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LAST-MILE LOGISTICS IN THE CONTEXT OF E-COMMERCE GROWTH: CHALLENGES AND PERSPECTIVES

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ЛОГІСТИКА ОСТАННЬОЇ МИЛІ В КОНТЕКСТІ ЗРОСТАННЯ ЕЛЕКТРОННОЇ КОМЕРЦІЇ: ВИКЛИКИ ТА ПЕРСПЕКТИВИ

The study of the directions of transformation of logistics processes associated with the development of e-commerce and changing consumer habits has allowed us to determine that last-mile logistics is one of the most important and at the same time complex links in the supply chain management of modern organizations. The quality of the customer experience and the organization's position among competitors depend on the effectiveness of last mile logistics management, hence the relevance of this study. This study examines a variety of information sources used in studying the essence of last mile logistics and

identifying market trends, investigating the characteristics, challenges of its functioning and aspects of last mile logistics management. The main objective of this study is to analyze the trends of last mile logistics in the e-commerce environment, to identify the challenges and prospects of last mile logistics. The combination of in-depth literature analysis and information resource assessment formed the basis of the qualitative methodology of this study. The results demonstrate the key role of classical information channels in the study of last mile logistics. Their advantages are clear systematization, verifiability, and normative regulation, which allows for a strategic vision of last mile logistics development. The combination of classical methods and new digital tools creates a solid foundation for analyzing the development of last-mile logistics. While social media and real-time monitoring systems offer unprecedented opportunities to quickly track opinions and manage last-mile logistics, they are not without drawbacks. The reliability of data can be compromised by fakes, biases, and willful misrepresentations. However, it is these digital tools that allow to instantly capture changes in the mood of target audiences and promptly respond to emerging crisis situations, which makes them indispensable in the modern information space. The methodological basis of the research was formed by general scientific and special methods. Methods of collection, processing and analysis of data on the development of logistics of the last mile, methods of comparison and generalization of information, analysis and synthesis, secondary and primary marketing research were used. Improving the mechanisms of last mile logistics development requires the introduction of modern innovative solutions. To implement effective management of logistics business processes at the last mile stage, organizations need to consider various aspects: organizational, competitive, value, technological and environmental.

Дослідження напрямів трансформації логістичних процесів, пов'язаних із розвитком електронної комерції та зміною звичок споживачів, дозволило визначити, що логістика «останньої милі» є однією з найважливіших і

водночас складних ланок управління ланцюгом поставок сучасних організацій. Від ефективності логістичного менеджменту «останньої милі» залежить якість клієнтського досвіду та позиція організації серед конкурентів. Саме ці фактори окреслюють актуальність дослідження, у якому розглядаються різноманітні інформаційні джерела, що використовуються для вивчення сутності логістики «останньої милі» та виявлення ринкових тенденцій, досліджуються характеристики, проблеми її функціонування та аспекти управління логістикою «останньої милі». Основна мета цього дослідження — проаналізувати тенденції логістики «останньої милі» в середовищі електронної комерції, визначити виклики та перспективи логістики «останньої милі». Поєднання поглибленого аналізу літератури та оцінки інформаційних ресурсів лягло в основу якісної методології цього дослідження. Результати демонструють ключову роль класичних інформаційних каналів у вивченні логістики «останньої милі». Їх перевагами є чітка систематизація, перевіреність, нормативна регламентація, що дозволяє стратегічно бачити розвиток логістики «останньої милі». Поєднання класичних методів і нових цифрових інструментів створює міцну основу для аналізу розвитку логістики «останньої милі». Хоча соціальні медіа та системи моніторингу в реальному часі пропонують безпрецедентні можливості для швидкого відстеження думок і управління логістикою останньої милі, вони не позбавлені недоліків. Надійність даних може бути скомпрометована підробками, упередженнями та навмисним спотворенням. Однак саме ці цифрові інструменти дозволяють миттєво фіксувати зміни в настроях цільових аудиторій і оперативно реагувати на кризові ситуації, що виникають, що робить їх незамінними в сучасному інформаційному просторі. Методологічну основу дослідження склали загальнонаукові та спеціальні методи. Використовувалися методи збору, обробки та аналізу даних щодо розвитку логістики «останньої милі», методи порівняння та узагальнення інформації, аналізу та синтезу, вторинні та первинні маркетингові дослідження.

