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Optimizing the order picking and delivery process to the final recipient

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Abstract: The aim of this study is to analyse and evaluate the order picking process and the transport of products to customers, taking into account the specific characteristics and potential of small and medium-sized industrial enterprises. Scientific standards and selected indicators for measuring the efficiency and quality of transport and order picking processes were used to achieve the intended objectives. The research was conducted in a small, family-owned manufacturing and trading company specialising in the production and sale of wrought iron finishing elements and fences. The analysis covered both internal and external transport processes. It was shown that the order picking process in the studied company is largely based on manual procedures, which, despite high precision, generates time-consuming activities related to the movement of warehouse employees. External transport efficiency indicators showed high efficiency and appropriate use of transport resources. The high quality of deliveries, as measured by on-time and reliability indicators, confirms customer satisfaction. The study was conducted in one company, which is a limitation. Future studies should include more companies from the same sector. Proposed improvements need to be verified sometime after implementation and solutions resulting from data analysis can help SMEs in similar industries to improve their logistics processes. The work brings a new approach to the analysis of order picking and transport processes in the context of SMEs, providing practical solutions and indicating areas for further research. It is aimed at logistics managers, researchers and practitioners interested in optimising logistics processes in the industrial sector.

1 Introduction

In an era of fierce competition, the activities of business entities are not only limited to production, delivering products to the target market, but also to achieving the desired sales volume, maintaining proper relations with suppliers and customers [1]. Close cooperation with suppliers and with the distributor is required. Both procurement and distribution are closely linked to the transport of materials, raw materials or finished goods. Without properly functioning transport, it is not possible to run any business. The organisation of the transport process has a significant impact on the logistics process, the fluidity of the logistics chains. Whether in warehouse management, production or finished goods transport, transport plays an overriding role.

One of the basic processes in the finished goods warehouse is order-picking, which involves taking specific types and quantities of products from the storage areas and combining them into one separate unit [2,3]. This will then be transferred to the release area for transport to the customer.

The following movements are carried out in the finished goods warehouse [4,5]:

- Receipt of finished goods from production.
- Unloading of the products: transfer to the storage area.
- Configuration of the corresponding sets of products, according to the order (picking).
- Releasing the goods, i.e. loading the products onto the means of transport.

Finished products arriving from the production line are labelled with the product symbol, name and, in the case of an individual order, its number and customer data. Such labelling facilitates the storage and, above all, the release of specific products for picking. In theory, the following types of picking are distinguished, i.e. the preparation of finished products for dispatch, according to the according to the order [6]:

- Simple picking: one person carries out a single order.
- Combined picking: combining individual orders into picking lists.
- Zone picking: picking of an order from a particular zone by one worker.

The analysis undertaken of the process of order picking and transport to the final customer, concerns a manufacturing and trading plant belonging to a small, family-owned enterprise located in Poland, in the Silesian province, in the city of Częstochowa. The company was founded in the interwar period and operated as a blacksmith shop. In 1992 it was transformed into a company, and the company is currently managed by one owner. The company is involved in the production and sale of wrought iron home finishing elements and complete

wrought iron fences, including the installation of automation. The company's development is evidenced, among other things, by a systematic increase in the range of products directed and tailored to the needs of the individual customer. An example of customer-oriented production is, for example, the realization of individual orders for armor and knightly weapons. The production and fulfillment of such orders is niche in Poland.

In the selected company, straight picking is used, which means that one warehouseman picks the goods for dispatch according to the order. In addition, a 'man to product' picking system is used [7]. This system is based on the fact that it is a man who reaches the storage area for a particular product, picks it and moves it to the picking area [8].

The results of the authors' research show that there is a lack, especially in Poland, of effective tools describing the order picking process with concrete examples. In addition, there is a shortage of commercialization of practical solutions to support the management of this process in order to optimize the activities of companies in the same industry. Most often, these topics are discussed in a general way in the context of logistics processes [9,10] i.e.: picking process optimization [11], picking automation [12-14] or inventory management in the context of picking [15,16]. Also analysed are examples of the implementation of innovative solutions in the handling infrastructure improving the discussed process [17], IT systems supporting picking processes [18,19] or working conditions in goods picking processes.

