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ENSURING THE EFFICIENCY OF TRANSPORT AND FORWARDING SERVICES BASED ON THE OPERATION OF LOGISTICS CENTERS

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ЗАБЕЗПЕЧЕННЯ ЕФЕКТИВНОСТІ ТРАНСПОРТНО-ЕКСПЕДИЦІЙНИХ ПОСЛУГ НА ОСНОВІ ФУНКЦІОНУВАННЯ ЛОГІСТИЧНИХ ЦЕНТРІВ

In the context of the gradual complexity of the logistics services market, increasing the efficiency of transportation and forwarding services becomes particularly important. These services do not exist merely as a functional part of logistics, but directly benefit from the development of logistics centers. In this context, effective cargo transportation organization is crucial (as it determines the level of customer service, cost optimization, and the competitiveness of participants in the logistics market) as well as the development of logistics centers (which act as key elements of logistics chains, ensuring comprehensive management of goods, information, and resource flows). Therefore, this article aims to justify the approaches to improving the efficiency of transportation and forwarding services through the direction of the systemic development of logistics centers. The study confirms that improving the efficiency of transportation and forwarding services is possible through the implementation of a systems approach to the development of logistics centers as strategic elements of logistics infrastructure. This approach involves coordinated interaction among all participants in the logistics process, the integration of functional components of logistics centers, and a focus on optimizing material, informational, and financial flows. The main directions of the systemic development of logistics centers are: implementing modern information systems for monitoring, planning, and coordinating transportation and forwarding operations; infrastructure modernization; optimization of routes and transportation schemes; development of partnership logistics interaction; regional specialization of logistics centers. Implementing these directions contributes to the overall effectiveness of transportation and forwarding services, ensuring their quality, timeliness, cost-efficiency, and flexibility. In conclusion, the systems approach to the development of logistics centers forms the foundation for building a competitive, adaptive, and efficient logistics system that meets the requirements of the modern transportation and forwarding services market. The prospects for further research lie in the improvement of information system integration technologies and the optimization of logistics chains in the context of developing new partnership interaction models and adapting to changes in market conditions.

В умовах поступового ускладнення ринку логістичних послуг особливого значення набуває підвищення ефективності транспортно-експедиційного обслуговування, яке є не просто функціональною частиною логістики, а безпосередньо вирає від розвитку логістичних центрів. У цьому контексті важливою є ефективна організація вантажних перевезень, що визначає рівень обслуговування клієнтів, оптимізацію витрат та конкурентоспроможність учасників логістичного ринку, а також розвиток логістичних центрів — елементів логістичних ланцюгів, які забезпечують комплексне управління потоками товарів, інформації та ресурсів. Відтак, метою даної статті є обґрунтування підходів до підвищення ефективності транспортно-експедиційних послуг шляхом системного розвитку логістичних центрів. У межах дослідження встановлено, що підвищення ефективності транспортно-експедиційних послуг можливе завдяки впровадженню системного підходу до розвитку логістичних центрів як стратегічних елементів логістичної інфраструктури. Такий підхід передбачає узгоджену взаємодію всіх учасників логістичного процесу, інтеграцію функціональних компонентів логістичних центрів, а також орієнтацію на оптимізацію матеріальних, інформаційних і фінансових потоків. Основними напрямками системного розвитку логістичних центрів є: впровадження сучасних інформаційних систем для моніторингу, планування та координації транспортно-експедиційних операцій; модернізація інфраструктури; оптимізація маршрутів і транспортних схем; розвиток партнерської логістичної взаємодії; а також регіональна спеціалізація логістичних центрів. Реалізація зазначених напрямів сприяє підвищенню загальної ефективності транспортно-експедиційних послуг, забезпечуючи їхню якість, своєчасність, економічність, гнучкість. У підсумку, системний підхід до розвитку логістичних центрів створює основу для формування конкурентоспроможної, адаптивної та ефективно логістичної системи, що відповідає вимогам сучасного ринку транспортно-експедиційних послуг. Перспективи подальших досліджень пов'язані з удосконаленням технологій інтеграції інформаційних систем та оптимізацією логістичних ланцюгів у контексті розвитку нових партнерських моделей взаємодії та адаптації до змін ринкового середовища.