Удосконалення механізмів розвитку логістики останньої милі потребує впровадження сучасних інноваційних рішень. Для реалізації ефективного управління логістичними бізнес-процесами на етапі «останньої милі» організаціям необхідно враховувати різні аспекти: організаційні, конкурентні, вартісні, технологічні та екологічні.

Keywords: *logistics, last mile, e-commerce, growth, challenges, prospects.*

Ключові слова: *логістика, остання миля, електронна комерція, зростання, виклики, перспективи.*

Statement of the problem in general terms and its relationship to important scientific or practical problems. Last-mile logistics is the transportation of goods from the seller's warehouse or distribution center to the final destination, usually the consumer's doorstep. Simply put, it is the final step in the supply chain process.

The importance of the last mile cannot be overemphasized in a world where customer satisfaction is a major determinant of business success. Last mile delivery is the last interaction between the customer and the logistics company. Any delays or problems in supply chain logistics can lead to a negative experience and affect customer loyalty.

Thus, the last mile problem refers to the inefficiencies and difficulties encountered during the final stage of product delivery. This stage is often considered the most difficult and costly in the delivery process.

Last mile delivery is not an easy task and it often involves logistical difficulties that affect the profitability and reputation of the seller.

An analysis of recent research and publications. Freight transportation manages the complete operation of moving cargo and related resources from the starting point to the final destination, paying special attention to customer requirements, according to G. Ghiani (2018).

ZHAO Zhen (2022) defines the last mile as one mile in terms of geographical location, and the last link of the distribution center, that is, the delivery of goods from the distribution center to customers. In essence, it represents the very end of logistics. It is the key link that dominates the quality of service and the effect of the whole logistics distribution, emphasizes WANG Hong (2020), which will also be considered as a key indicator to measure users' satisfaction with their service.

With the rapid growth and expansion of e-commerce, more space is created for the development of logistics industry, asserts WANG Shuang (2022). A number of logistics companies have formed their own logistics distribution system with full distribution service, so the common practice is next day delivery or same day delivery. However, for enterprises, logistics management is a key issue of great concern, determines MLADENKA B. et al. (2023). Nowadays, both suppliers and buyers want to promptly deliver goods purchased on an e-commerce platform to their consumers. This places tremendous demands and challenges on logistics enterprises to deliver the last mile.

For logistics businesses that intend to stay in the market and in the industry for a long time, they must do their best to meet the needs of suppliers and consumers. According to statistics, 55% of consumers and suppliers prioritize logistics companies with strong distribution capabilities. However, the high cost, believes YUE Chao-gang (2022) creates great difficulties in managing the whole delivery, resulting in a complicated process of achieving fast delivery. In addition, CORTES J D (2022) emphasizes that last mile delivery has a direct impact on customer satisfaction with the entire consumption of the product. Therefore, although some costs may be incurred, a business's investment in this aspect is bound to have a positive impact on its future development.

Due to the unprecedented growth of e-commerce and the availability of goods over the internet, the role of the LSP has become more important in the supply chain network. This makes logistics systems more complex than before,

Savelsbergh & Van Woensel (2021) determine. The cheapest delivery to meet customer needs has been the top priority for the logistics industry.

Nowadays, on-time delivery commitments are also becoming very important goals in the competitive and cost-oriented logistics market.

The last mile issues in e-commerce are covered in a number of publications by domestic and foreign experts, in particular Y. Vakulenko, P. Shams, D.A. Gellstrom and K. Hjort (2018) in their study reveal how service innovation affects e-commerce, consumer behavior and identify the main map of e-customer journey. D. Fancello, D.G. Paddeu, P. Fadda (2019) conducted a study on the characteristics of food supply in urban areas aimed at understanding consumers' needs and expectations of fresh food through last mile logistics. C. Ye (2020) emphasizes on evaluating the effects of three new delivery models and focuses on economies of scale and economies of time and space. O. V. Gorbenko, O. A. Karpenko (2022) study the impact of e-commerce on the development of last mile logistics in Ukraine and analyze the status and trends of e-commerce market development in Ukraine.