Therefore, the motives for taking up this topic were:

- The relatively small number of studies on the Polish and foreign publishing market concerning the order picking process in manufacturing companies in the forged fencing sector.
- The lack of a set of practical solutions in the context of order picking.
- The lack of scientific and research publications analysing order picking on specific examples.

The purpose of this study is to analyse and evaluate the process of order picking and transportation to the destination, taking into account the requirements and potential of small and medium-sized industrial enterprises. The authors' analysis identifies a gap in research on order picking processes, particularly in the SME manufacturing sector. It highlights the need for practical solutions and commercialization of tools to support the management and optimization of order picking, especially in an industry such as wrought iron fencing.

The research results presented will contribute to the development of a remediation plan to improve order picking and external transportation processes. Practical solutions from the data analysis can help SMEs in similar industries improve their logistics processes and overall efficiency. This opens the way for further research in order picking optimization, transportation logistics and supply chain management, especially in the context of SMEs. This highlights the importance of addressing specific industry challenges and implementing innovative solutions to drive business growth and competitiveness.

2 Methodology

2.1 Research background - the company's transport infrastructure

The transportation infrastructure of a plant is closely related to its characteristics and activities. First of all, as mentioned in the introduction, it is a production and commercial activity. The plant carries out external and internal transportation tasks. External transport is carried out to a small extent, only for its own needs. The entrepreneur owns two delivery trucks. These are Opel and Renault tarpaulin vans with a capacity of up to 3.5 tons. If necessary, the tarpaulins are pulled down. One of the vehicles is a 2018 version of the Opel MOVANO. It is characterised by relatively low fuel consumption. It can accommodate 8 to 10 pallets. The other vehicle is a 2014 Renault Master 2.3 dCi, which can also accommodate up to 10 pallets. Both vehicles are leased. The vehicles are mainly used for supplying the plant. Materials are delivered, semi-finished products intended for the production of products. Transportation is carried out over short distances. All materials are purchased from suppliers in Silesia, Malopolska, or Swietokrzyskie provinces. First of all, steel, stainless steel and, in insignificant quantities, aluminum, paints are delivered.

The plant cooperates with wholesalers based in Częstochowa. The short distance between suppliers of steel products contributes to the low transportation costs for supplies. The number of deliveries per month is variable and depends on the volume of orders. The vehicles also handle product deliveries to customers. In the case of a large order, customers carry out the pickup with their own transport. Such a decision by the plant owner is due to economic reasons. Recipients of the products are not only small locksmith stores, but also large chains of construction stores, which receive large quantities of products of varying dimensions (spans, or handles). The organisation of external transportation above 3.5 tons is the responsibility of the recipient. The owner would have to rent the means of transport (a set of tractor and semi-trailer), which would involve significant costs.

Intra-plant transport refers to the short-distance transportation of raw materials for production, inter-station transport and to the finished goods warehouse. Its task is to synchronize the flow of goods in the production cycle. The organisation of internal transportation within the plant is adapted to the specifics of production. It makes the flow of goods take place safely and at low cost. Transport of materials or finished goods is carried out along the shortest routes, using forklifts. The plant is equipped with five forklifts. Due to the parameters, the plant has purchased Still brand forklifts, which can carry loads of up to 8 tons:

- Model RX 50, which is particularly suitable for unloading and loading cars and transporting pallets in the warehouse, delivering components to workstations, makes it possible to transport loads of up to 1.6 tons in narrow spaces between workstations (2 units).
- Model RX 60 makes it possible to transport heavy loads of up to 8 tons, is used for loading and unloading of trucks (1 piece).
- Horizontal compliment cart model OPX 20/25, with a lifting capacity of up to 2,500 kg.
- Horizontal stacking cart OPX D 20, characterized by minimal twist, load capacity up to 2 tons.

They are used already at the time of receipt of loads into the raw materials warehouse. Unloading of vehicles is carried out using forklifts. These are electric forklifts, which do not emit exhaust fumes into the environment. Batteries are fully sufficient for eight hours of single-shift operation. Delivered goods are transported by forklifts to the designated location in the raw materials warehouse. All raw materials are stored on pallets for quick movement. In addition, two HPS hand forklifts are used at the plant.