Key words: market conditions change; customer service; cost optimization; competitiveness; logistics center development; functional part of logistics.

Ключові слова: зміна ринкових умов; обслуговування клієнтів; оптимізація витрат; конкурентоспроможність; розвиток логістичних центрів; функціональна частина логістики.

PROBLEM STATEMENT

In the context of the gradual complication of the logistics services market, increasing the efficiency of freight forwarding services is gaining particular importance. These services do not merely function as a part of logistics but directly benefit from the development of logistics centers. In this context, the effective organization of cargo transportation becomes crucial, as it determines the level of customer service, cost optimization, and the competitiveness of logistics market participants. Equally important is the development of logistics centers, which serve as elements of logistics chains that ensure comprehensive management of the flow of goods, information, and resources. Thus, the integration of freight forwarding services into the structure of logistics centers enables a high level of coordination among all participants in the supply chain. This, in turn, contributes to reduced delivery times, improved transport reliability, decreased losses and downtime, and ensures flexibility in responding to changes in market conditions or customer needs.

Moreover, modern logistics centers increasingly function as points for the physical handling of cargo and

as information and analytical hubs that enable real-time data exchange, freight flow monitoring, inventory management, and demand forecasting. Digital technologies and automated management systems used within logistics centers significantly enhance the efficiency of freight forwarding operations.

With this in mind, improving the efficiency of freight forwarding services should not be viewed in isolation but rather in conjunction with the development of logistics infrastructure, the implementation of innovative solutions, and the enhancement of management approaches. It's this integrated model that enables logistics companies to respond effectively to the challenges of the modern market and build competitive advantages in the context of the global economy.

ANALYSIS OF RESEARCH AND PUBLICATIONS

The specific aspects of improving the efficiency of freight forwarding services have been examined in the scholarly works of Strunin V.V., Hyra M.M., Beketov Yu.O., Kovalik A.O., Reznik N.P., Kharchevnikova L.S., and Puhachova V.R. In their research, they focus on key elements

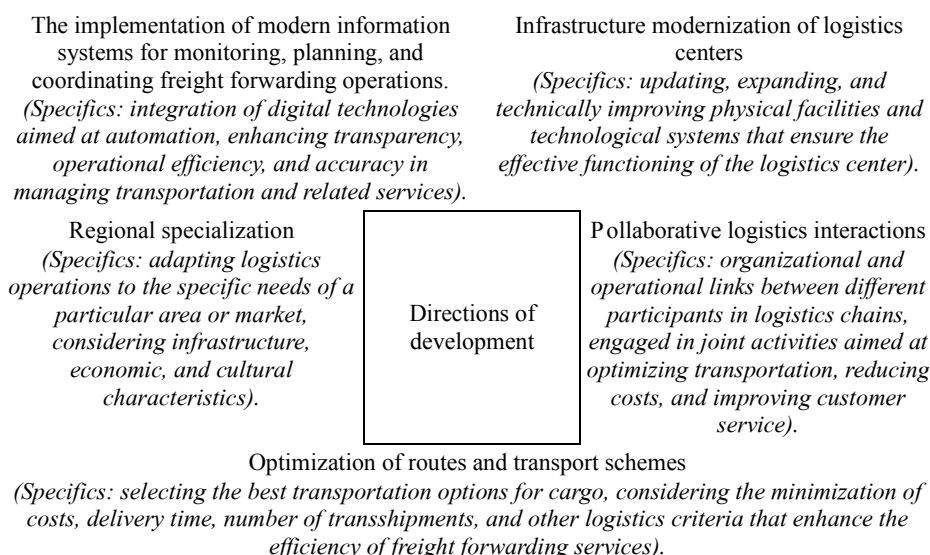


Fig. 1. Key directions for the systematic development of logistics centers

Source: compiled based on [1; 3—4; 6].

of enhancing logistics processes and increasing efficiency in freight forwarding services, particularly in the context of rising demands for transport quality, cost optimization, and the adoption of modern technologies.

