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ANALYSIS OF THE TRANSPORT ROUTE SELECTION OF A SELECTED LOGISTICS OPERATOR IN THE ORGANIZATION OF CLOTHING TRANSPORT AT THE LAST MILE STAGE

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Purpose: The main goal of this article is to optimize transportation processes to reduce financial losses resulting from inefficient fleet utilization at the "last mile" stage. The research problem focuses on finding an optimal solution that would reduce losses while maintaining a high level of customer service and timely delivery.
Design/methodology/approach: The study combines a comprehensive literature review with empirical research. The literature review included an analysis of literature concepts related to transportation and an analysis of the fast fashion sector. The empirical study used an analytical method - the transport routes of the selected logistics operator were analyzed.
Findings: The low cost-effectiveness of the "last mile" route was noted, requiring precise planning and resulting in highly variable delivery conditions. On some routes, cargo weight exceeds the allowable weight for smaller vans, forcing the use of larger, more expensive vehicles. As a result, vehicle capacity is not fully utilized, and the company incurs losses. Destinations such as Nowy Sącz, Tarnów, Opole, Ostrava, and Rzeszów generate the lowest profits, and often even losses. It was also noted that the logistics operator's client (the fast-fashion sector) requires regular transport, even for small volumes of goods, which generates losses for the logistics operator.
Research limitations/implications: The main implications of the conducted research are focused on increasing the profitability of the logistics operator's operations and optimizing transport processes at the "last mile" stage, especially in the context of routes generating financial losses.
Practical implications: Both the analyzed entity and other companies should prioritize the implementation of dynamic route planning (routing on demand) and consolidation of low-volume deliveries, as well as negotiate individual rates with their customers for routes characterized by a high unit cost.
Originality/value: The value of the work is utilitarian, because based on the diagnosis, it was proposed to increase the profitability of service activities by changing the structure of routes and connecting unloading points in a way that allows for a fuller use of the vehicle's cargo space.
Keywords: transport, logistics operator, last mile, transport routes, clothing industry, fast fashion.
Category of the paper: research paper.

1. Introduction

Contemporary civilizational progress and dynamic economic development are largely the result of the intensification of digital information flow, which is an integral component of globalization processes. The transformation of communications, based on free access to data exchange channels, not only enables more efficient management of commercial transactions, but also contributes to increased competitiveness on the international stage. In this context, digital infrastructure appears to be a key element supporting the functioning of global supply chains. The development of information and communication technologies (ICT) and their integration with logistics systems enable the synchronization of activities between economic entities from different regions of the world. Electronic forms of contact, such as B2B platforms, ERP systems, and cloud solutions, are becoming not only an operational tool, but also a strategic resource supporting the coordination of production, distribution, and warehousing processes. As a result, digital communication channels should be seen as an integral part of an extensive point-to-point and linear infrastructure, built over decades to ensure effective cooperation between importers, exporters, and logistics operators (Christopher, 2016).

The modern global economy no longer functions in isolation from the mechanisms of globalization. On the contrary, it is shaped by them. A dense network of transport, ICT, and institutional connections forms the foundation for the flow of goods, services, capital, and information (World Bank, 2023). The increase in the number of market participants, both on the supply and demand sides, generates the need for continuous improvement in the quality of logistics services offered (Neider, 2008). Consumer expectations, growing time pressure, and variability in order volumes require companies to be flexible, innovative, and adaptable (Ghemawat, 2018).

In response to these challenges, it is crucial to streamline transport processes, with particular emphasis on the selection of appropriate means of transport (Grabowska, 2023). Technical parameters, load capacity, infrastructure availability, and compliance with international regulations determine the operational and cost efficiency of orders (Jóźwiak, 2019). In this context, international logistics is no longer just a function supporting commercial activity — it is becoming a strategic area of management, determining the competitive position of a company on the global market.

The primary goal and research problem of this article is to analyze the transport route selection of a selected logistics operator in organizing clothing transport at the last mile stage. The discussion includes a portion of the transport activity within the "last mile" dimension. The analysis covers destinations in Poland and partially in the Czech Republic. Particular attention is paid to the implementation of services for the warehouse in Pyskowice. The aim of the analysis is to determine the profitability of transport routes and propose improvements.

2. Literature review - the concept of transport, methods of cargo transport and last-mile transport

Transport has contributed to the development of civilization and the economy around the world. It plays a key role in the proper functioning of every city and country. Every day, transport meets the needs of both people and all kinds of goods. Everything that is transported constitutes cargo and is the basis of all logistics systems (Urbanyi-Popiołek, 2013).

One definition describes transport as a set of activities whose task is to move goods, including material goods, in time and space. All this can be done with the use of appropriate technical means (Skowronek, 1995). Another definition is supplemented with the information that transport not only includes activities related to the movement itself, but also many other things that are necessary for transport to be carried out properly (Stochaj, 2017). Such activities include, for example, handling and loading.

Transport service is the process of continuous and physical movement of cargo or people (Ciesielski, 2005). It is constantly changing as a result of the needs reported on the market by service users, as well as growing and increasingly fierce competition on the market. When providing a transport service, four phases must be taken into account, namely: the preparatory and organizational phase, the implementation phase, the control phase, and the post-control phase. A very important factor is that there is a strong link between the service provider and the service recipient, and the entire process takes place in constantly changing market conditions.