Formulation of the goals of the article (problem statement). The main purpose of this research is to analyze the directions of last mile logistics in the e-commerce environment, identify the challenges and prospects of last mile logistics. Aiming to improve the management of last mile logistics, this paper offers a comprehensive analysis of existing analytical approaches and current challenges in this area. Organizations interested in optimizing logistics processes will receive practical recommendations for implementing effective tools, which will allow them to build a more efficient system for delivering goods to the final consumer.

A combination of in-depth literature analysis and information resource assessment formed the basis of the qualitative methodology of this study. The results demonstrate the key role of classical information channels in the study of last-mile logistics. Their advantages are clear systematization, verifiability, and normative regulation, which allows for a strategic vision of last mile logistics

development. The combination of classical methods and new digital tools creates a solid foundation for analyzing the development of last-mile logistics.

Results of the main study material. A modern supply chain is a system of processes and objects (its links) that ensures the movement of material, information, financial and service flows from suppliers to end consumers [3]. It starts with the delivery of raw materials to producers and ends with the delivery of finished products to consumers.

The last mile is the final stage of the supply chain, involving the delivery of products directly to the final consumer in a specific place at the right time and in the required quantity. In general, in the practice of logistics activities the following types of logistics are distinguished (Figure 1).

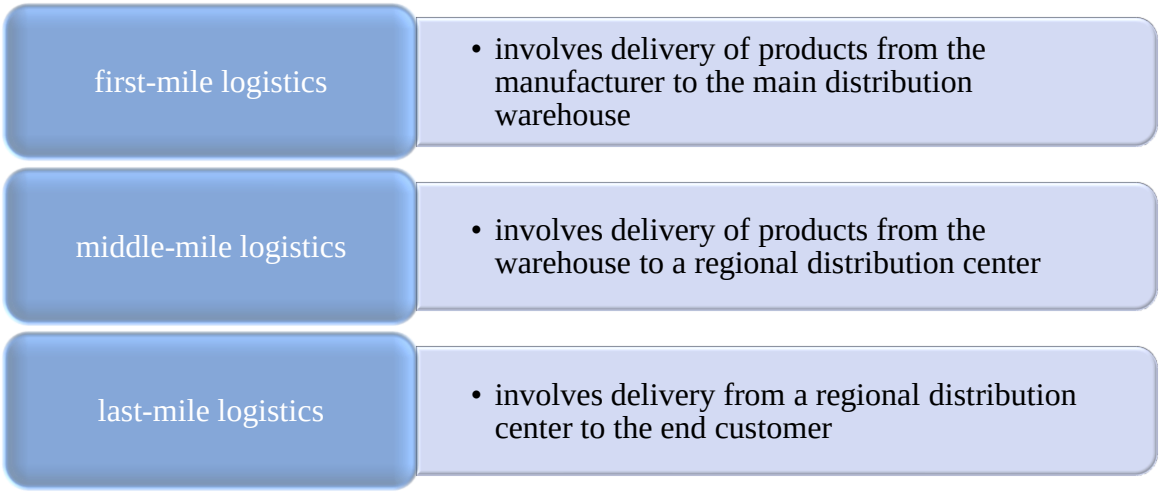

Fig. 1. Types of logistics

The delivery of goods directly to the end consumer, known as the “last mile”, is a critical element of the supply chain. Despite its short length, this final stage requires a significant financial investment and involves many operational complexities. It is the final link in the overall customer experience journey that determines whether a customer will be satisfied with the service and want to make repeat purchases.

Last-stage delivery problems. A significant part of delivery costs is formed due to the complex logistics of the final stage. Traffic jams, multiple drop-off points and complex routes significantly increase costs. The final leg of the journey

to the recipient turns out to be the most expensive - it accounts for more than half of all transportation costs. This is due to the high costs of gasoline, courier labor and other associated costs in reaching the final address.

Last-mile logistics challenges include the following aspects (Figure 2).

