companies. There is an urgent need for in-depth research into which digital technologies are the most promising, how to integrate them into existing business models and how to reformat organizational processes to maximize their potential [2].

Analysis of recent research and publications. Researchers are deepening their understanding of logistics decision-making processes, particularly in the context of uncertainty and risks that accompany global supply chains. The problem of effective supply chain management in times of crisis, as Olson D.L., & Wu D. argue in their research, emphasizes that success depends on the ability to quickly adapt to change [8]. Gomez S. notes that in complex situations, ready-made solutions are needed that can be used to quickly adapt to change, as well as to implement innovative solutions to optimize management processes [5].

In the research of the international company McKinsey & Company Bartman, T. et al. conducted a number of studies in the field of logistics: substantiated issues of risk management in logical supply chains; current changes and global challenges in the logistics sector, optimization of global logistics supply routes. Researchers describe new types of risks that have appeared in global supply chains in recent years, such as cyber threats, climate change, pandemics, etc., and offer various strategies and tools for managing them in supply chains [15]. Diversification of suppliers, creation of reserves, use of innovative technologies for risk tracking make it possible not only to respond to problems that have already arisen, but also to predict potential threats and develop measures to prevent them, emphasizes Sandul M. [11].

In the context of the development of Industry 4.0, researchers led by García-Reyes, H. determine how to modernize supply chains. They offer directions that allow for the gradual integration of new technologies, while increasing the flexibility, sustainability and reliability of logistics processes, such as increasing efficiency, saving costs and increasing customer satisfaction, redesigning supply chain processes to use digital capabilities, creating reliable processes for collecting, storing and analyzing data, etc. [3]. Hassani Y., Ceauşu I., & Iordache A. emphasize that seemingly contrasting models (Lean – on efficiency, Agile – on flexibility) can be combined for effective management of the global supply chain, but only if there is a balance between the need for efficiency and the need for flexibility [6]. Thanks to digital solutions, such as process automation, accurate accounting, location optimization and data analytics, companies gain full control over their inventories, shipments and identify potential problems at an early stage, as emphasized by Shpak Y., Ilnytskyi V., & Andrukhiv I. [12]. Although big data technologies are still in their infancy, they are already playing an important role in transforming various industries, in particular by facilitating the development of new services, increasing the competitiveness of companies and developing innovative solutions in the field of logistics [10]. Researchers have shown that the implementation of digital solutions, such as warehouse management systems (WMS), enterprise resource planning systems (ERP) and transportation management systems (TMS), the use of blockchain technology for secure and transparent tracking of goods throughout the supply chain, improve agility and response to disruptions in force majeure circumstances and reduce costs and waste in the supply process.

The objective of research. The purpose of this article is to explore and substantiate key strategies for optimizing global supply chains that meet the requirements of the current digital transformation and allow enterprises to achieve a new level of competitiveness and sustainability in the modern global economy.

Objectives of the article. The rapid pace of globalization and technological development presents businesses with new choices, requiring companies to constantly adapt to changing conditions and build resilient supply chains that can withstand any threat. Based on the experience of the pandemic, governments and businesses are developing new models of global supply chains that will be more flexible and adaptable to unforeseen events. Increasing the resilience of supply chains remains a critical task even for the largest global companies. This process covers a wide range of activities, from analyzing potential threats to using modern technologies and collaborating with partners to create reliable supply networks [4].

The trend towards investing in technology to reduce costs and increase productivity is becoming increasingly evident, as noted in a McKinsey & Company study (Fig. 1). With supply chain finance, exporters and importers can flexibly adjust payment terms, maintain the necessary level of liquidity, and ensure the smooth movement of goods and funds between countries. Sustainable finance allows for the combination of social responsibility with economic