The demand for the service is related to the globalization of the economy and the development of information technology, which allows for accurate planning, ordering, and tracking of the transport service provided. An important factor in the field of logistics is cost reduction. Transport costs are one of the main categories of logistics costs, so efforts are made to eliminate them. The costs of transport services include, among other things, the cost of producing the transport service and the external cost incurred as a result of paying for losses and damage occurring in the area of the transport service provider. The elements that directly influence the formation of transport costs are: the technology of the transport service provided, the weight of the goods, the volume of the goods, the distance of transport, the danger associated with the transport of goods, the transport susceptibility of the goods, and the value of the goods.

In addition, the continuous expansion of the range of goods produced is associated with an increase in demand for transport services. The process of creating supply chains has also contributed to the increased demand for transport. Transport services are a natural part of the outsourcing process. Logistics is an element of cost optimization in a company, and the selection of transport service providers is an integral part of this process.

The processes involved in transport are closely interlinked. The participants in the transport market are (Tarski, 1985):

1. Shippers – appearing on the demand side for transport services. These are buyers purchasing the service of moving goods. Shippers can be direct producers of various goods, as well as commercial enterprises professionally involved in the purchase and sale of goods of various sizes, values, and degrees of processing.
2. Carriers – appearing on the supply side of transport services. They produce and simultaneously perform the transport services offered. Due to their strong bargaining position on the market, carriers can dictate their terms regarding prices, more specifically transport rates and the manner in which transport activities are performed.
3. Intermediaries – appearing on the demand and supply side of the transport market. This is a group of companies that is very diverse in terms of the tasks and functions it performs in the transport market.

Each component of a country's economic policy, including transport policy in the context of foreign trade, has specific entities and subjects of action, strategic objectives, operational tasks, and a set of implementation methods and tools (Witkowski, 2020). Within this policy, the main decision-makers are central government authorities responsible for shaping and implementing systemic solutions.

The most general and overarching objective of the state's transport policy is to create and maintain a coherent and effective transport system that functions harmoniously on a national scale and remains integrated with the international logistics environment. Specific objectives include, among others, the modernization of transport infrastructure, the development of organizational structures, and the adaptation of the transport system to the needs of the national economy and social expectations.

In the context of transport classification, a division according to the environment in which transport operations are carried out is commonly used, covering the following branches:

- road transport (motor vehicle),
- inland waterway transport,
- maritime transport,
- air transport,
- pipeline transport,
- rail transport.

An alternative criterion for classification is the type of cargo transported, which allows us to distinguish between passenger and freight transport (Skowron-Grabowska, 2019). Depending on the characteristics of the cargo, transport conditions, safety requirements, and the degree of automation of loading and unloading operations, three basic transport technologies can be identified (Rucińska, 2017): a) universal transport – covering the transport of standard cargo that does not require specialized means of transport; b) unified (container) transport – based on standardized cargo units, such as containers; c) specialized transport – dedicated to the transport of cargo requiring special conditions, e.g., refrigerated, oversized, dangerous (ADR), or fragile, such as glass.

Transport services are also characterized by three types of vulnerability (Gołembska, 2010): a) natural vulnerability – resulting from the physicochemical properties of the cargo, such as sensitivity to time, moisture, temperature, light, or susceptibility to damage, spontaneous combustion, or explosion; b) technical vulnerability – related to the physical characteristics of the cargo, such as shape, size, unit weight, or state of aggregation; c) economic vulnerability – determined by the unit value of the cargo, which affects the profitability of its transport.

From the point of view of transport organization and transshipment methods, the following forms of transport can be distinguished (Kautsch, 2018; UNCTAD, 2022):

- intermodal transport – carried out using at least two means of transport belonging to one branch,
- multimodal transport – involving transport using different modes of transport, without a specific method of transshipment, under a single transport contract and with a single operator responsible for the entire process (Bławat, 2012),
- intermodal transport – involving the movement of cargo in the same loading unit (e.g., container) using different modes of transport, also under a single contract and with a single operator (Borucka, 2017),
- combined transport – a type of intermodal transport in which the loading unit is transported by at least two modes of transport, using road transport at the beginning and end of the route and delivery and collection services (Woźniak, 2007).

Taking into account the aforementioned contemporary trends and tendencies, the purpose of transport is not only to ensure the flow of goods or people within the specified spatial and temporal framework, but also to provide features such as (Woźniak, 2011):

- efficient synchronization of related flows,
- good value for money,
- large volume of organized deliveries,
- the possibility of sending shipments of various sizes, including small consignments,
- access to up-to-date information on the status of orders,
- environmentally sustainable transport.

In order to demonstrate the flexible nature of the modern transport industry, the concept of transport can be presented in a more systematic and detailed form of classification. The basic classification criteria include those that differentiate transport based on the characteristics of the cargo being transported (passenger or freight transport) and those that focus on the spatial environment of cargo transport, i.e., road, rail, air, sea, inland waterway, and transmission (Kulpa, 2009). Each of these modes of transport has its own specific advantages and additional requirements, and thus limitations for the customer. An important aspect of transport is the question of its organization in space and time.

The concept of multimodal transport remains closely linked to the issue of the so-called "last mile", understood as the final stage of the distribution process, consisting in the delivery of goods directly to the end recipient. When using solutions such as multimodal, intermodal, combined, or split transport, there is a challenge associated with the need to deliver to the "specified address", which can be particularly difficult when using global means of transport, such as sea transport (Cichosz, 2020).