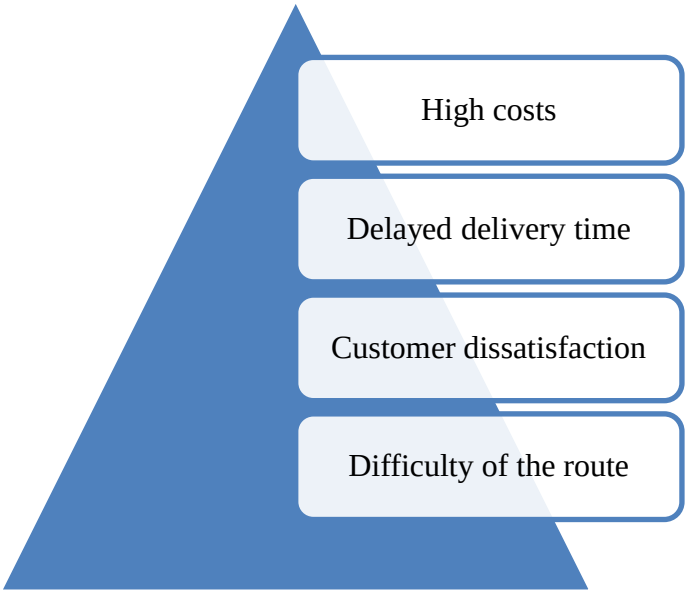

Fig. 2. Last-mile logistics challenges

The complexity of routing with multiple stopping points significantly hampers the work of couriers, creating obstacles for timely delivery of goods. Drivers face the problem of optimizing their routes, which leads to time overruns and extra kilometers of travel.

Different geographical conditions significantly affect the cost of delivering goods to the final recipient. In the city, the main problem is traffic congestion, forcing vehicles to stop and start frequently, which increases fuel consumption. And when serving remote communities, the main factor in the cost increase is the significant distance between delivery points.

Modern companies face serious difficulties in organizing efficient delivery due to a number of factors. Customers often provide inaccurate addresses, live in hard-to-reach areas or return goods, which significantly complicates the logistics process. The situation is aggravated by the use of outdated delivery technologies and insufficient number of distribution centers in the regions [7, p.56].

The inability to deliver orders quickly and efficiently leads to disappointed customers leaving for other sellers offering better service. The lack of modern logistics infrastructure not only increases transportation costs, but also significantly reduces the quality of service at the final stage of delivery - the so-called “last mile”.

Modern customers are extremely demanding about the speed of receiving orders and expect delivery on the day of purchase. Statistics show an alarming trend: more than 80% of customers are ready to abandon the company's services after a single case of unsuccessful delivery. Such a negative experience can cause irreparable damage to the brand reputation and lead to the loss of a significant part of the customer base.

The delivery driver ends up making multiple failed delivery attempts only to eventually be directed elsewhere and leave the package for the customer to pick up. This can result in significant costs for sellers. Failure to find an address or gain access to the building are other possible reasons for failed deliveries.

All of the above problems can be solved with the right last mile solutions. These solutions aim to optimize last mile delivery through technology and by changing some aspects of the traditional delivery model.

Current trends in the development of last-mile logistics and directions of its improvement. Last-mile logistics is the most resource-intensive and responsible link in the supply chain. To organize efficient logistics business processes at the last mile stage, organizations need to constantly monitor changes in the market, identify new trends and tendencies, understand the specifics of market functioning, among which are the following [5, p.1137]:

1. With the growth of the e-commerce market and the transformation of online consumers' demands, delivery is becoming a part of the product and determines its customer value. The possibility of free delivery, choosing a convenient place and interval of delivery, reducing the delivery time (up to 15 min) becomes a serious competitive advantage of modern companies. In addition, the last mile stage is a link that unites the brand with the customer, where the last and

sometimes the only physical contact with the customer often takes place. It largely determines the level of customer satisfaction. At this stage, customers often note the following problems: insufficiently polite communication from the courier, unpunctuality (late or too early delivery), lack of notification of delivery time and other problems, the solution of which will improve the quality of service. Thus, experts emphasize the following key requirements of online stores and marketplaces to logistics partners due to customer requests: speed and punctuality, flexibility and adaptability, the possibility of additional services (returns, fitting, weekend delivery, overnight delivery), geographical coverage and, finally, the ability to represent a brand or brand.