Due to the nature and variety of production, transportation is carried out from the warehouse to individual stations. There are distinguished positions for the production of balustrades, railings, gates, in addition to the production of details (decorative knobs, letters, numbers, etc.), handles, hinges, building management systems, paint shop. This organisation of workstations is due to the diversity of production technologies. Internal transport is shuttle, which means that a forklift delivers a particular material to a particular workstation. On the way back, it picks up waste.

Pallet trucks are mainly used for shifting pallets with an insignificant load All forklifts and pallet trucks have the necessary technical documentation, which allows them to be serviced. Due to the plant's single-shift operation, batteries are recharged after eight hours of use.

The use of forklifts is higher in the situation of transporting raw materials to the warehouse, as well as during car loading. On the other hand, the use of forklifts in production depends on the type of orders being processed. It should be mentioned that the plant has no overhaul downtime during the year. Production takes place cyclically in one shift. Hence servicing, technical inspections of forklifts take place successively, so that the plant is not deprived of means of internal transport.

Thanks to the delegation of authority, each person operating a particular forklift is responsible for its proper use, controlling its technical condition, as well as its daily operation. He or she is responsible for entries in the equipment records of maintenance performed, fluid changes, tires, etc. Delegation of authority also promotes the economical use of means of transportation. The correct organisation of internal transportation promotes the proper course of the production process. This is because the products are delivered at the right time to a specific position. There are then no unforeseen interruptions.

Another type of transport is small overhead cranes, which allow the transportation of large elements, such as railings, balustrades, gates, fence spans for powder coating. Painting is preceded by cleaning the welded elements from impurities. The plant has an automated washing station, where metal parts are cleaned of grease and protected against corrosion. Paint (powder) is applied to the thus prepared surface in a spraying manner.

Depending on the order, the elements are painted in different colors. The parts are then sent to an electric paint oven, where the paint is cured. The painted parts are heat-treated for about 20 minutes at a temperature of about 200° C. The paint coating makes the metal parts resistant to moisture, temperature changes, UV rays, chemicals, and, above all, to corrosion and mechanical damage. These properties are important for products that are used in natural environments. Painted components are subject to detailed inspection and then transported to finished goods warehouses. When discussing internal transportation issues, it is also necessary to characterize roads, storage, unloading and loading points for raw materials/products. The maneuvering area provides a safe approach of vehicles to the unloading or loading ramp. Intra-plant roads are of adequate width to ensure maneuvering of vehicles. The main roads are 1.5 to 2.0 meters wide. However, between stations up to one meter. Larger distances are between individual departments, i.e. the warehouse, the production section, the paint shop and the finished goods warehouse. These distances take into account health and safety rules, including fire safety. It should be noted that the roads are smooth, without thresholds, marked in yellow. The speed of internal transportation means must not exceed 5 km/h. Employees use the internal parking lot, the location of which does not impede the entry and exit of external transport vehicles. The length of the ramp and door openings ensure the free reception and transfer of loads. Lift gates are used - segmented.

2.2 Research methods and material

The aim of this study is to analyse and evaluate the process of order picking and transportation to the destination, taking into account the requirements and potential of small and medium-sized industrial enterprises. This main objective required answering the following research questions:

1. What is the organisation of internal and external transport in the company in question?
2. How is the picking process carried out in the company?
3. How is the transport of finished goods to customers organised?

In order to obtain answers to the questions posed, a case study was selected as the research method. The research

tools used were - a direct casual interview with the owner of the company and a critical analysis of documents provided by the company under study. The interview was conducted in July 2022. The analysis of procurement documents covered the entire year 2022.

Selected indicators were used to measure the efficiency and quality of transportation and picking. The data obtained allowed the calculation of external transportation costs on a monthly and annual basis. The originality of the presented material lies in the development of a recovery plan for the picking process. The collection correctness index was calculated to measure the correctness of product picking. A measure of the correctness of the completion of products is complaints of non-conformity with the customers' order, i.e. the collection correctness index. For this purpose, the following formula (1) was used:

$$ICC = \frac{N}{T} \quad (1)$$

ICC - Correct collection,
N - Number of improved orders completed,
T - Total orders completed.