The issue of the "last mile" applies to both e-commerce logistics and retail supply (Kołata, 2020). Depending on the context, the end customer can be defined as an individual consumer receiving a shipment at their place of residence or as a commercial entity, e.g., a brick-and-mortar store. From the perspective of a logistics operator, the "last mile" means the point of completion of a transport order, while for the customer it may be an intermediate stage in the process of purchasing a product from a retailer. Estimates indicate that the "last mile" stage generates the highest costs in the entire delivery process, accounting for as much as 40-50% of total logistics expenses. Paradoxically, although this is the shortest section of the route, its implementation requires the use of smaller vehicles, such as delivery vans, which entails greater operational intensity, the need for precise planning, and highly variable operating conditions (Sieć Badawcza Łukasiewicz, 2023).

In the case of multimodal transport, involving the use of different modes of transport or a change of transport mode within a single mode, one of the decisive factors influencing the choice of logistics solution is the length of the route. Over shorter distances, the same load could be transported by a single vehicle, without the need for transshipment or a change of transport mode.

The entire transport process can be divided into three main stages: the so-called "first mile", the main transport phase, and the "last mile". The initial stage is usually planned taking into account a time reserve resulting from the length of the route, the specific nature of the cargo being transported (e.g., its transport susceptibility), and the availability of logistics infrastructure. The customer assesses the quality of this stage, among other things, through the prism of the contractor's response time to the order – the so-called reactive services – which may influence the decision to continue cooperation.

The "last mile" is the final stage of the delivery process, which is a consequence of the previous stages. In practice, this means that any delays that occur at the initial or main stage can accumulate at this stage. From the customer's point of view, however, it is crucial to ensure timely delivery, even if this requires additional operating costs (Dąbek, 2013).

Both the initial and final stages of the logistics process – referred to as the "first mile" and "last mile" – play a significant role in shaping the customer's perception of the quality of order fulfillment. However, particular importance is attached to the final phase, which marks the completion of the entire service and must be carried out in a timely, environmentally friendly, and economically justified manner – both from the perspective of the recipient and the logistics operator (Guzowski, 2025).

This stage is characterized by a high degree of operational complexity, resulting, among other things, from the need to use vehicles with limited load capacity, which are less cost-effective compared to long-range means of transport. In addition, due to the cyclical nature and high frequency of deliveries, the "last mile" generates a significant infrastructure and organizational burden (Boichuk, 2022).

All these constraints fit into the broader context of sustainable transport, which is increasingly at the center of customer expectations, both individual and institutional. In urbanized areas, logistics operators must adapt their activities to local regulations, which increasingly restrict the access of large vehicles to city centers. These regulations are expected to become even stricter, including the introduction of additional fees for conventional delivery vehicles to enter city centers (Różański, 2024).

Therefore, it is necessary to optimize delivery routes, with particular emphasis on reducing empty runs and reorganizing the fleet (Ocicka, 2020). The response to these challenges is increasingly the implementation of electric vehicles, which, thanks to the possibility of using privileged infrastructure, such as bus lanes, allow for shorter delivery times in urban agglomerations. The nature of the "last mile" favors the use of alternative power sources, as short distances allow for effective battery range management and eliminate the risk associated with limited vehicle autonomy.

3. Literature review - conditions for development and specific characteristics of the fast-fashion sector in the clothing industry

Contemporary industry is not limited to satisfying existing consumer needs, but actively participates in shaping them through intensive promotional and marketing activities. Companies' pursuit of dynamic growth and profit maximization results in the implementation of operating models based on rapid response to changing market conditions. In the context of the increasing pace of social life and intensifying competition, sectors operating within the "fast" concept are becoming particularly important, currently playing a key role in global trade (Centrum Analiz PKO BP, 2024).

The clothing industry is a clear example of such a model – it is thanks to its strategy of rapid design, production, and distribution that the "fast fashion" sector has achieved a dominant position in the international market (Sales Intelligence, 2020). However, it is worth noting that the increase in sales does not only apply to the fast fashion segment. The entire textile and clothing industry is showing an upward trend, as confirmed by consumer demand data (Czajkowski, 2023).

In Poland, in 2025, compared to the same period in 2024, the textile, clothing, and footwear sector recorded sales growth in every month of the analyzed period. In January 2025, the value of clothing sales was 8.8% higher than in the previous year. In February, the growth rate was slightly lower, but still amounted to 6%, while in March there was an increase of 6.7% compared to March 2024. These data indicate a continuing high market absorption and a lack of saturation in the clothing sector, which confirms its stable position in the consumption structure (Dynamika sprzedaży detalicznej…, 2025).

According to information published by the Central Statistical Office, the value of clothing sold in Poland in 2010-2023 shows a systematic increase (Figure 1). Despite the dominance of large entities such as LPP, the leader in the domestic clothing trade, small and medium-sized enterprises continue to have a significant share in the industry structure and play an important role in local and regional trade.