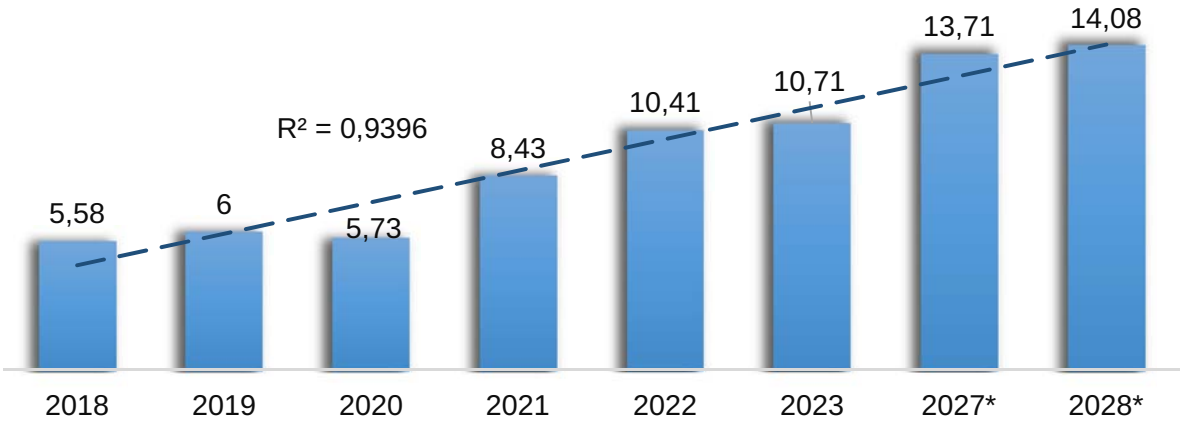

Figure 1. Investing in the technological development of logistics at the world level, trillion. dollars USA

Source: constructed by the author using data [1]

benefit, meeting the needs of customers striving for sustainable development. Sustainable finance is expected to become a decisive factor in the formation of sustainable supply chains, and the sustainability of supply chains will become a new criterion for making investment decisions.

A recent study confirms that global supply chains are undergoing continuous transformation, primarily due to the accelerated digital revolution and increasing geopolitical uncertainty. To effectively optimize operations in this dynamic environment, it's not enough to simply adopt new technologies; instead, a deep integration of digital solutions across all supply chain stages is crucial [11]. This involves leveraging artificial intelligence for demand forecasting, blockchain for enhanced transparency and trust, and advanced analytical tools to improve decision-making and mitigate risks. Ultimately, this digital transformation is emerging as the pivotal factor enabling companies to boost their flexibility, resilience, and competitiveness within the ever-changing global economic landscape [11].

An analysis of the brand value dynamics of the world's leading logistics companies, according to Brand Finance for 2022–2024, provides clear evidence of the impact of these trends (Tab. 1). While market leaders such as UPS and FedEx maintain their positions, demonstrating significant brand value of over $28 billion, there are noticeable and mixed changes. In particular, DHL demonstrates a steady growth in its brand value, while major players such as JR, Union Pacific, BNSF, SF Express, China Post and Maersk experienced a significant decline in the value of their brands in 2024 compared to previous periods. This indicates that even for established market leaders, maintaining and growing brand value is a difficult task that requires continuous adaptation and effective response to global challenges. Changes in the economic climate, geopolitical conflicts, fluctuations in supply and demand, as well as the pace of digital transformation directly affect the competitiveness and market capitalization of these companies.

Therefore, successful strategies for optimizing global supply chains in the face of digital transformation

Table 1

Top 10 logistics companies with the largest market value, 2024

Rating 2024	Logistics company	Country	Brand value in 2024, billion dollars	Brand value in 2023, billion dollars	Brand value in 2022, billion dollars
1	UPS	USA	34552	35400	38533
2	FedEx	USA	28556	28854	26012
3	DHL	Germany	12181	11865	11095
4	JR	Japan	11914	13773	12347
5	Union Pacific	USA	8018	8474	8203
6	BNSF	USA	6434	7583	6932
7	SF Express	China	5873	8241	8005
8	China Post	China	5485	6326	7460
9	USPS	USA	5422	5103	4912
10	Maersk	Denmark	4803	7417	4841

Source: compiled by the author using data [9]

must be comprehensive, flexible, and proactive. Enterprises are required to transcend a singular focus on operational efficiency, achieved through the deployment of sophisticated digital solutions. Concurrently, it is imperative for them to integrate a comprehensive understanding of macroeconomic and geopolitical dynamics, given their significant capacity to influence both the stability and intrinsic value of the business entity. Companies that are able to quickly adapt to changing conditions, invest in innovation, and build more resilient supply chains have the best chance of maintaining their leadership position and ensuring long-term growth of brand value in the face of constant uncertainty [14].

Despite the challenges, the logistics sector is also seeing positive trends that are improving customer satisfaction, optimizing costs, and accelerating decision-making. That's why companies are actively implementing these innovations around the world. A recent Maersk survey conducted by Statista among more than 500 logistics executives in Asia-Pacific, Europe, Latin America, the Middle East and Africa, and North America, identified the top ten global trends for 2025. Among the most critical trends highlighted in the study, five main areas are particularly prominent. First, supply chain transparency is key, offering a complete view of a product's journey from its origin with the producer all the way to the consumer. Second, the Internet of Things (IoT) plays a vital role by enabling real-time monitoring and control of operations. Third, supply chain diversification is essential for mitigating risks, preventing over-reliance on any single supplier or transportation route. Fourth, financial sustainability provides a crucial foundation for stable growth, especially during periods of uncertainty. Finally, digital transformation is overarching, integrating and automating all logistics processes to enhance efficiency and responsiveness. These trends indicate active work to increase the sustainability, efficiency and innovation of logistics operations around the world (Fig. 2).