The indicator value for the six warehousemen involved in picking and shipping products for 2022 is presented. The efficiency of the process of transporting goods to the recipient was also diagnosed. For this purpose, selected indicators were used, i.e:

- Vehicle utilisation rate - k_p.
- Technical readiness index of rolling stock - k_g.
- Vehicle time utilisation rate - k_{hp}.
- Utilisation rate of technically fit vehicle - k_{up}.
- Vehicle load space utilisation rate - w_{vp}.

3 Results

Simple picking is used in the company, which means that one warehouseman picks the goods for dispatch according to the order. In addition, a 'man to product' picking system is used [20]. This system consists of a man reaching the storage area for a specific product, picking it and moving it to the picking area [21-23]. Warehousemen begin the picking process when they receive the preparation of goods for shipment. This order includes:

- An inventory of the products, including their characteristics.
- Number of pieces (packages).
- The location of the products.

In cases of small orders, picking of goods is done manually. The warehouseman delivers the products according to the order to the picking point. As mentioned, he carries out only one order. The process of picking a single, specific product consists of the following steps:

- Scanning the storage location code.
- Scanning the code from the label of a particular product.
- Picking up the particular product and transporting (transferring) it to the picking location.

A warehouse is a place from which finished products are manually retrieved by a designated warehouseman. Such a solution requires the allocation of adequate time not only for finding and retrieving the product, but also for the movement of the warehouseman. The order picking process is often time-consuming. Figure 1 shows the percentage of individual operations that constitute the picking process.

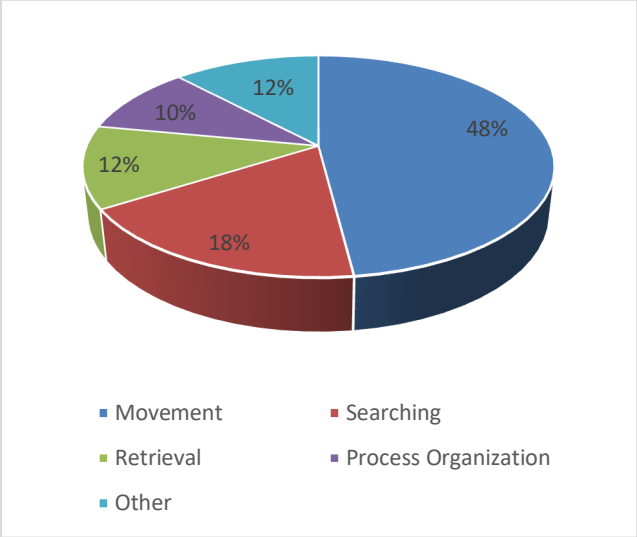

Figure 1 Picking process - % share of individual activities

Analysing the data presented in Figure 1, it should be noted that almost half of the time involved in picking an order is the movement of the warehouse worker. This person does not always use forklifts. In the case of orders for details such as handles, hinges or other small items, the warehouse worker moves between the racks on foot. Despite the use of automated warehouse handling (RFID), the retrieval period for product data is still relatively long. The time taken to retrieve products varies, depending on the level of storage and also the location (shed). It is clear that the fastest picking time is on the first level and the longest on the highest level. It should be noted that the total time it takes to pick five products and transport them to the picking area is 4 minutes. It should be noted that the average speed of the warehouseman is 5 km/h. His route is optimal. Similar picking times occur when using forklifts when the products are large and heavy. The picked goods are moved/transported to the picking area. There, the warehouseman assembles the goods. The organisation of picking takes place according to the order of shipment, order by order. Small-sized goods that are on the order list are stored on pallets and then protected with foil or packed in cardboard boxes. Once all items have been completed,

the prepared goods are handed over for dispatch to the customer. Associated with picking is the quality of shipment preparation. The correctness of the completion of the products is measured by complaints of non-conformity with the customers' order, i.e. the collection correctness index.