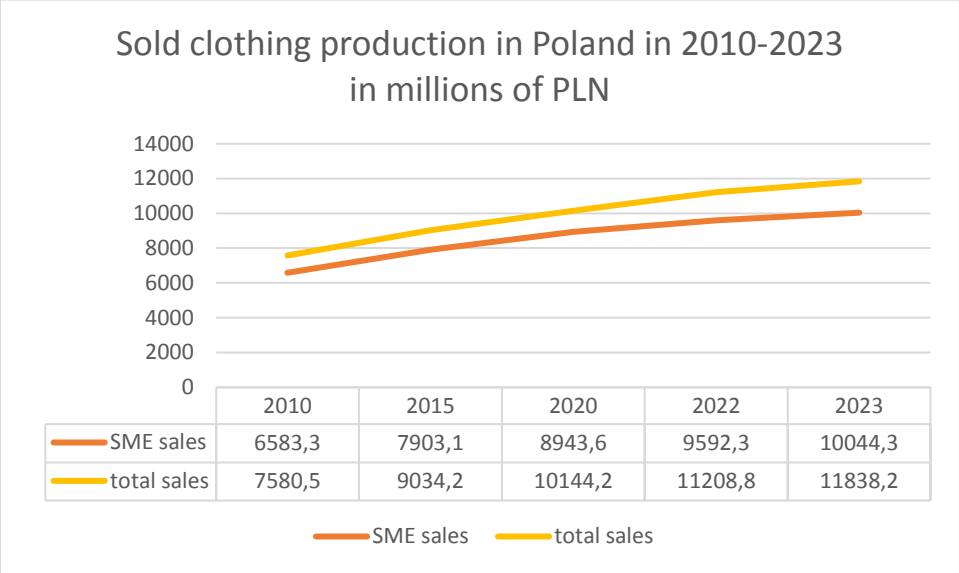

Figure 1. Clothing sales in Poland between 2010 and 2023.

Source: Own study based on: *Rocznik Statystyczny Przemysłu 2024* (2024). Warszawa: Główny Urząd Statystyczny.

From a global perspective, the clothing sector continues to show a steady upward trend (Boichuk, 2022). According to data published by Statista, despite the difficulties associated with the COVID-19 pandemic, the industry recorded growth of 1.9% between 2020 and 2022 (Statista, 2024). In the following year, i.e. 2023, this growth accelerated significantly, reaching a sales growth rate of 7.4%, and the positive trend continues. Asia has the largest share in global clothing production, accounting for 38.9% of the total global supply. Translating this data into financial terms, the global clothing market achieved sales of €1.6 trillion in 2023, of which €622 billion was generated by Asian countries. Clothing production also involves the movement of goods within supply chains, which directly affects transportation issues (KPMG, 2023). In terms of clothing exports outside the country, China was the leader in 2023, with a share of 29.6%. The largest importer of clothing was the United States, which accounted

for 18.2% of global imports. In terms of consumer spending on clothing, the average annual amount spent on this by the world's population in 2023 was €209. In Europe, this figure was significantly higher, reaching €520. In Poland, the average per capita expenditure on clothing was €328 (Centrum Analiz PKO BP, 2024).

It is estimated that the coming years will see an increase in the volume of clothing sold. These figures will grow not only in Europe, Asia, and North America, but on all inhabited continents[1]. However, the chart shows a significant advantage for the Asian market. China will see the strongest growth trend in the coming years in national terms.

The dynamic growth of e-commerce has significantly influenced the transformation of contemporary sales models, making online shopping an integral part of consumers' everyday lives. Both SMEs and global leaders in the clothing industry, such as LPP S.A., H&M (H&M Group, Annual and Sustainability Report, 2023; H&M Group, Sustainability Performance Report, 2023), and Inditex S.A. (Inditex Group, 2023), are implementing omnichannel sales strategies, combining brick-and-mortar operations with an extensive logistics infrastructure supporting digital channels. Stores are increasingly operating in the virtual space, and customer service is provided through models such as dropshipping or distribution based on the concept of cross-docking. These companies are among the leaders in the global clothing market (LPP S.A., Over…). Financial data for 2023 shows that Inditex achieved the highest revenues – €36 billion, followed by H&M – €20.6 billion, and LPP – as the largest retailer in Central and Eastern Europe – generated €5.5 billion (Inditex, Annual Report, 2023; LPP S.A., 2024). These figures confirm consumers' growing interest in quick access to clothing, which poses a number of logistical and ethical challenges for the industry.

Globalization, improved information flow, and the development of transport infrastructure have enabled companies to implement offshoring strategies, moving production to countries in the Global South. As a result, Asian countries play a key role in global clothing production and exports. Low manufacturing costs in these regions contrast with the high margins achieved by companies in retail sales, raising questions about the ethical aspects of the fast fashion sector.

This model is based on shortening the life cycle of products, intensifying the rotation of trends, and stimulating consumption. Instead of physical wear and tear, the main factor determining wardrobe replacement is becoming the volatility of aesthetics and fashion. Products are made from low-quality raw materials, which reduces their durability and increases the amount of waste generated. As a result, reverse logistics cannot keep up with the pace of consumption, as evidenced by the growing textile landfills, including in the Atacama Desert.

In addition, the fast fashion sector is sometimes criticized for perpetuating social inequalities in manufacturing countries by maintaining low wages and a lack of regulations on working conditions. These controversies are driving the development of sustainable logistics,

[1] Own study based on the PKO Bank Polski report International Markets: Clothing. Current situation and forecasts until 2028. Economic Analysis Department August 2024.

which aims to reduce carbon footprints, improve supply chain transparency, and build consumer trust.

The growth in clothing sales is generating an increasing demand for efficient warehousing and transportation services. Logistics operators, in order to remain competitive, must demonstrate operational flexibility and the ability to expand the range of services they provide. Establishing long-term cooperation with clothing companies within the framework of joint supply chain management is the foundation for stable revenues and long-term development in this dynamically evolving industry.