Current trends are playing a key role in overcoming the growing challenges facing global logistics. The vast majority of decision-makers (82%) agree that implementing these trends helps to effectively address the complexity of global logistics. Optimism is particularly strong in the Middle East and Africa region, where 96% of respondents believe that new logistics trends are a viable solution to existing challenges. Positive sentiment also prevails in other regions: in Europe, this figure is 76%, and in Latin America, North America and Mexico – 78%. This indicates a global belief in the positive impact of new trends on logistics operations. Despite the general optimism, the degree of implementation of these trends varies by region, reflecting the unique strengths and priorities of each area. For example, technological innovation dominates in the Middle East and Asia-Pacific regions. In particular, the Middle East is a leader in the implementation of artificial intelligence (AI) and the Internet of Things (IoT), while the Asia-Pacific region is distinguished by its achievements in ensuring supply chain transparency. In contrast, the regions of Europe, Latin America and North America are more focused on digital transformation and innovation in the field of

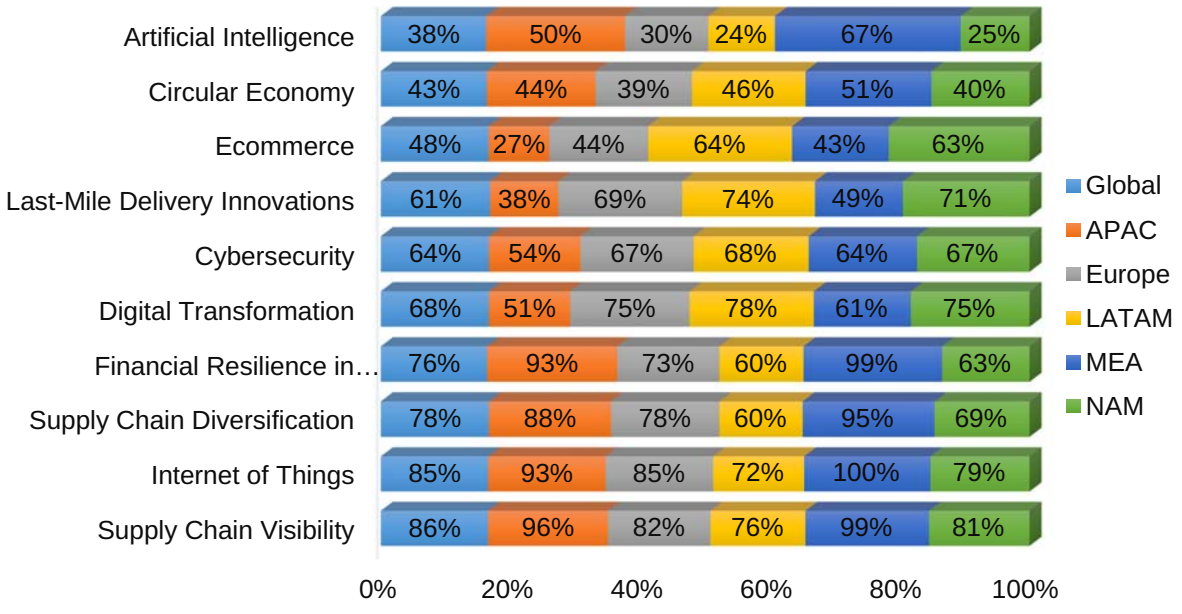

Figure 2. Main regional trends in global logistics for 2025

Source: constructed by the author using data [13]

"last mile" delivery. This priority is due to their strong service sectors and emphasis on direct-to-consumer (B2C) models, where efficiency and speed of delivery directly affect customer satisfaction.

Thus, the global landscape of logistics innovation is extremely multifaceted and has a huge impact on all countries of the world. This innovation flow does not bypass any country, regardless of its level of economic development or geographical location. Countries with developed economies are actively implementing advanced technologies, seeking to increase the efficiency of their supply chains and competitiveness. At the same time, developing countries are also feeling the impact of these changes as global logistics networks integrate their markets and production into the global system. This leads to the unification of standards, increased availability of goods and reduced delivery times worldwide.

