CALCULATION OF LOGISTICS COSTS OF IMPLEMENTATION INNOVATIVE AUTOMATIC IDENTIFICATION SYSTEM IN THE WAREHOUSE

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Abstract

Warehousing is the main pillar of the logistic chain. In spite of its importance, issues related to inaccurate item registration, misplacement of goods, and inefficient movement of staff after warehouse remain. Each made error leads to an increase in logistics costs. More and more companies are constantly trying to implement automatic identification system in warehouse management that lead to the solution of these problems at the present time. The most applied automatic identification systems are the use of barcodes and radio frequency identification. The aim of this paper is the implementation of innovative automatic identification system in the warehouse that will lead to the reduction in human error rates when identifying items and increasing work efficiency. The paper is based on the case study, which is one of the qualitative research methods and very useful method in the scientific field. The case study will in detail present two of warehousing cases, which are processing of order for goods warehouse and processing orders for goods removal.

Key words: calculation of logistics costs, warehousing, automatic identification system

JEL Code: M11, M21

Introduction

Logistics especially warehousing is an area that plays an irreplaceable role in business in recent time. The chain of warehousing activities ensures the smooth running of the production process and warehousing costs are associated with every warehousing activity. These costs are not negligible items that largely affect the company's total profit or loss. The need to track costs in terms of warehousing activities is a prerequisite for identifying rationalization measures in warehousing activities and optimizing the company's warehousing costs.

Companies have begun to invest in new systems with continued technological advancement to boost the competitiveness of the market in which they operate. The trend

of reducing warehousing costs is to maximize the use of warehousing space, the minimum number of transfers, efficient warehouse solutions or reduce the number of warehouse stocks.

It is crucial to have enough inventory for a business, but only enough to be idle for the shortest time. Processes that do not increase their value have to be reduced at the same time. Modern companies use innovative automatic identification system in warehouses to achieve maximum warehousing efficiency.

The aim of this paper is the implementation of innovative automatic identification system in the warehouse that will lead to the reduction in human error rates when identifying items and increasing work efficiency.

1 Theoretical Background and Methodology

Logistics is primarily limited to the distribution and warehouse of finished products traditionally. This perspective has evolved towards a more holistic framework in the recent years. Logistics is seen as a link between supply and market bases including the process of strategic procurement management, movement and warehousing of materials, parts and finished products and information flow (Hansen, Hovi and Veisten, 2014). Logistics is essential to be successful in running a business as it promises to deliver to the customer. However, the fulfilment of the promise relates to additional costs (Adamczak, Domanski and Cyplik, 2018).

Warehousing and material handling systems play a key and a crucial role in the supply chain. Requirements for warehousing and handling operations have increased significantly in the recent years (Manzini, Bozer and Heragu, 2015). Proper and reasonable calculation of logistics costs of a manufacturing company will be one of the important ways to face more intense competition in the market (Zhu and Liu, 2007). Calculation of logistics costs has become a challenge in logistics and supply chain management (Bokor, 2012). It is necessary to obtain reliable and accurate information on the structure of calculations to achieve efficient resource allocation within the logistics service provider (Bokor and Markovits-Somogyi, 2015). The most general goal of allocating item in the calculation of logistics costs is to provide information about the costs that are relevant to a particular decision. Logistics costs represent significant and relevant share of business costs: depending on the used method and the industry, their share of business turnover in advanced economies is at least 10-15% (Engblom, Solakivi, Toyli and Ojala, 2012). Logistics costs are the basis of accounting for the economic evaluation of a company (Shvartsburg, Zaborowski and Cyplik, 2017). Continuous effort in logistics

