MANAGEMENT OF THE ORDER PICKING PROCESS VERSUS TRANSPORT TO THE POINT OF DESTINATION. A CASE STUDY

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Abstract

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. Close cooperation with suppliers and with the distributor is required. Both supply 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. The aim of this study is to analyse and evaluate the process of order picking and transport to the point of destination using a selected example. This main objective required answering the following problem questions:

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

As a research method, selected indicators were used to measure the efficiency and quality of transport and picking. The data obtained made it possible to calculate external transport costs on a monthly and annual basis. The originality of the presented material is the development of a repair plan for the picking process and external transport on the basis of the obtained data.

Keywords: picking, orders, transport, management

1. INTRODUCTION

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 [1,2]. 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 [3,4]:

- 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.

Incoming finished products 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 [5]:

- 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.

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 [6]. 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 [7].

The authors' research shows that there are few tools describing the order picking process in Poland using a concrete example. There is also a lack of commercialisation of practical solutions to support the management of this process in order to optimise the activities of companies in the same industry. Most often, these issues are discussed in general terms in the context of logistics 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 aim of this study is to analyse and evaluate the process of order picking and transport to the point of destination using a selected example.

As a research method, selected indicators were used to measure the efficiency and quality of transport and picking. The data obtained made it possible to calculate external transport costs on a monthly and annual basis. The originality of the presented material is the development of a repair plan for the picking process.

2. RESEARCH METHODS

The analysis concerns a production and sales plant belonging to a small, family-owned enterprise located in Poland, in the Silesian Voivodeship, in the city of Częstochowa. The company produces and sells wrought iron elements for finishing houses and complete wrought iron fences including the assembly of automatics. The company's development is evidenced by, among other things, a systematic increase in the range of products directed and adapted to the needs of the individual customer. An example of customer-oriented production is, for example, the realisation of individual orders for knights' armour and weapons. The production and realisation of such orders is niche in Poland.

In order to answer the research questions, a research tool was chosen - a direct, free-of-charge interview with the owner of the company as well as a critical analysis of the documents provided by the company under investigation. The interview was conducted in July 2022. The analysis of the ordering documents covered the entire year 2022.

In turn, 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 was used:

$$ICC = \frac{N}{T}$$

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

3. RESULTS AND DISCUSSION

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 [8]. This system consists of a man reaching the storage area for a specific product, picking it and moving it to the picking area [9]. 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 [10].

The order picking process is often time-consuming. Figure ten shows the percentage of individual operations that constitute the picking process.

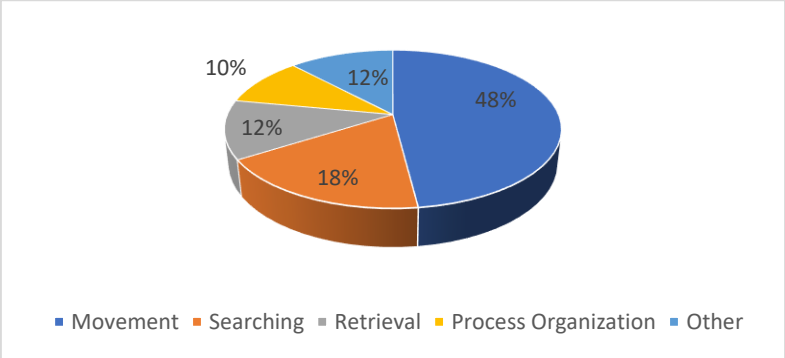

Figure 1 Picking process - % share of individual activities

Analysing the data presented in the chart, 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. 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 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 warehousemanr	Number of correctly completed orders	Completed orders	Collection accuracy rate
1.	8370	8680	96,4%
2.	7750	8060	96,1%
3.	5580	5890	94,7%
4.	8624	8932	96,6%
5.	7320	7625	96,0%
6.	7540	7830	96,3%

When 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%. 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 - 2 500 zł,
- depreciation approximately PLN 2,000 per year,
- servicing: approximately 3,000 zł.
- 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 the Table 2.

Table 1 External transport performance indicators for 2022

Meter	Formula	Indicator value
Vehicle utilisation rate- k_p	$k_p = \frac{T_p}{T_c}$ T_p – 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	94,0%
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%.

4. CONCLUSION

Throughout the picking process, individual activities have been isolated in order to identify those negative activities that do not deliver the expected value. When considering the picking sphere, in addition to the improvements already indicated, the focus should be on:

- reducing the time of the picking process, which is equivalent to increasing the productivity of the finished goods warehouse;
- minimising errors occurring at the preparation stage;
- reducing the costs associated with picking.

Reducing the number of errors will contribute to fewer complaints from customers, thereby increasing satisfaction with the cooperation with the plant and the products.The analysis carried out is particularly conducive to eliminating downtime, duplication of activities or, finally, waste. The conclusions drawn from conducting observations and analyses include:

Research should be carried out on the basis of an analysis of not just one company but several in the same industry. Proposed improvements can only be verified after a certain period of time since their implementation. The proposed modifications will not only improve the organisation of picking and transport, but also increase efficiency, reduce costs, strengthen the position in the industry and, above all, influence customer satisfaction, which is why more research is planned in this area in the future.The paper must contain conclusion. The conclusion should summarize the findings and explain the implications of the paper. Conclusion contains no new data or findings.

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