Innovations in logistics create a domino effect, with advancements in one region rapidly influencing others, such as more efficient Asian port technologies reducing delivery times and costs to Europe and America. The global rise of e-commerce and the demand for rapid delivery are compelling logistics companies worldwide to adopt novel, more adaptable, and efficient strategies. Consequently, these logistics innovations are a primary driving force of globalization, fostering international cooperation and the formation of a unified global market. Given that logistics is crucial for maintaining business continuity amidst uncertainty, it's vital to establish clear criteria for assessing the efficiency and sustainability of logistics processes. The core of optimization lies in defining the most effective criteria for evaluating logistics chain management strategies in unpredictable environments. The main criteria are the system's ability to self-adjust and flexibility in responding to changes, the efficiency of resource use and resilience to external threats. The cornerstone of an optimized logistics supply chain lies in establishing a robust system of key performance indicators (KPIs). These indicators are crucial because they provide a precise and quantifiable means to evaluate the efficacy of the adopted strategic approaches. In essence, without a clear framework of KPIs, it's challenging to accurately gauge whether your logistics strategy is truly delivering the desired results [8]. Achieving high efficiency is achieved by increasing production efficiency by increasing throughput, eliminating bottlenecks and reducing the production cycle, increasing labor productivity, optimizing logistics processes and accelerating the turnover of material resources. To minimize the risks associated with uncertainty, strategies for increasing the resilience of global supply chains should be applied (Tab. 2).

Significant fuel price increases, labor shortages, and the destruction of transport infrastructure have created a critical situation that requires a radical restructuring of logistics processes using the latest technologies. Digital transformation has become

Table 2

Global supply chain optimization strategies

Strategy	The essence of the strategy	Directions of use	Advantages of use
Multisourcing	Creation of backup supply channels	Distribution of risks between several sources, minimizing the consequences of crises	Ensures high stability of supply, competitive prices, continuous improvement of product quality and access to the latest technological developments
Niashoring	Bringing production closer to the consumer	Full control over all stages of supply	Speeds up order fulfillment and reduces transportation costs
Decentralization of production	Territorial distribution of production	Reduction of logistics costs and increase in delivery speed	Reduces risks of supply chain disruption
Harmonization	Implementation of a single quality standard	Systematization of actions at all levels of the supply chain	Increases the productivity and efficiency of all business processes
Maintaining excess production assets	Creating reserves of inventory or production capacity	Increasing inventory or production capacity	Insuring against possible supply disruptions and increasing the resilience of supply chains
Building strategic alliances	Creating mutually beneficial partnerships	Entering a common logistics ecosystem	Stimulating joint efforts, market interaction and exchange of experience
Supply flexibility	Creating adaptive logistics networks	Investing in dynamic logistics systems	Ensures rapid adaptation to changing market conditions
Digital modernization	Adoption of digital tools	Blockchain, AI and cloud computing in supply chain management	Provides transparency, intelligence and scalability of supply chains

Source: supplemented by the author based on [7]

a necessity for global supply chains that are facing unprecedented challenges. Digital solutions and IT tools are revolutionizing supply chains, significantly enhancing their transparency and efficiency. These advancements enable comprehensive tracking of goods, from the moment they leave the manufacturer until they reach the end consumer. This detailed visibility allows for precise monitoring of inventory levels in warehouses and the proactive identification of potential delays or disruptions, ultimately streamlining the entire process. A wide range of software solutions helps to increase the productivity of the entire supply chain (Fig. 3). To achieve maximum transparency and control over the performance of tasks, it is necessary to develop systems that will store reliable and undistorted data. Blockchain technology, for example, guarantees the highest level of data security, making it impossible to falsify or unauthorized access. IoT sensors have transformed supply chains into interactive systems where each product has its own digital passport containing detailed information about transportation conditions, allowing companies to ensure product quality and meet customer requirements [6].

Digital platforms significantly enhance supply chain operations by streamlining communication and facilitating transparent, efficient financial transactions among partners. This digitalization transforms traditional, static supply chains into agile, dynamic networks, boosting overall transparency, efficiency, and adaptability. Furthermore, the integration and comprehensive analysis of diverse big data sets empower businesses to make rapid, well-informed decisions, crucial for navigating today's ever-evolving market landscape [10].

As geopolitical tensions escalate and nations increasingly prioritize the protection of their domestic markets, major corporations will need to fundamentally reassess their operational strategies. This shift will likely entail a reduced dependence on extensive global supply chains, favoring instead a more localized approach to production aimed at satisfying regional consumer demand [16]. This strategic adjustment is driven by a desire to mitigate the vulnerabilities associated with disruptions to supply and to bolster resilience against external pressures. Nevertheless, this trend toward reduced globalization doesn't signify a complete dismantling or drastic overhaul of existing production networks; rather, many companies are actively focused on fortifying their current supply chains..