2. Multi-categorization (multimodality) is becoming a mandatory last mile delivery feature. With the rise of e-commerce, the line between retail categories is blurring. Ice cream, pet food, and flowers can all lie in the same shopping cart. This complicates the work of logistics services, as the delivery of different products requires its own conditions and regulations. The task of cargo grouping for logisticians becomes much more complicated, they need to combine several different orders or better plan several pick-up and drop-off points on the courier's route.

3. Hyperlocality of logistics at the stage of the last mile, which is caused by the need for fast delivery of goods, which is facilitated by the opening of darkstores, PVZs, postamats in the maximum number of city districts.

4. Due to the complexity of business processes, last-mile delivery is becoming more of an IT product involving the use of information systems, specialized software products, routing modules, and predictive algorithms. Last mile processes are becoming more complex every year as this is where many details and complexities come into play in response to customer requests. Narrow delivery interval, 24/7 delivery, multimodality, hyperlocality, personalization of delivery create the need to plan the route of couriers in different periods of time, including “rush hour”, night time, cause difficulties in organizing interaction with customers, require the use of different modes of transport: cars, bicycles, scooters,

etc. Organizations are seeking to reduce the length of the route at the last mile, combine the efforts of different logistics operators and enter into collaborations. A number of companies are outsourcing last-mile logistics functions to robots: rovers, drones and unmanned vehicles. It is only possible to manage such complex and numerous logistics business processes using specialized software.

5. Greening of logistics is becoming a response to the requirements of consumers, investors, and changes in legislation. Thus, with the growing popularity of delivery services, increasing intensity of vehicle use in urban spaces, logistics organizations are given serious attention in terms of compliance of their activities with the principles of sustainable development.

Thus, logistics at the stage of the last mile is becoming a high-budget activity of modern organizations, which requires them to increase its efficiency and optimization in order to reduce operating costs. This requires the directions indicated in Figure 3.