The Table 1 below shows the value of the indicator for the six warehousemen involved in picking and shipping products for 2022.

Table 1 Collection validity index

No. of warehousemen	Number of correctly completed orders	Completed orders	Collection accuracy rate
1.	8,370	8,680	96.4%
2.	7,750	8,060	96.1%
3.	5,580	5,890	94.7%
4.	8,624	8,932	96.6%
5.	7,320	7,625	96.0%
6.	7,540	7,830	96.3%

Considering the values of the indicators presented, it should be noted that they are close, at just over 96%. Only in one case, that of the warehouseman processing the smallest number of orders, is this indicator below 95%. At the plant, each poorly executed order is analysed for products that were mistakenly completed. The most common mistakes involve details, metalwork, handles. These products are produced in different assortments, colors, which can result in incorrect classification of the product to the order. Analysing the mistakes made, it was found that they are mainly due to lack of attention, absentmindedness of warehouse employees. They mainly concern:

- Taking the wrong number of products (inconsistency with the order).
- Taking products from the wrong place.
- Wrong storage.

It should be mentioned that the plant accepts such complaints and sends the correct product at its own expense. Also, rechecking the order before sending the completed cargo eliminates mistakes. Efforts should be made to improve order picking, through more effective use of IT systems. Correct labelling of products, proper storage will help to reduce the number of complaints. Incorrectly completed orders incur costs due to complaints and corrections. In the plant, each wrongly completed order is analysed for products that were mistakenly completed. The picking process is completed when the transport unit is handed over to the dispatch area.

The company in question does not organise external transport if the load exceeds 3.5 tonnes. Transport of larger goods is carried out (organised) by the ordering party itself. As mentioned, the main customers for the products are locksmith shops, wholesalers, chain shops or individual customers. External transport is carried out exclusively within the country, primarily in the Silesian, Opole and Lesser Poland Voivodeships. Thus, transport is carried out over short distances. The task of the driver receiving a transport order is to work out the shortest possible route. This task is facilitated by the GPS system.

One vehicle covers an average route of 300 km in one day. There is rarely a further trip of more than 500 km per month. The cost of transport is:

- Fuel consumption 9 litres/100 km, i.e. about 30 litres per day x 5.5 PLN per litre: about 165 PLN (monthly 3,630 PLN, for two cars about 7,300 PLN).
- Driver's remuneration including other benefits: PLN 6,500 (two drivers PLN 13,000 per month).

The monthly cost of fuel and work of two drivers is PLN 20,300. When calculating the cost of transport, we will also add:

- Insurance including AC: PLN 2,500.
- Depreciation approximately: PLN 2,000 per year.
- Servicing: approximately: PLN 3,000.
- Tyre replacement: PLN 3,200 per year.
- Other expenses, e.g. vehicle washing: PLN 3,000.

On the basis of the data presented, it should be concluded that the annual cost of external transport is PLN 257,300. Most funds are allocated to driver remuneration and fuel. In the case of delivery of products to the recipient, the cost of transport is mentioned in the product sales contract. Drivers making deliveries on the return journey collect raw materials from suppliers, which eliminates empty runs. Managers also analyse the efficiency of external transport using selected metrics. These metrics are shown in Table 2.

Table 2 External transport performance indicators for 2022

Meter	Formula	Indicator value
Vehicle utilisation rate - k_p	$k_p = \frac{T_v}{T_c}$ T_v – lifetime of the vehicle T_c – total inventory time	83%
Technical readiness index of rolling stock - k_g	$k_g = \frac{T_u}{T_u + T_o}$ T_u – time of use of means of transport T_o – vehicle operating time, i.e. inspections and repairs	94%
Vehicle time utilisation rate - k_{hp}	$k_{hp} = \frac{T_j}{T_p}$ T_j – driving time of the vehicle T_p – total working time	84%
Utilisation rate of technically fit vehicle – k_{up}	$k_{up} = \frac{T_p}{T_u}$ T_p – total working time T_u – time of use of means of transport	94%
Vehicle load space utilisation rate - w_{vp}	$w_{vp} = \frac{v_l}{V_p}$ v_l – volume of cargo to be transported V_p – the volume of the loading space of the means of transport	81%