4. Methods – Analysis of transport route selection by a selected logistics operator

This section uses an analytical approach – the transport routes of the selected logistics operator were analyzed. Using the analysis of the selected logistics operator's transport routes in the empirical study allowed for:

- Obtaining actual data – analysis of specific routes enabled the assessment of operational efficiency based on actual volumes, distances, and fleet utilization, which increases the reliability of the results.
- Identifying problems and optimization potential – the analysis allowed for the identification of unprofitable routes, unsuitable delivery models, and inefficient resource utilization.
- Adapting recommendations to practice – conclusions and proposed solutions were based on the operator's actual operating conditions, increasing their usefulness and implementation potential.

The entity analyzed in the empirical part of this study is a company acting as a logistics operator. The scope of services provided by the company includes comprehensive transport services, including full truckload (FTL) and less than truckload (LTL) shipments, carried out using semi-trailers and vehicles adapted for local distribution. The cross-docking system plays an important role in the company's operational structure, enabling effective management of the flow of goods, especially in the context of last mile deliveries.

In addition to transport services, the company offers warehouse space rental, full forwarding services, logistics consulting, customs procedures, and support in the area of accounting and bookkeeping. In addition, the company provides comprehensive warehouse services tailored to the individual needs of its customers. The company can be described as a logistics operator which, according to the definition, offers comprehensive logistics solutions in the form of full warehousing, transport, and complementary services (Walasek, 2014).

The logistics operator under analysis mainly handles distribution processes for companies in the clothing industry, but also carries out orders for other customers, usually in the form of groupage transport, temporary storage, or vehicle repairs thanks to its vehicle service facilities.

The customer of the operator in question has stores in many shopping malls throughout Poland. It has seven own brands under its umbrella, which are otherwise referred to as brands. Therefore, there may be several stores of this brand in each shopping center. There are also destinations where there is only one store of this brand.

Deliveries to shopping malls combined with the collection of returns are called rotations. A total of three rotations are carried out during the week, each at night, after the mall closes to customers. The first one takes place on Wednesday night and covers 6 of the 7 brands, while the next day, on Thursday night, goods are delivered to the seventh brand. These two deliveries are collectively referred to as C1. C2, on the other hand, is a weekend rotation, in which transport to stores is organized on Sunday night. This is the delivery with the largest volume of goods, due to the fact that products for all 7 brands are shipped at the same time. From the point of view of logistics specialists, the process of organizing the first rotation of the week begins on Tuesday, when employees at the headquarters in Spain receive data from the customer regarding the volume of goods that will be delivered to Poland from Spain. This data is available in the Extranet system. The information is then entered into the IT system, which acts as a module for creating transport documentation, collecting data on rotations, and entering services for which the customer is invoiced. The turnover volume consists not only of goods arriving in Poland from, among others, Arteixo, Meco, Zaragoza, and Tordera, but also shipments from Lelystad in the Netherlands. In the case of data from Spain, specialists rely on values that largely correspond to the actual volume of goods shipped, while in the case of data from the Netherlands, they rely on forecasts that may differ significantly from actual volumes. After the Spanish side adds actual and probabilistic data to the system, logistics specialists from the distribution department download a report from the system that includes the quantities of clothes and shoes for a given store. By the end of the day, employees also receive orders from customers for items such as packaging materials or furniture stored in the temporary storage warehouse. This data is also added to the system, providing a complete overview of the quantities for a given rotation. Next, the warehouse stocks are updated. The task of the distribution department is to plan the distribution of these quantities, most of which will arrive on semi-trailers, for loading onto smaller delivery trucks. After the volume has been distributed, the demand for trucks is sent by email to specific carriers. The customer also sends files with the quantities of returns for individual stores directly to the branch in Pyskowice. These quantities are assigned to specific routes and checked to see if all returns will fit on the planned vehicle. If not, the customer is notified by email. The distribution department creates documents, which it prints and forwards to the warehouse coordinator: checklists, loading orders, delivery notes for individual stores, and return collection orders.

The implementation of transport processes depends on a number of constraints, including time, capacity, and vehicle load capacity. The most important organizational challenges include: synchronizing warehouse operations with the schedule of trailer arrivals, the effective distribution of goods volumes between vehicles, taking into account their load capacity and the availability of the carrier fleet, monitoring drivers' working hours in the context of the obligation to complete deliveries by 6:00 a.m., adapting to the individual requirements of specific shopping malls and stores, and responding to unforeseen traffic events.

The operational efficiency of the analyzed branch is influenced by both external factors, such as volatility in consumer demand, and internal constraints, which include, among others, the available parameters of the transport fleet and the specific requirements of receiving facilities. The amount of goods transshipped and transported is subject to cyclical changes resulting from seasonal fluctuations in demand for clothing and product range diversity. For example, in the fall and winter, there is an increase in the tonnage of transported cargo relative to its volume, which is due to the characteristics of products such as thicker fabrics and heavier footwear (https://retailnet.pl/…). A comparison of volume data over time reveals regular fluctuations characteristic of seasonal cycles, as shown in Figure 2.

