NEW INNOVATIVE LOGISTICS IN MANUFACTURING AND ITS IMPACT IN MODERN BUSINESS ENVIRONMENT

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Abstract

The latest handling and software technology can help organize the smooth running of logistics activities with innovations. The solution in this article will include an analysis of the current state of innovation and possible solutions in logistics. The analysis will cover several analytics techniques and activities from the arrival of a specific product from the supplier to the warehouse to the specific removal of the relevant components to the right place at the right time. The activities will be divided into several specific groups, in which it will be more specifically characterized. The goal of problem-solving proposals in companies is to select possible other options that would help rationalize time and possibly replace existing logistics activities, handling equipment or packaging in the company to help the company in economic growth and warehouse efficiency. The aim of the article is to find possible innovative logistics solutions for a specific manufacturing company in the Czech Republic.

Key words: innovative modern logistics, logistic process, warehousing, handling equipment, manufacturing company

JEL Code: M11, M21, O31

Introduction

Warehousing can be described as a link in the logistics chain that helps to bridge the spatial and temporal mismatch between the place of production and the place of consumption. Furthermore, according to the authors, warehousing within the logistics chain occupies an important position for companies, as it is necessary to maintain the necessary quality of customer service. In the modern phase of development of transformation processes in the economy, considerable attention must be paid to the process of forming logistics and outsourcing systems, the purpose of which is to create an effective complex of logistics services and optimize regional logistics infrastructure. All this will make it possible

to optimize the structural proportions of production or manufacturing and to systematize information, financial and commodity flows. Logistics deals with the flow of goods, money, and information both between the supplier and the customer, as well as within individual companies, including various inventory systems. The purpose of the entire industry is to optimize these flows so that they represent the optimal cost for the company.

The motivation for warehousing and implementation of warehousing systems is the difference between the current need for a given material or goods and the actual supply options. To reduce costs, smaller individual deliveries are being replaced by larger and less numerous. This creates the need to temporarily store a larger number of imported stocks. Capital that could otherwise make a profit is numb in inventory. The goal of inventory management is therefore to reduce the amount of stored inventory and approach the ideal state, in which no warehouse or inventory is needed. Material handling and warehousing is a key part of the entire work process in companies. Production is the main element, but incorrect warehousing and poorly implemented material handling directly affect the quality, fluidity, and the actual implementation of the production process. Errors in material handling are the most common cause of financial losses, prolongation of the entire work process, accidents at work and, last but not least, damage to the material itself. The aim of the article is to find possible innovative logistics solutions for the specific manufacturing company in the Czech Republic.

1 Theoretical Background and Methodology

Warehousing represents a continuous connection of customers with producers. Sixta and Žižka (2009) describe warehousing as the most important part of the logistics chain. The chain of warehousing activities ensures a smooth production process and warehousing costs are associated with each warehousing activity (Kučera, 2019). Warehousing addresses many critical issues, inventory levels, order cycles, warehouse equipment and spatial distribution, warehouse management distribution and inventory management (Kučera, 2017).

The modern turbulent market environment forces companies to cooperate and organize themselves into supply chains not only in logistics and transport (Chocholáč, Sommerauerová and Polák, 2018). Cempírek (2010) identifies warehousing as an essential link that is used by companies to shorten delivery times to consumers in logistics. According to Lambert, Stock and Ellram (2000) warehousing provides storage of individual items, information services, packaging, grouping, and ungrouping of items. Cempírek (2010) mentions that warehousing

is mostly done in the classic way for items that are not suitable for direct deliveries or cross-docking. Lambert, Stock and Ellram (2000) define three basic warehousing functions, which include moving items, storing items, and transferring information about stored items. Item move is a collection of several activities, which include receiving an item, storing it, assembling according to the customer's request, reloading items within cross-docking, or final shipping the requested item. According to Lambert, Stock and Ellram (2000) can be performed in the form of temporary or temporary warehousing. According to the mentioned authors, temporary warehousing of items is used only for the indispensable addition of basic items. According to the authors, time warehousing is used for items that are affected by seasonality, fluctuations in demand, speculative purchasing, or the necessary adjustment of the item. Another reason for time warehousing is the specific trade conditions, for example in the form of quantity discounts.

Logistics coordination and synchronization of material, information and financial flows have hit production and logistics companies in the conflict of sub-objectives, which are pursued by individual organizational units and are very diverse and often contradictory (Kučera and Dastych, 2018). The logistics services provided must be a source of value not only for the final customer, but for all stakeholders (Kučera, 2018).

The design of an automated warehouse centre includes the planning of automatic warehousing and removal of products on the shelves. Existing automated warehousing and retrieval mechanisms primarily use an automatically controlled vehicle or automated warehouse and retrieval mechanism to move along a picking aisle, items from fixed racks, and then warehouse and retrieve products across a conveyor belt. However, this model is expensive and inefficient when handling small bales and irregular objects (Koster, Tho and Roodbergen, 2007; Hu and Chang, 2009). Automated warehouse and retrieval systems not only save labour costs but increase security and increase efficiency. Automated warehousing and retrieval systems are therefore considered good solutions to logistics problems (Malmborg, 2001). The importance of the study and justification of the development of logistics outsourcing at the level of the state, region and companies is confirmed by both theory and practice. Thus, according to the European Business Association, most of the total cost of the turnover process is made up of warehousing, supply, and other logistics operations nowadays and in the future (Irtysheva, Stehnei and Zavhorodnij, 2018).