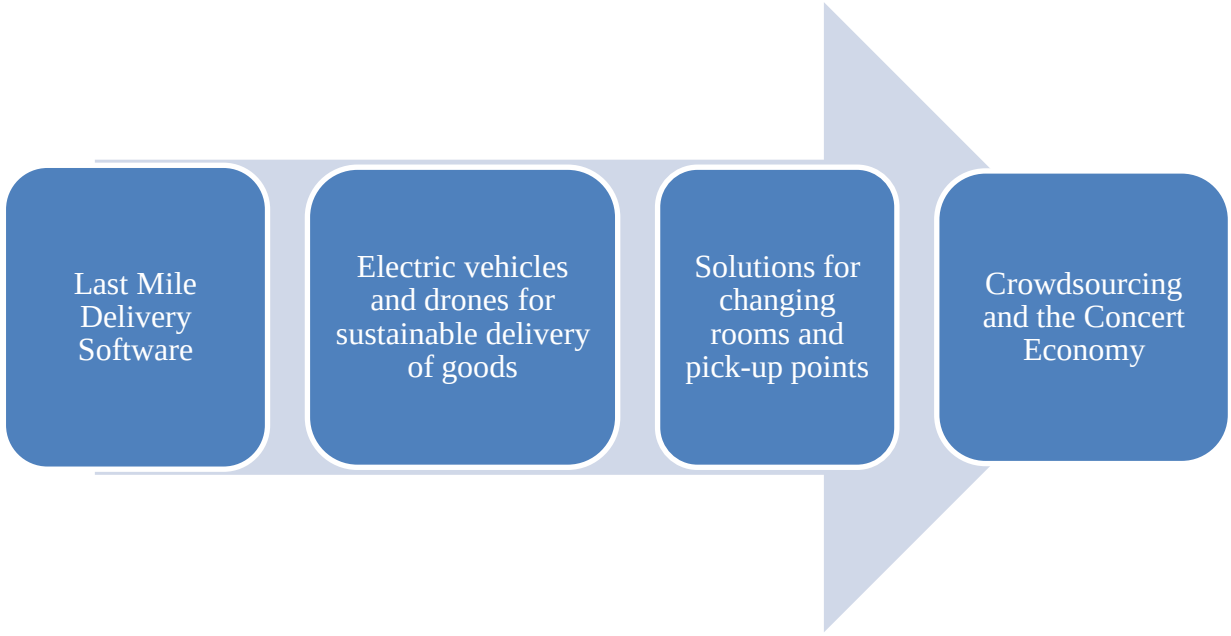

Fig. 3. Directions for improving the efficiency of last-mile logistics

Technology is the best ally in solving most last-mile delivery challenges. Today, there are several advanced artificial intelligence-based platforms that improve delivery efficiency, thereby reducing costs and eliminating delays. These tools offer specific last-mile delivery technology features such as route

optimization, last-mile delivery tracking, delivery confirmation, and delivery notifications, all of which optimize different aspects of delivery [10, p.123].

For example, route optimization uses real-time data and advanced artificial intelligence algorithms to determine the most efficient routes for your drivers. Meanwhile, with real-time tracking capabilities, you can offer your customers prompt package updates. This improves overall delivery quality by reducing delays and increasing transparency. Tools such as Onfleet, FarEye and Onro are some of the best last-mile delivery software solutions available today.

A pioneering solution involving crowdsourced delivery apps to connect merchants with a large number of self-employed workers such as independent drivers, cyclists or even pedestrians to perform last mile deliveries. This unique logistics solution for the free income economy is based on the effective use of community collaboration.

By utilizing the help of these movers, several problems usually associated with a regular delivery fleet are automatically solved. For example, one can completely solve the problem of low delivery density in rural areas by utilizing local drivers to deliver in smaller runs.

Secondly, you can save on the monthly salary of regular drivers. One can also reduce the maintenance costs of their delivery vehicles. When the crowdsourcing model is used, freelancers (who have their own vehicles) are paid per delivery or trip, reducing overhead costs. All of this makes crowdsourcing one of the most flexible solutions for last mile delivery.

Delivery stalls and pickup points are alternative delivery solutions that avoid various problems associated with last-mile delivery, such as failed deliveries and environmental impact. In these solutions, orders are delivered to a secure centralized location rather than to the customer's doorstep. While delivery stalls are usually set up in easily accessible locations such as supermarkets or shopping malls, delivery points can be local department stores or post offices. This will automatically improve the location of customers' warehouses.

This type of delivery is beneficial to both buyers and sellers. For buyers, it means that they can pick up the parcel whenever they want. For sellers, it means no more failed deliveries. They also feature a high degree of security. For example, self-service lockers require customers to enter a unique code each time to access their contents.

By reducing the number of delivery attempts and combining them, you can easily reduce your carbon footprint. Fewer trips means less fuel consumption and lower CO_2 emissions. Ultimately, this reduces the environmental impact associated with traditional last-mile delivery.

Using drones and electric vehicles (EVs) for delivery is very beneficial to the environment. Electric vehicles and drones do not emit harmful emissions from their tailpipes. This makes them a more sustainable last mile logistics solution compared to traditional delivery trucks that consume gasoline.

There are also savings on fuel costs. According to a study, direct delivery using drones saves 60% of the cost compared to delivery by truck alone. The benefit is even more noticeable in urban areas where dense traffic leads to higher fuel consumption and particulate emissions in gasoline-powered vehicles [9, p.118].

Finally, there is an additional speed advantage when utilizing these solutions, especially when using drones. Drones in many cases significantly reduce delivery times compared to automobile transportation. For example, in hard-to-reach regions or regions with poor road infrastructure, drone delivery is by far the fastest and most cost-effective solution.

Effective communication with customers is probably the most underrated and easiest solution to most last mile delivery problems. All you have to do is keep your customers informed about the whereabouts of their parcel.

For example, you can send them timely delivery notifications or give them access to the status of the parcel on the order tracking page. This will help them plan their day and be available to receive their parcel. This will significantly reduce the number of failed deliveries.

Conclusion. Thus, there are highly efficient delivery solutions to address all last-mile delivery challenges. These innovative delivery strategies can quickly lead to logistics optimization and help the logistics business meet the growing expectations of consumers in the e-commerce industry. Ultimately, the company will keep its business competitive and future-proof in the shortest possible time.

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