system is to increase the efficiency of automated identification system. Automatic identification system has a great importance in enhancing the company's responsiveness and the associated increase in quality and costs reduction (Zajac and Kwasniowski, 2017). Automatic identification system means that during production and especially at the end of the production chain and in logistics the products or their packaging are labelled with barcode labels or direct marking on the product surface. Automatic identification can be interpreted as automatically identifying objects or elements, not only as part of logistic chain. Quality information is the basis for effective management that must come in the required quantity, at the right time and in the right place. Computer applications are used to process this information (Mojžíš, 2003). Various ways of obtaining material, semi-finished and finished product information can be obtained with the automatic identification system. The main prerequisite for implementing the logistic principle of forward flow of information before material flow is to receive correct and timely information (Daněk, 2006). The innovative automatic identification system can be defined from the logistic point of view as a system that uses passive elements when passing through a logistic chain, thus transferring related information between the individual links of the logistic chain. The passive elements include products, parts, or handling and transport units made of them, as well as means of transport such as crates, pallets, containers, etc. Active elements include means of transport and service that move passive elements, but these can also be monitored. The purchasing department aims to purchase a large amount of goods with shorter payment terms when planning the amount of feedstock because this is the easiest way to get volume discounts. This has an impact on the logistics costs especially warehousing costs due to the additional warehousing and capital costs of stocks (Škerlič, Muha and Logožar, 2016).

Logistics managers are usually interested in providing high-quality services in warehousing to their customers at a minimum costs (Kučera, 2017). Warehousing is a part of the logistics, including the conversion of the procurement, production, sales and transport. It is a trend to reduce warehousing costs and use the maximum of warehousing space, the minimum number of relocations, efficient warehousing solutions, or the reduction of stock levels (Yang, Zhang and Tang, 2016).

A real case study is a qualitative research method based on the study of one or a small number of situations for the application of findings for similar cases. The case study is briefly characterized as a detailed study of one or a small number of cases in order to apply lessons learned to understand similar cases. It contains an intensive analysis and a description of a separate unit or system bounded by time and space (Hendl, 2016).

2 Results and Discussion

Time is a fundamental priority for efficient warehousing. Warehousing time is understood as every act from the moment that the order is received to entering the last item in the internal information system. The time value is calculated at CZK 200 per hour according to the expert estimate.

Tab. 1: Time-consuming processes

Process	Average duration (minutes)
Processing of order for goods warehouse	
Finding and allocating a pallet space for warehousing 1 item including its entry in the delivery note	0.51
Opening the door after truck delivery	0.25
Moving 1 item from truck to handling area	0.86
Check 1 item based on delivery note	0.50
Create 1 item in the rack	1.65
Introducing 1 item into Microsoft Excel	0.42
Processing orders for goods removal	
Find 1 item for picking in Microsoft Excel and printing it	0.82
Picking 1 item from shelf to handling area	1.50
Check 1 item	0.16
Opening the door after truck delivery	0.25
Moving 1 item from handling area to the truck	0.95
Delete 1 item from the system	0.71

Source: Author

It is not possible to deduce from the Table 1 the total sum of the time as some of the processes are in parallel level. It takes an average of 2 hours to process an order with 33 europallets. The road truck is delivered at the entrance sectional doors within 45 minutes, including handing over the documents from this time.

2.1 Calculation of logistics costs of implementation innovative automatic identification system

The costs of implementing an innovative automatic identification system can be exactly calculated. The price for basic software is CZK 466,000 according to an expert estimate. The amount consists of a license for using the software of CZK 230,000 and its implementation costs are CZK 236,000. The implementation costs will increase by CZK 278,000 if all software extensions are applied. The maximum amount of the implementation costs

(CZK 236,000 + CZK 278,000) is used to calculate costs. Table 2 shows calculation of logistics costs of implementation innovative automatic identification system with the maximum amount.