Strunin V.V. and Hyra M.M. [4] emphasize the importance of integrating warehousing and transportation functions to achieve maximum efficiency. They note that improving logistics processes requires a comprehensive approach, which includes the automation of operations, enhancement of inventory management, and reduction of cargo handling time.

Beketov Yu.O. and Kovalik A.O. [2] examine the role of effective transport quality management as a crucial element in enhancing the efficiency of freight forwarding services. They highlight the importance of using innovative quality assessment methods, such as real-time monitoring technologies, to optimize transport processes and reduce costs.

Reznik N.P., Kharchevnikova L.S., and Puhachova V.R. [2] examine the main challenges faced by the logistics sector in Ukraine, particularly in the context of the development of freight forwarding services. They emphasize the importance of implementing digital technologies for cargo flow management, process monitoring, and ensuring effective information exchange among participants in the logistics chains.

These studies demonstrate that improving the efficiency of freight forwarding services requires a comprehensive approach that includes technological innovations and the enhancement of organizational and management processes. All these aspects collectively contribute to cost reduction, improved service quality, and the optimization of logistics processes—key factors in strengthening competitiveness in the logistics services market.

FORMULATION OF THE ARTICLE'S OBJECTIVES

The aim of this article is to justify approaches for improving the efficiency of freight forwarding services through the systematic development of logistics centers.

THE PAPER MAIN BODY

Since the emergence of the first logistics centers in the mid-20th century, their primary goal has consistently been to ensure the efficient functioning of logistics processes, particularly providing high-quality freight forwarding services. In this context, efficiency implies an optimal balance between quality, speed, cost, and reliability of delivery, meeting both customer needs and the demands of a dynamic market.

We agree with the statements of Reznik N.P., Kharchevnikova L.S., and Puhachova V.R. [2], who argue that logistics centers serve as a tool for integrating transportation, warehousing, and information components, allowing for a high level of service while reducing the overall costs of the logistics system.

Improving the efficiency of freight forwarding services is achievable through the implementation of a systematic approach to the development of logistics centers as strategic elements of logistics infrastructure. This approach involves coordinated interaction among all participants in the logistics process, the integration of the functional components of logistics centers, and a focus on optimizing material, informational, and financial flows.

Noted that the main directions of the systematic development of logistics centers are (Fig. 1): the implementation of modern information systems for monitoring, planning, and coordinating freight forwarding operations; infrastructure modernization; route and transport scheme optimization; collaborative logistics interactions; and regional specialization.

These outlined directions ensure the systematic development of logistics centers, as they cover the most significant aspects that influence the specifics of their operations in the market environment.

We emphasize that the term "systematic development" refers to a comprehensive approach to the operational format of the logistics center and to the format of all its operations [6].

The implementation of modern information systems for monitoring, planning, and coordinating freight forward-

Table 1. Features of logistics center development through the implementation of modern information systems

Directions for implementing information systems	Specifics of changes from the implementation of information systems	The content of logistics center development
Inventory management (through WMS)	Automated tracking of goods in the warehouse, which reduces the likelihood of errors and allows for more accurate planning of cargo volumes.	The time required for cargo processing in warehouses, transportation terminals, or during customs clearance is significantly reduced. The human factor is eliminated, and the likelihood of errors, such as incorrect labeling, wrong routes, or inaccurate cargo data, is minimized. All stages of logistics operations — from the concentration of goods to their storage and transportation — become transparent to all participants in the process.
Transportation management (through TMS)	Route optimization, transportation planning, and real-time monitoring of vehicles to ensure fast and accurate delivery.	
Resource planning (through ERP)	Integration of all aspects of the company's operations, enabling proper management of finances, materials, personnel, and other key components.	