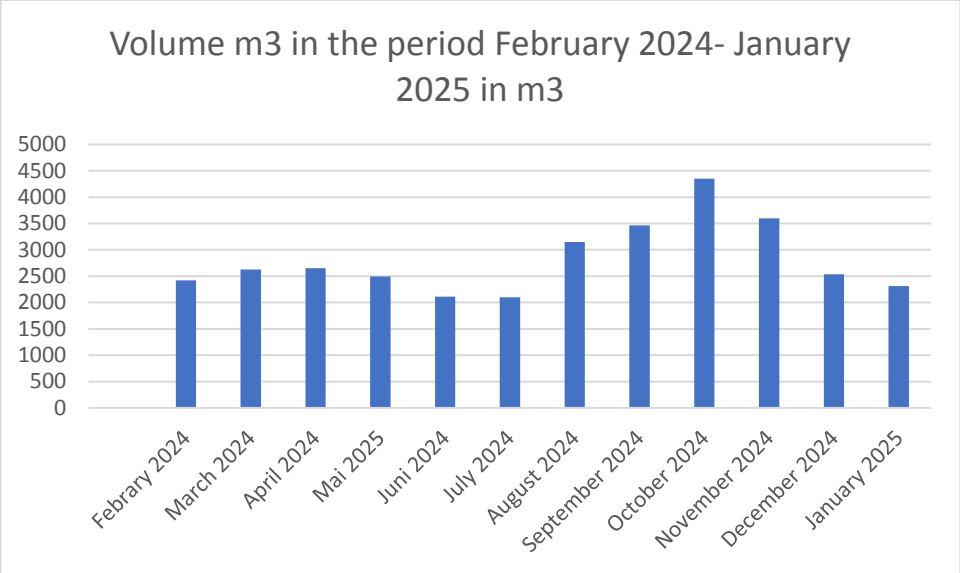

Figure 2. Volume in m3 for the period February 2024 - January 2025.

Source: Study based on Gandawska, 2025; Delimata, 2023, pp. 22-34.

The highest transport demand in the analyzed branch occurs between August and November. In the following months, until the beginning of the next year, there is a significant decrease in the volume of shipments. Therefore, the company increases its demand for carrier services every year to meet customer requirements during peak traffic periods. The billing model assumes that the customer pays for each cubic meter of goods transported, at an average rate of PLN 121.50/m³. In turn, the company settles accounts with carriers based on the cost of renting a vehicle with a specific load capacity, assigned to a specific route. This system creates difficulties in situations where the weight of the goods transported is relatively high while the

volume remains similar. In such cases, vehicles are not fully utilized in terms of load capacity, which leads to cost inefficiency and losses on the part of the logistics operator.

Among the vehicles used by carriers, there are four basic load capacity classes: VS (7 m³, 800 kg), S (12.5 m³, 1250 kg), B (25 m³, 3250 kg), and VB (30 m³, 4000 kg). There is a noticeable difference between the capacity of smaller units (VS and S) and larger ones (B and VB), which makes it difficult to optimally select the means of transport for a specific route — especially when it is necessary to meet the requirements for both the volume and weight of the transported cargo at the same time. In the company's operational practice, there are situations where the weight of the goods exceeds the permissible load for bus-type vehicles, even though their volume would fall within their range. In such cases, it becomes necessary to use larger single-axle vehicles (e.g., 15 EP or 18 EP), which, however, does not translate into full utilization of their cargo space. An analysis of the vehicle load utilization rate indicates that some routes are characterized by a relatively low level (see Table 1), which is often associated with lower profitability of transport on these routes. The destinations generating the lowest margins, and sometimes even losses, include Nowy Sącz, Tarnów, Opole, Ostrava, and Rzeszów.

Table 1.
Summary of the average vehicle load utilization rate and average profit for the period from February 2024 to January 2025, broken down by route

Route	Average vehicle load factor	Average profit
Bielsko-Biała	71%	984,17
Bielsko-Biała + Katowice	89%	1472,44
Bielsko-Biała + Rybnik	81%	1427,21
Częstochowa	65%	839,41
Częstochowa + Kielce	81%	845,09
Katowice	82%	1489,69
Kielce	76%	820,14
Kraków	75%	999,13
Nowy Sącz + Tarnów	**52%**	**-469,81**
Opole	62%	224,00
Ostrawa	**44%**	**-101,66**
Rybnik	69%	391,26
Rybnik + Katowice	76%	1307,84
Rzeszów	74%	90,10

Source: Own study based on Gandawska, 2025.

Similarly, if we look at which vehicles are more often fully loaded, some of them have a much lower average load factor, which translates into lower profits on a given route (Table 2). The data shows that the lower the load capacity of a truck on a route, the greater the losses for the company.

Table 2.
Summary of the average vehicle load utilization rate and average profit for the period from February 2024 to January 2025, broken down by delivery vehicle size

	Average load percentage	Average profit on a given route
B	69%	638,6545393
S	**55%**	**14,70367113**
VB	84%	1459,063648
VS	**44%**	**-435,3734746**

Source: Own study based on Gandawska, 2025.

The company's use of VS and S vehicles is primarily due to infrastructure limitations that prevent cars with larger load capacities from entering certain shopping malls. In addition, selected routes have significantly lower delivery volumes compared to other locations. Despite the small amount of goods, the logistics operator's customer expects regular service to these points, which is a consequence of the adopted "fast-fashion" production model. This method of organizing deliveries generates losses for the operator due to the underutilization of cargo space.