Tab. 2: Calculation of logistics costs of implementation innovative automatic identification system

Item	Quantity (pieces)	Price per unit in CZK	Price in CZK
Software implementation (maximum amount)	1	514,000	514,000
Software license	1	230,000	230,000
Access point	11	15,000	165,000
Online terminal	1	55,000	55,000
Printer	1	60,000	60,000
Cart terminal	2	100,000	200,000
Barcode reader	2	14,800	29,600
Total costs			**1,253,600**

Source: Author

The total costs of the implementation innovative automatic identification system is CZK 1,253,600. Only the price of labels will increase the amount of the monthly costs of the total warehouse operation after the implementation innovative automatic identification system. The price depends on the number of labels taken, the type of label material used, the type of carbon tape used and the type of adhesive used. The calculation is based on internal company materials:

- Self-adhesive, paper, glossy labels using 10,000 x 100 mm regular glue cost CZK 1,654.
- Wax carbon tape with up to 5,000 labels can cost CZK 245.

The price of one self-adhesive, paper, glazed label and glue comes to CZK 0.1654 in this case and printing of one label with carbon wax tape at 0.047 CZK. The final price of one label is 0.2124 CZK. The monthly increase costs is calculated as a multiple of the average number of pallets per month warehoused and the price of one label. The average number of stacked pallets is 3,960 pieces. The resulting amount is therefore CZK 841.10.

The relatively high costs of implementation innovative automatic identification system is based on barcodes, which generally amount to CZK 1,253,600 based on the calculation. Operating monthly costs will only increase by CZK 841.10.

2.2 Evaluation of the benefit of implementation of innovative automatic identification system

Implementing an innovative automatic identification system based on barcodes will greatly reduce the error rate for each item identification activity, warehouse at the correct location, and picking for the handling area during the unloading process. The time of individual operations associated with identifying items in the current state is greatly reduced. A slight reduction in time is also expected for the start-up and picking of items through high-quality warehouse navigation. Table 3 shows the processes (marked in green) that are expected to be reduced in time, red process that increases in time, and yellow processes where time remains the same.

Tab. 3: Changes in time requirements for individual processes

Process	Average duration (minutes)
Processing of order for goods warehouse	
Finding and allocating a pallet space for warehousing 1 item	0.51
Opening the door after truck delivery	0.25
Moving 1 item from truck to handling area	0.86
Check 1 item based on delivery note and labelled	0.50
Create 1 item in the rack	1.65
Introducing 1 item into information system	0.42
Processing orders for goods removal	
Find 1 item to pick out in the information system	0.82
Picking 1 item from shelf to handling area	1.50
Check 1 item	0.16
Opening the door after truck delivery	0.25
Moving 1 item from handling area to the truck	0.95
Mark 1 items as picked	0.71

Source: Author

Table 3 shows the increase in labour efficiency, which leads to an increase in the capacity of warehouse operations per working day. There is also a probable influx of new customers, as they can expect actual reports on the movement of their own goods. According to an in-depth interview with the warehouse manager, some of the potential customers demanded some of the innovative automatic identification system. The calculation resulted in relatively high acquisition costs, but the operating costs only increase by a small amount. The implementation of innovative automatic identification system in the warehouse will lead to that error rates will be rapidly reduced, labour productivity will increase and new customers are expected to flow. The implementation of innovative automatic identification system

in the warehouse can have positive effects at the end on the time reduction (especially in warehousing activities) and increasing efficiency and continuity of the production. There is a lot of pressure to increase labor productivity and speed up production of logistics companies nowadays. The implementation of innovative automatic identification system has positive effects that are desired.

Conclusion

The aim of this paper was the implementation of innovative automatic identification system in the warehouse that leaded to a reduction in human error rates when identifying items and increasing work efficiency.

The innovative automatic identification system brings many positive impacts. The innovative automatic identification system means that the software controls all material movement; the material is identified by a barcode transmitted by the radio frequency terminal in practice. Workers minimize errors and increase productivity of the company. Warehouse processes can be monitored and evaluated at any time. The system minimizes claims to merge orders and guarantees first in first out compliance. It is necessary to monitor the synchronization of individual logistics processes, the availability of information needed for each management level, the assessment of employee work, customer feedback, and flexible action when deviating from the financial plan. It is essential that logistic information flows and provides the required management in today's competitive environment. The innovative automatic identification system can obtained this information in a timely and quality manner.

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