Source: compiled based on [1—2; 4; 6].

ding operations in logistics centers promotes the automation of operations (through the introduction of TMS, WMS, ERP systems [1; 4]), which helps reduce cargo processing time, minimize the risk of errors, and enhance process transparency in the concentration, handling,

storage, redistribution, and transportation of goods. The specifics of implementing modern information systems in the activities of logistics centers are presented in Table 1.

In this regard, the development of logistics centers is ensured by the fact that information systems enable the

Table 2. Features of logistics center development from their infrastructure development

Directions for infrastructure modernization	Specifics of Phanges from Infrastructure Modernization	The content of logistics center development.
Increasing storage space allows for more efficient handling of larger volumes of goods.	This includes both the expansion of storage areas and the implementation of automated warehouse management systems (WMS), which improve the accuracy and speed of operations.	Installation of modern shelving systems, temperature control systems (for storing sensitive goods), as well as automation of loading and unloading processes, which contributes to increased operational efficiency.
Improving the throughput capacity of terminals and platforms.	Expansion of cargo platforms, increasing the number of transshipment points, and the installation of specialized terminals for different types of cargo (containerized, palletized, etc.).	The use of innovative technologies for automating loading and unloading processes, which helps reduce transshipment time and increase throughput capacity.
Installation of supply chain management (SPM) systems.	Installation of supply chain management (SPM) systems integrated with ERP systems, which help reduce order processing time and improve the accuracy of demand forecasting.	The use of RFID technology for real-time monitoring of goods, which improves control over cargo movement and ensures accurate tracking at every stage of logistics operations.
Upgrading infrastructure to enhance connections between different modes of transportation.	Upgrading infrastructure to improve connections between different modes of transportation (road, rail, water), which helps reduce travel time and increase efficiency.	Upgrading infrastructure to improve connections between different modes of transportation (road, rail, water), which helps reduce travel time and increase efficiency.

Source: compiled based on [1; 4—6].

effective coordination of all stages of the logistics process [6].

The infrastructure modernization of logistics centers occurs through the expansion of their warehousing capacities, the throughput capabilities of their terminals and platforms, which improves the continuity and rhythm of logistics operations. The specifics of the development of logistics centers in relation to their infrastructure development are presented in Table 2.

Thus, the infrastructure modernization of logistics centers is focused on improving operational efficiency, reducing costs, increasing throughput capacity, and minimizing environmental impact [1; 4].

Optimization of route planning processes and transportation schemes of logistics centers through the optimization of mathematical modeling and logistics planning methods. This optimization is necessary to determine the most economical and reliable delivery routes, as illustrated by the data in Table 3.

In this area, logistics centers are capable of reducing costs and improving the quality of transportation and freight forwarding services, particularly by ensuring a seamless delivery process for goods [5—6]. One notable example of how logistics centers can lower costs and enhance service quality is the integration of automated warehousing systems in large retailers such as Amazon.

Amazon operates its own logistics centers using advanced technologies that enable efficient order processing, reduce delivery times, and lower transportation costs. These centers automatically sort products using robotic systems, which helps minimize human error and shortens the time required to process orders. This also significantly increases warehouse efficiency by reducing labor and inventory management costs. Moreover, the presence of such centers enables faster delivery, which is a crucial factor for market competitiveness.

Partnership interaction involves the establishment of a network of partnerships by logistics centers with transport operators, freight forwarders, and shippers.

Table 3. Features of logistics center development from optimization of route planning and transportation schemes processes

Directions of optimization	Specifics of changes from route planning and transportation scheme processes	The content of logistics center development.
Optimization of delivery routes	Reduction of overall transportation costs (fuel, time, resources)	The implementation of mathematical models for calculating the most efficient routes, which reduces costs and improves customer service quality.
Pargo and transport distribution	Improvement in the efficiency of vehicle and warehouse utilization.	Optimization of the use of transportation vehicles and warehouses, which helps reduce congestion and improve the productivity of logistics operations.
Dynamic optimization	Flexibility in responding to changes in traffic, weather conditions, and unforeseen situations.	The use of real-time data to adapt delivery routes, reducing delays and improving delivery reliability.
Traffic analysis and forecasting	Improvement of the accuracy of delivery time forecasts and route load capacity.	The use of traffic forecasting systems allows for more efficient route planning and reduces the risk of delays.
Use of environmentally friendly routes	Reduction of PO ₂ emissions and energy consumption in transportation*	The use of optimal routes to reduce the environmental footprint of logistics operations in accordance with environmental standards.
Ensuring delivery reliability	Increase in the throughput capacity of transport flows	The implementation of innovative technologies for automating cargo platforms, which reduces cargo processing time and improves throughput.