Considering the presented values of the indicators, it should be concluded that their values are appropriate. The value of the vehicle utilisation rate - 83% - indicates a significant use of vehicles for transporting products and importing raw materials. Drivers are almost fully utilised for transport tasks. The technical readiness index also takes on a high value - 94%. The cars are relatively new, which translates into their low failure rate. Linked to the vehicle utilisation rate is the driver time utilisation rate. The calculated indicator has a value of 84%. The drivers' total working time consists not only of transport, but also of loading and unloading. The good technical condition of the vehicles is evidenced by the high value of the technically efficient vehicle utilisation rate - 94%.

The lowest value was recorded in measuring the use of the cars' cargo space. Cars can hold up to 10 pallets of cargo, but the order is not always that large. Managers prefer to deliver cargo to a customer faster, rather than wait for an order from another customer with a similar direction of transport. In the case of an increased number of cargoes waiting to be transported, they are consolidated onto a single mode of transport. Based on the indicators presented, it should be concluded that the efficiency of transportation is significant. The means of external transportation are properly used. Another group of measures of external transportation concerns its quality. Table 3 shows the values of selected transport quality measures.

Analysing the quality indicators of external transportation, it should be noted that they are very high and therefore satisfactory. The level of the delivery quality factor - 97% indicates that only 3% of deliveries were not accepted by customers. Reliability of deliveries is at 94%, which means that 6% were complained about by customers In this case, it is not about compliance with the order, but about possible damage to the cargo during transportation. Due to the short distances between the manufacturer and customers, the on-time delivery rate is very high - 98%. Delays in deliveries may be due to road congestion caused by the construction of the Częstochowa bypass and the connection to the A 1 in Dźbów (Silesia Province, Poland).

Table 3 External transportation quality indicators for 2022

Measure	Formula	Value of the indicator
Quality of delivery	Delivery volume accepted by customers//total delivery volume	97%
Reliability of delivery	Number of advertised deliveries/number of total deliveries	94%
Timeliness of delivery	Level of deliveries within the agreed timeframe	98%

Based on the data presented, it should be noted that the production and trading plant constantly analyses the efficiency of transportation, its use and the quality of deliveries. Despite the modest fleet, the task of delivering products to customers is carried out on a regular basis. Two delivery trucks fully meet the needs in terms of product deliveries, as well as transporting finished products to customers. A great convenience in the field of transportation is the fact that a significant part of the production is received by its own transport by locksmith stores or wholesalers, construction stores. Such a solution of transport needs affects savings in terms of costs incurred.

Drivers, perfectly familiar with the routes safely deliver goods to the indicated address. Each trip is made in accordance with the order. It is the responsibility of the drivers to properly secure the cargo, unload and control the quantity and type of transferred products in accordance with the shipping documentation.

4 Discussion

The challenges faced by SMEs in the manufacturing sector primarily revolve around common difficulties in effectively managing costs and processes, particularly in areas related to order fulfillment and transportation. Effective management of production processes, order fulfillment, and transportation requires continuous analysis and improvement, which can be challenging for SMEs due to limited resources and capabilities. Implementing strategies such as reusing packaging, employee engagement, and adherence to transportation regulations is crucial in the context of production. Leveraging modern technologies such as route optimization and vehicle tracking can improve delivery efficiency. Continuous improvement of logistic processes is essential for the competitiveness of SMEs in the manufacturing sector.

The diagnosed company, which operates in the area of picking and transportation, faces the challenge of effective cost management and process optimization. One of the key aspects of cost reduction is the reuse of bulk packaging, sourced from home improvement store chains and wholesalers. The quality of picking, a key component of the supply chain, is closely dependent on the human factor. Inattention or absentmindedness on the part of employees can lead to errors and longer lead times. Employee involvement and motivation have a significant impact on the work atmosphere and the results achieved. The value of the company is conscious employees who realize the benefits of following procedures, including health and safety rules. Another area for improvement is external transportation, where cost analysis and possible outsourcing can bring savings. Developing regulations for the application of transportation rates, taking into account various factors such as distance, loading and unloading activities, is a key step in managing this area. When it comes to loading transportation equipment, it is important for warehousemen and drivers to work together to secure cargo safely and properly. Also, efficient management of shipping documentation, especially in the era of electronic information exchange, is essential for the smooth operation of the process.