A case study is a qualitative research method based on the study of one or a small number of situations to apply the findings to some similar cases. The case study is briefly characterized as a detailed study of one or a small number of cases in order use the acquired knowledge to understand similar cases (Hendl, 2016).

2 Results

Good warehouse cooperation must work so that orders can be processed quickly and efficiently. It must be actionable and adapted to the customer's needs. Only in this way will companies remain competitive and flexible today. In this respect, warehouse automation has become one of the important factors of competitiveness and is therefore so indispensable for a modern company. The biggest advantage of an automatic warehouse is the transfer of all responsibility from the operators from the warehouse to the devices that ensure the warehousing of components in the warehouse. This results in a large reduction in the number of people needed to pick orders for the customer. However, the necessary investment is always so demanding for the company that it is always necessary to quantify whether the initial investment would return at all. Therefore, it is necessary to determine the exact time of operation of the warehouse per day. So that it can be proven that even with a lower load, the automatic warehouse will be at a lower cost than if the warehouse with operators were in operation. For the variant of warehouses, there would be two types of warehousing. One type would be an automatic warehouse for small components and the other would be an automatic pallet warehouse. The division into these two types is mainly from different types of components.

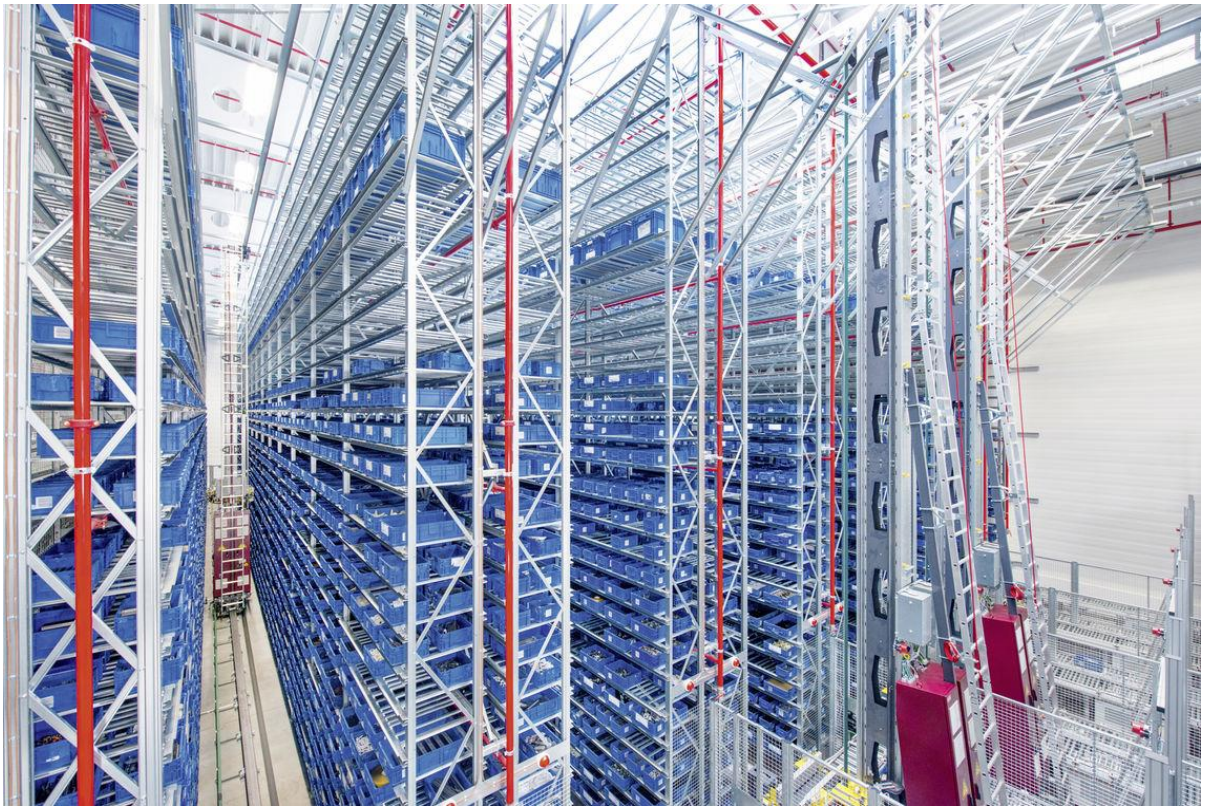
Advantages:

- cheaper to operate than manual warehousing,
- cost savings,
- reduction of working hours,
- increase of warehouse security,
- minimization of errors in picking orders,
- increase customer satisfaction,
- elimination of safety breaks.