Effectively navigating global crises within logistics chains demands more than just leveraging advanced technology; it necessitates a thorough grasp of the intricate connections among all chain components and a swift capacity for adapting to external shifts. Implementing digital platforms streamlines numerous supply chain processes by automating tasks, thereby decreasing manual work and significantly lowering error potential. A crucial development in contemporary logistics, facilitated by these digital advancements, is the evolution from linear to interconnected, networked supply chains.

Conclusion. The ability to be flexible and adaptable is becoming a fundamental requirement for global supply chains that are faced with unpredictable market changes and dynamic consumer needs. In contrast to static traditional models, adaptive supply chains are characterized by deep cooperation between all participants, operational data exchange

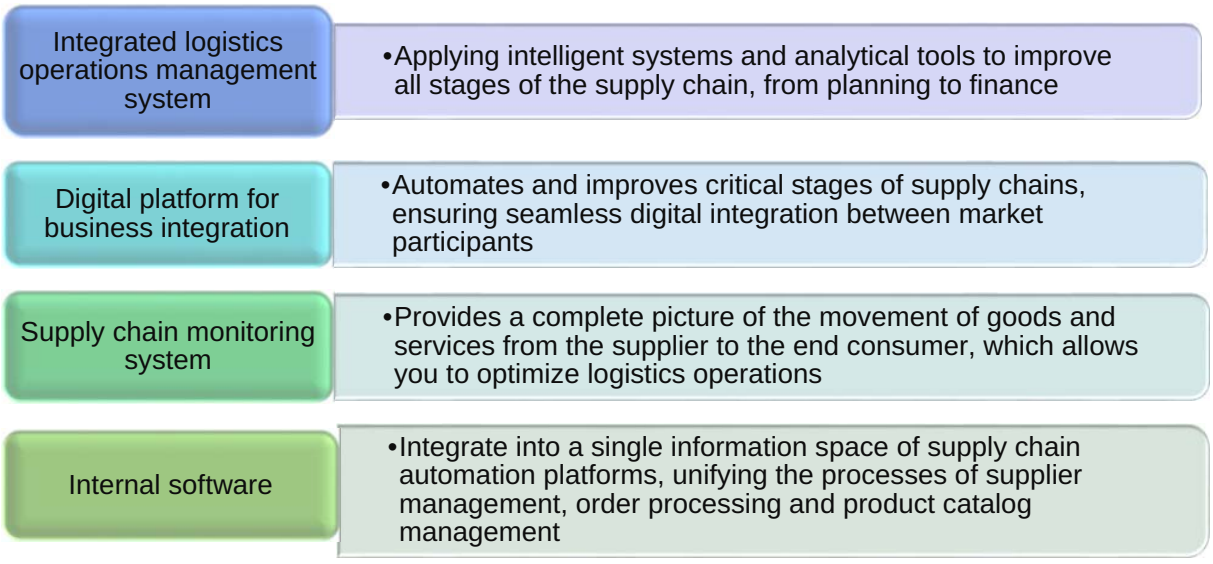

Figure 3. Supply chain management platforms

Source: compiled by the author based on [16]

and the widespread use of innovative digital technologies, which ensures a quick and effective response to any external influences. The introduction of advanced technologies, such as the Internet of Things (IoT) and artificial intelligence (AI), into logistics processes not only significantly increases their productivity and efficiency, but also significantly improves the quality of customer service. Thus, digital solutions are becoming an indispensable tool for navigating the complexities of global supply chains and maintaining a competitive advantage in the face of constant globalization and change.

It is worth noting that the optimization of global logistics supply chains in the face of modern global crises is not the sum of discrete measures, but a comprehensive approach that includes interrelated actions. Successful implementation of such optimization involves the holistic application of modern technologies, strategic diversification of suppliers to reduce risks, proactive optimization of inventories, ensuring full transparency at all stages of the chain, investments in own infrastructure, as well as in-depth cooperation between all participants. Constant adaptation to rapidly changing market conditions and readiness for innovation are integral components of this process. The study's proposed solutions could significantly impact global logistics by not only enhancing current business models but also enabling the development of entirely new ones. This innovation would empower businesses to thrive amidst intense competition and ongoing geopolitical instability.

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БІБЛІОГРАФІЧНИЙ СПИСОК:

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