The efficiency of deliveries can be increased with the use of GPS, which allows optimization of routes, analysis of fuel burn and real-time location of vehicles. It is also worth focusing attention on the after-sales stage, where customer complaints should be properly analysed and addressed.

The lack of research on customer relations is an area for further development. Conducting customer surveys, evaluating, among other things, meeting order deadlines, the condition of goods after transport or speed of delivery, will allow a better understanding of customer needs and improve the quality of service.

Despite the competitiveness of the market, the plant's strength is in delivering products in line with customers' needs. Modern tools, such as visualization of fencing elements on the website and social media presence, can expand the market. Offering additional services, such as gate automation and video cameras, adds to the company's strengths. In the pursuit of complete customer satisfaction, it is important to continuously improve processes and analyse results at both the completion and customer service stages.

Continuous process improvement and adaptation to changing market conditions are crucial for the success of small and medium-sized manufacturing enterprises in today's competitive business environment.

5 Conclusions

The study focused on the processes of order picking and transportation in the context of small and medium-sized industrial enterprises. It was demonstrated that the order picking process, particularly in the examined production and trading plant, largely relies on manual procedures. Despite the manual nature of picking, the accuracy rate consistently indicated a high level of precision, averaging over 96% for the involved warehouse employees. The study identified efficient order picking processes; however, it also highlighted challenges, such as time-consuming activities mainly related to the movement of warehouse personnel within the facility. Despite the use of automated warehouse handling systems, the picking time significantly deteriorated, especially for small items. In addition to the mentioned improvements, when considering the picking sphere, it is essential to focus on:

- Shortening the picking process time, which is synonymous with increasing the productivity of the finished goods warehouse.
- Minimizing errors occurring at the preparatory stage.
- Reducing picking-related costs.

Reducing the number of errors will contribute to reducing the number of customer complaints, thereby increasing satisfaction with the plant's cooperation and products. The conducted analysis particularly favours the elimination of downtime, duplication of actions, or wastage.

The transport infrastructure of the examined plant primarily focuses on short-distance external transportation, mainly within the Silesian, Opole, and Lesser Poland voivodeships. The plant uses two delivery vehicles, which efficiently cover an average of 300 km of route per day. The use of GPS systems helps optimize routes, ensuring timely deliveries to customers. The efficiency of external transportation was assessed using various indicators,

including vehicle utilization rate, fleet technical readiness index, vehicle utilization time index, technically efficient vehicle utilization rate, and vehicle cargo space utilization rate. These indicators consistently indicated a high level of efficiency and proper utilization of transportation resources. The study also evaluated the quality of deliveries using indicators such as delivery quality, delivery reliability, and delivery timeliness. The results showed a high level of customer satisfaction, with a delivery acceptance rate of 97%, reliability at 94%, and timeliness at 98%. Despite the overall efficiency and quality of order picking and transportation processes, the study indicates areas requiring improvement, including adopting more efficient IT systems to increase picking accuracy and efficiency. Additionally, to maintain a high level of service quality, actions aimed at further route optimization and minimizing delays caused by external factors such as road traffic were recommended.

The results of this study provide valuable information for small and medium-sized industrial enterprises, emphasizing the importance of continuous assessment and optimization of logistic processes. Further research could explore innovative solutions and technologies to meet identified challenges and further increase efficiency and customer satisfaction in order picking and transportation operations.

Throughout the order picking process, individual activities were identified to pinpoint those negative activities that do not bring the expected value.

A limitation of the study was the analysis conducted in only one company. A comparative analysis should be conducted in at least several manufacturing enterprises within the same sector. Proposed improvements can only be verified after a certain period has elapsed since their implementation. The proposed modifications will not only streamline the organisation of order picking and transportation but also increase efficiency, reduce costs, strengthen the company's position in the industry, and most importantly, impact customer satisfaction. Therefore, further research in this area is planned for the future.

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