Note

*These are processes and measures aimed at reducing carbon dioxide (CO₂) emissions and lowering energy consumption during the transportation of goods.

Source: compiled based on [1; 5—6].

Such cooperation is implemented through a set of organizational, contractual, and technological mechanisms that ensure coordinated and efficient operation of all participants in the logistics chain, contributing to the reduction of transaction costs and the formation of effective supply chains. Accordingly, the features of logistics center development influenced by partnership interaction are presented in Table 4.

Thus, in this regard, logistics centers are capable of ensuring their integration into global supply chains, as well as their development through the alignment of standards and service procedures [4].

Table 4. Features of logistics center development resulting from partnership cooperation

Areas of partnership interaction	Specific changes resulting from partnership interaction	The concept of logistics center development
Integration with transport operators	Coordinated transportation planning, reduced downtime, improved coordination.	Establishment of a unified transport management platform, increased speed and consistency in cargo flow processing. Formation of long-term contracts, stabilization of logistics flows, optimization of warehousing and resource provisioning. Joint use of infrastructure.
Cooperation with freight forwarders	Ensuring a continuous delivery chain, joint management of routes and shipments	
Partnership with shippers	Better demand forecasting, alignment of delivery schedules	

Source: compiled based on [1; 3—4].

Regional specialization involves the development of logistics centers according to the specific needs of a particular region or industry, allowing for flexible responses to demand and the formation of competitive advantages in the field of transportation and forwarding services.

The application of a systems approach to the development of logistics centers in the specified areas positively impacts the efficiency of transportation and forwarding services. This approach ensures the integration of all elements of logistics infrastructure into a single functional system, where all components interact coherently and purposefully.

The improvement of service quality is achieved through the implementation of modern digital technologies, which ensure precise route planning, real-time delivery tracking, efficient inventory management, and optimization of logistics operations. This contributes to minimizing errors, increasing order processing speed, and ensuring timely delivery of goods.

Cost reduction is achieved through the optimization of transportation flows, selection of cost-effective routes, efficient use of resources, as well as reducing vehicle downtime and excess storage costs. The systems approach also allows for rational planning of logistics center capacity.

Furthermore, the systematic development of logistics centers ensures their high adaptability to changes in the market environment, while their flexible structure and the presence of modern information systems enable rapid response to external challenges, restructuring logistics schemes, and maintaining efficiency in unstable conditions.

CONCLUSIONS

The study confirms that improving the efficiency of transportation and forwarding services is possible through the implementation of a systems approach to the development of logistics centers as strategic elements of logistics infrastructure. This approach involves coordinated interaction among all participants in the logistics process, the integration of functional components of logistics centers, and a focus on optimizing material, informational, and financial flows.

The main directions of the systemic development of logistics centers are: implementation of modern information systems for monitoring, planning, and coordinating transportation and forwarding operations; infrastructure modernization; optimization of routes and transportation schemes; development of partnership logistics interaction; regional specialization of logistics centers.

The implementation of these directions contributes to the overall effectiveness of transportation and forwarding services, ensuring their quality, timeliness, cost-efficiency, and flexibility.

In conclusion, the systems approach to the development of logistics centers forms the foundation for building a competitive, adaptive, and efficient logistics system that meets the requirements of the modern transportation and forwarding services market.

The prospects for further research may focus on improving the integration technologies of information systems and optimizing logistics chains in the context of developing new partnership interaction models and adapting to changes in market conditions.

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