At the same time, cooperation with this customer is one of the most profitable for the company — due to long-term business relations and effective communication between the parties, this contractor is a stable source of revenue. The "last mile" stage remains the most sensitive element of the entire transport process in terms of costs, which is why the logistics operator focuses on identifying the causes of the difficulties and optimizing the activities carried out on the route between the warehouse and the shopping mall. The most advantageous solution would be to implement an operational model that would reduce financial losses while maintaining a high standard of customer service and timely deliveries.

The volume of goods transported for the customer shows clear seasonal characteristics. The highest values are observed in the period from August to November, when monthly shipments exceed 3000 m³, with a record level recorded in October 2024 — over 4348 m³. It is worth noting that during this period, both the volume and weight of cargo are significantly higher than in other months. This is probably due to the nature of the product range — from August onwards, stores prepare for the fall and winter season, which involves deliveries of heavier products made of thicker materials.

In the remaining months of the year, the volume of goods transported remains at a level slightly above 2000 m³. The lowest values were recorded in June and July, 2112.97 m³ and 2099.42 m³ respectively. Higher volumes translate directly into higher revenues for the company, mainly because vehicles with greater load capacity can be used on these routes. As previously shown, they are more cost-effective. They enable deliveries to be made with one vehicle instead of several smaller ones, which significantly reduces the unit cost of transport per cubic meter.

An analysis of the regular routes served by a given logistics operator indicates that some of them are critical points in the operational structure, generating high costs while generating low revenues. In the case of these locations, deliveries are primarily aimed at maintaining positive customer relations rather than maximizing profits. They are more of a financial burden than

a source of income, but their presence in the service portfolio is crucial for maintaining stable cooperation and the ability to serve more profitable routes. There are several reasons for the limited economic efficiency of deliveries to these locations. For example, vehicles with lower load capacities must be used for deliveries to Ostrava, which significantly reduces the profitability of transport over longer distances. In the case of Opole and the Nowy Sącz-Tarnów route, the problem is the small volumes of goods transported, which do not allow for the full utilization of logistics potential.

The route to Rzeszów is characterized by low revenues, mainly due to its long distance from Pyskowice. The cost of renting a vehicle for this route is relatively high, which is at odds with the uniform rate per cubic meter that applies to all locations. It is worth noting that, regardless of the destination, the problem of low transport efficiency intensifies during periods of reduced volume, as confirmed by the data for the Nowy Sącz-Tarnów route presented in Table 3.

Table 3.
Summary of profits and load factor broken down by month for the Nowy Sącz-Tarnów route

Route	Average load percentage	Average profit
NOWY SĄCZ + TARNÓW	**52%**	**-469,81**
Styczeń	47%	-619,8225
Luty	43%	-735,3950057
Marzec	45%	-661,5975
Kwiecień	45%	-638,655
Maj	51%	-618,1475
Czerwiec	49%	-620,7725
Lipiec	47%	-664,185
Sierpień	64%	-152,005
Wrzesień	62%	-104,345
Październik	65%	-12,175
Listopad	58%	-253,96
Grudzień	49%	-556,6425

Source: Own study based on Gandawska, 2025.

The greatest operational challenges in transport occur between December and July, when the efficiency of logistics processes drops significantly. Similar difficulties occur on less profitable routes, such as Ostrava, Opole, and Rzeszów. For this reason, these months and the indicated directions should be prioritized in optimization efforts. In the case of Rzeszów, the main factor affecting low profitability is the considerable distance from the warehouse. Carriers expect higher rates for deliveries on this route, which is due to the costs associated with the distance. Meanwhile, the customer pays a uniform rate per cubic meter, regardless of the location of the destination. Therefore, it would be reasonable to attempt to renegotiate the financial terms with the carrier in order to reduce costs. In the case of other less profitable destinations, such as Ostrava or the Nowy Sącz-Tarnów route, the main problems are low cargo volumes and the need to comply with tonnage restrictions when entering shopping malls. This forces the use of vehicles with lower load capacities, which translates into higher unit transport costs. Importantly, in each of these locations, the operator delivers to only one shopping center, which further limits consolidation opportunities and increases the cost burden.

Table 4 shows a summary of transport efficiency indicators and measures for the Pyskowice-Nowy Sącz-Tarnów-Pyskowice route, and Table 5 shows a summary of transport efficiency indicators and measures for the Pyskowice-Ostrava-Pyskowice route.

Table 4.
Summary of transport efficiency indicators and measures for the Pyskowice-Nowy Sącz-Tarnów-Pyskowice route

Indicator	average load factor	average profit level	route length	cost per 1 km	cost per 1m^3	transport time
value for the route	52%	-469,81 zł	494 km	3,04 zł	218,66	6,23 h

Source: Own study based on Gandawska, 2025.

Table 5.
Summary of transport efficiency indicators and measures for the Pyskowice-Ostrava-Pyskowice route

Indicator	average load factor	average profit level	route length	cost per 1 km	cost per 1m^3	transport time
value for the route	44%	-101,66 zł	185km	4,59 zł	131,38	2,15 h

Source: Own study based on Gandawska, 2025.