Disadvantages:

- higher purchase price,
- planning the overall process of the automatic warehouse,
- flexibly limited adaptation compared to employees,
- find suitable programmers for the necessary adjustments,
- misuse with a small number of orders,
- efficiency decreases at low load.

Fig. 1: Automatic warehouse for small parts



Source: Authors based on Schäfer (2022)

The warehousing system should be designed for the transport and automatic warehousing of pallets with products. Pallets are strapped before entering the system. The strapped and marked pallets would be manually pushed onto the input conveyor, oriented, and automatically identified in the hopper after identification. Upon request, the selected pallets would be automatically removed from warehouse and transported to the dispensing point via a connecting tunnel. The dispensing point could then also serve as a return for the stacked empty pallets. All information about the pallets and their warehousing

in the appropriate place would be scanned using barcodes at the appropriate position on the pallet. During the design, great emphasis should be placed on the possibility of an unexpected fire. Therefore, the construction should be chosen appropriately due to the possible intervention of firefighters in the rows between the racks. The selected company also has car batteries stored in various car components. It is with car batteries that there is a possibility of unexpected ignition or unexpected chemical reaction. Figure 1 shows an example of what an automatic small parts warehouse might look like.

The automatic stacker should consist of a rail and a steel column. The steel column should be equipped with horizontal and vertical travel. The horizontal travel of the column along the supporting rail in the floor would be ensured by a servo drive via a toothed belt located along the track. Stability of horizontal movement would be ensured by a system of guide rollers. The exact position of the stacker could be sensed by an integrated actuator with zero-point control in both extreme travel limits. A suitably selected spatial scanner could then be used for free track passage. The ends of the track should be equipped with position sensors, safety switches and fixed end stops. All these specifications should then be passed on to the manufacturer or contractor, who will then implement it. Another important section would be to increase the warehousing space, i.e., both in height and width. Because keeping the existing warehousing space would not be a big reduction in overall costs.

Last but not least, the principles of Industry 4.0 are also consistently applied in the automatic warehouse. Warehousing and removal of parts from the racks should take place fully automatically, to make full use of the potential of the warehouse. Smaller parts could be delivered from there in just-in-sequence mode as needed. So, they would come to the production line in exactly the order in which they would be assembled. Automation also allows further increase in work accuracy, further acceleration of logistics processes and minimization of errors. The robots take over physically strenuous activities and thus relieve employees. Especially when working with heavy objects, any lightening of human activity is a good step forward. They will then be able to perform other tasks, such as scanning labels or moving small crates to receive and issue goods. The pre-removal method could also be an improving approach. The downtime of the handling equipment is used here to prepare for the removal operations, which will soon come next. The required items or components are moved close to the transfer point. Then the first commands can be executed very quickly due to the short path. However, this presupposes the existence of downtimes for handling equipment.

3 Discussion

An improvement in the form of an automatic warehouse would have great potential, but its financial intensity is estimated at around tens of millions of Czech crowns. Building a warehouse would mainly cripple the operation of the whole company and it would not be able to meet customer requirements. Thus, the manufacturing company supply components to produce automobiles. If there is still a way to build an automatic warehouse, another key point is to adapt it to the customer's operation. The warehouse should respond better to unusual situations compared to the operators in the warehouse. Another advantage is the work in the 24/7 mode. However, this type of operation requires the acquisition of responsible persons in order to solve technical problems that may occur during operation. So, it would certainly be an increase in technical positions as if he/she were a programmer, maintenance worker and others. Thus, the company would not only have to spend large sums of money on the warehouse but would also have to pay specially trained people to ensure the operation of the entire warehouse. Another important factor is the height of the building. Automatic warehouses are characterized by the suitability to use warehouse at higher heights than is possible with forklifts. In terms of the height of the building, this would not be a big shift. The height of the roof is around 8 meters at the highest points. Drivers now could store material at a height of 6 meters. It would therefore be only 2 meters extra, which would increase the warehousing capacity, but it would be a small overall increase. For an optimal increase in warehousing areas, the height of the warehouse would have to reach at least 12 meters. Then the possibility of announcing a tender for this project could be considered.

Conclusion

After analysing the current state of development of logistics services, it is possible to identify key directions of further research in the areas of logistics infrastructure development and outsourcing. Inventories are an integral part of almost every manufacturing company and bring with them a few advantages and disadvantages. With inventory, the company can ensure continuous production and overcome unforeseen fluctuations or failures. On the other hand, stocks weigh capital, and it is not good to have a surplus. It is therefore necessary to pay attention to stocks and manage them in some way. Proper inventory management can lead to improved business performance. The aim of the article was to find possible innovative logistics solutions for the specific manufacturing company in the Czech Republic. The article

mentioned an innovative improvement in the form of an automatic warehouse, which would have great potential, but its financial demands are estimated at tens of millions of Czech crowns, so it is necessary for the manufacturing company to consider this investment sufficiently and make the right management decision. One of the biggest advantages of an automatic warehouse is the transfer of all responsibility from the operators from the warehouse to the equipment ensuring the warehousing of components in the warehouse. Each logistics solution has its pros and cons, these were also mentioned in this article in the field of automatic warehouse for small parts.

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