As can be seen, the Pyskowice -Nowy Sącz – Tarnów - Pyskowice route is currently unprofitable, as indicated by the calculations of selected indicators. The average cargo space utilization rate is only 52%, which means that the available cargo space is not being used efficiently. The average cost of transporting 1 m³ is PLN 218.66 (taking into account the price of the most commonly used vehicle on this route, an S-type truck with a load capacity of 12.5 m³), which, considering the rate paid by the customer per m³ (PLN 121.50), means an average loss of PLN 97.16 per 1 m^3. For the Pyskowice-Ostrava-Pyskowice route, the results of the calculations are better than for the previously analyzed route, but they are still unfavorable in terms of transport process efficiency. The average cargo space utilization rate is only 44%, which means that more than half of the vehicle's cargo space remains empty and unused for rotation purposes. The cost per 1 km in this case is higher, at PLN 4.59/km, while the cost of transporting 1 m^3 is PLN 131.38, which still indicates losses for the company.

5. Results

An analysis of the two least profitable routes indicates that the key factor in improving their profitability is to increase the utilization rate of vehicle capacity. Optimizing this indicator would reduce the unit cost of transport per cubic meter, which, with a billing model based on volume transported, would directly translate into increased revenue. Importantly, these measures are also in line with sustainable development principles. Better use of cargo space

means fewer trips needed to make deliveries, thereby reducing fuel consumption and CO_2 emissions. Reducing the number of vehicles on the road not only improves cost efficiency, but also contributes to reducing the company's carbon footprint, which is an increasingly important element of responsible logistics and the expectations of customers and business partners.

To reduce losses resulting from underutilization of load capacity and varying delivery volumes, the following solutions should be implemented:

1. Consolidation of deliveries within micro-networks: grouping low-volume destinations within a single route or creating local transshipment hubs (e.g., near Tarnów or Rzeszów), from which distribution to several shopping centers would be carried out.
2. Dynamic route planning (routing on demand): use of TMS systems with dynamic route planning based on current data on volume, vehicle availability, and infrastructure constraints, and automatic assignment of vehicle type to a route based on an algorithm that takes into account tonnage, volume, and delivery time.
3. Introduction of time windows with a flexible buffer: negotiation with shopping centers for wider delivery time slots (e.g., 6:00-9:00 a.m. instead of a fixed 6:00 a.m.), which allows for better utilization of the fleet and cost reduction.
4. Use of vehicles with variable bodywork: implementation of a fleet with adaptable cargo space (e.g., modular containers or box bodies), allowing for better adaptation to variable volumes.

To increase operational efficiency and reduce losses resulting from unprofitable routes, it is worth implementing the following measures:

1. Segmenting routes by profitability: routes can be divided into three groups: Highly profitable – high volume, full capacity utilization, and short distances (e.g., Katowice, Wrocław); Medium-profitable – variable volume, partial fleet utilization, moderate distances; and Low-profitable – low volume, long distances, requiring the use of smaller vehicles (e.g., Rzeszów, Ostrava).
2. Introducing flexible delivery models: this involves reducing the frequency of deliveries to low-volume locations while maintaining the SLA (Service Level Agreement) and consolidating deliveries with neighboring points (e.g., Nowy Sącz + Tarnów as a single route). In the context of logistics and B2B cooperation, an SLA means a formal agreement between the logistics operator and the customer that defines the scope of services, quality parameters, performance indicators (KPIs), communication and escalation procedures, and financial consequences. In the case analyzed, the SLA could regulate, for example, the obligation to deliver to shopping malls at specific times, regardless of volume, which impacts route profitability.

3. Revision of rates per cubic meter for selected destinations – negotiating individual rates with the customer for routes with high unit costs (e.g., Rzeszów), instead of applying a flat rate.
4. Sharing resources with other contractors – utilizing the "shared transport" model for low-occupancy routes – sharing a vehicle with the operator's other customers.

To reduce losses resulting from underutilized capacity and fluctuating delivery volumes, it's worth implementing delivery consolidation into micro-networks, dynamic route planning, flexible time windows, and variable-body vehicles. To increase operational efficiency, segment routes based on profitability, limit the frequency of deliveries to low-volume locations while maintaining SLAs, and negotiate individual rates for high-cost destinations. Additionally, sharing resources with other contractors can improve fleet utilization on low-occupancy routes.

6. Discussion and Conclusion

Transport processes carried out by a logistics operator for a customer are carried out according to a strictly defined schedule and on pre-determined routes, with no possibility of ongoing modifications. While the schedule remains unchanged, the route structure can be subject to flexible adjustments, particularly in response to seasonal fluctuations in demand. Decisions in this regard rest with the operator and do not require direct consultation with the customer. Based on the analysis of the current delivery model, it seems justified to implement measures aimed at improving service profitability by redesigning the route system. Particular attention should be paid to routes generating the highest financial losses. One possible solution is to combine unloading points to enable better utilization of vehicle cargo space, which would reduce unit transport costs and increase operational efficiency. A key aspect in this context is the seasonality of transported goods volumes, which should be taken into account when planning routes. Systematic monitoring of key performance indicators (KPIs), such as vehicle capacity utilization and transport cost per cubic meter, is also necessary. It's worth emphasizing, however, that despite the potential benefits of improved cargo space utilization and cost reduction, the proposed changes may pose operational risks. For years, the operator has operated based on a fixed route network, which may lead to resistance from employees at the transshipment warehouse in Pyskowice and regular carriers accustomed to the current work model. Implementing a new system may result in organizational challenges, including adjusting route lengths and unloading time windows. Therefore, it is recommended to supplement the proposed actions with FMEA (Failure Mode and Effects Analysis) and PHA (Preliminary Hazard Analysis), which will allow for the design of a new routing model that takes into account potential threats and operational risks. This will be the subject of further research and implementation.

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