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The Impact of Organizational Change on the Improvement of the Picking Process in a Logistics Center – A Case Study

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Abstract:

Purpose: *The aim of the article is to determine to what extent the introduction of organizational change in the picking process will affect its efficiency and to identify factors influenced by this innovation.*
Design/Methodology/Approach: *The study will make use of quantitative tools to measure the relationship between the introduction of innovation and the duration of the picking process. The impact of introducing innovation on the order picking employee will be examined A case study was chosen as the primary research method.*
Findings*: The results of the work show that the introduced organizational change has an impact on the efficiency of the process, the reduction of operating costs and electricity consumption. The level of work comfort of employees directly involved in the picking process also increased.*
Practical Implications: *In practice finding the shortest route is extremely important during the picking process. Therefore, in warehouses, instead of complicated optimization methods, it is worth using simple solutions that are faster and easier to implement. The results of the work indicate that the introduced change has an impact on the efficiency of the process, cost of electricity consumption, and work comfort of employees who are directly related to the picking process.*
Originality/Value: *This article presents the overall impact of the implemented organizational change. The impact of the change is on the efficiency of the process, and also on the human factor and the environmental aspect.*

Keywords: *Warehousing, picking process, organizational change, efficiency, case study*.
JEL codes: *D24, O30, J20.*
Paper Type: *Case study*.

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1. Introduction

Global supply chain management is an important issue for many companies and warehousing and is a basic link between producers and customers in the supply chain (Kudelska and Niedbał, 2020). It buffers production operations to manage variable customer demands (Bowersox *et al.,* 2002; Kim *et al.,* 2017). According to Bartholdi and Hackman (2016), human work accounts for about half of all non-automated warehouse operations. De Koster *et al.* (2007) report that in 80% of all warehouses, human work still constitutes about 60% of total labour costs.

Warehouses face challenges in responding faster to customer orders. This type of challenges requires more flexibility and thus increases the importance of order picking strategies. The decision to introduce organizational changes in the area of picking may be made on the basis of the results of computer simulations, but it may also be the result of comments submitted by employees or ongoing observations of this process.

2. Literature Peview

Researchers mainly focus on warehouse design and warehouse process improvements - primarily in terms of optimizing picking routes and methods of arranging goods in the warehouse - in order to pick them faster (De Koster *et al.,* 2007; Gu *et al.,* 2010; Gong and De Koster, 2011; Bartholdi and Hackman, 2016). In their research, Rouwenhorst *et al.* (2000) found that aspects such as warehouse efficiency, environmental and ergonomic issues are necessary but at the same time difficult to estimate. Grosse, Glock and Neumann (2017) showed in their analysis of the literature that a large part of research concerns the development of mathematical models and simulation methods using test data.

Various planning approaches are developed to increase the efficiency of manual order picking. Planning, first and foremost, aims to reduce time needed to fulfill a single order by properly configuring the picking route (De Koster *et al.,* 2007). The developed methods determine the order in which the warehouse employee picks products from rack shelves. In most cases, Return and S-shape strategies are discussed (Petersen and Aase, 2004; Theyset *et al.,* 2010). Other issues discussed include problems related to searching in a variable set of locations considering payment dates - to minimize the total delay of a given range of customer orders (Henn, 2015).

Some previous studies focus on the importance of human factors to in improving the efficiency of the entire system (Grosse *et al.,* 2015; Larco *et al.,* 2017; Kudelska and Pawłowski, 2018). The papers highlight not only physical fatigue experienced by warehouse workers, but also mental fatigue. Both of these factors can influence the efficiency of the process (Konz, 1998; Rose *et al.,* 2014). This fatigue is mainly caused by the necessity to transport objects from one place to another and the

necessity to reach and carry objects of various weights and sizes (Calzavara *et al.*, 2018). Physical fatigue can be affected not only by the activity performed, but also by the way in which it is performed. The researchers point out to the use of a devices. Vujica Herzog, Buchmeister, Beharic and Gajšek (2018) show the negative effects of using smart glasses during the picking activity in the warehouse.

Dewa, Vanany, and Pujawan (2017) emphasize that warehouse operations rely heavily on manual labour - hence people play a key role. In their opinion, the elimination of human error is very important for the efficiency of warehouse operations (improved reliability and speed). To this end, they developed a warehouse operations improvement model using QFD (Quality Function Deployment) logic that can help managers to systematically improve warehouse performance.

In the opinion of Zhao *et al.* (2019), also a human factor is very important in warehouse functioning - especially in picking processes. Despite rapid technological development, manual picking is indispensable. In manual order picking systems, employee fatigue and workload can have a big impact on picking times and picking error rates. A large amount of human work related to order picking turns this activity into a time-consuming and costly stage in warehouse operations (Elbert *et al.*, 2017). At the same time, there is empirical evidence that order pickers tend to deviate from optimal routes, which jeopardizes the effectiveness of various methods of planning picking routes for employees and putting them into practice.

The basic measure for assessing warehouse efficiency is the average order picking time (Tarczyński and Jakubiak, 2017). There are five basic groups of factors that affect picking times (Yu and De Koster, 2009), layout of the warehouse (i.e., the number and length of aisles, the number of transverse passages), storage location assignment, order routing, zoning, order batching.

In summary some studies concern the impact of implemented changes on the efficiency and effectiveness of the warehouse process, and recent years have also seen the impact of change on a human factor. Research shows not only the influence of technological changes but also the influence of organizational changes on the aforementioned factors. They are implemented using case studies as well as simulation models. However, realizing the importance of the warehouse process, and in particular the picking process, it is difficult to find publications regarding the impact of improvement on all factors, treating them as a whole.

3. Aim and Scope of Study

The efficiency of the warehouse whose functioning relates to activities such as the arrangement of goods and order picking can be affected by a range of variables. They are mainly: distance to be covered, employees' experience, order in which goods are picked. However, changes that may be introduced in the company through organizational changes may increase the efficiency of workplaces and the entire

warehouse system. The aim of the article is to fill the gap in the existing literature related to the identification of factors affected by the implemented change. The following research questions are stated:

RQ 1: Will the introduction of organizational change in the order picking method reduce the time of collecting goods in the service and logistics centre/company warehouse and, as a result, shorten the picking time?
RQ 2: What is the impact of the introduced change in the organization of order picking on employees?

The research results presented in this paper, obtained as part of the analyzed case study, constitute a contribution to the literature related to the implementation of organizational changes in warehouse processes connected with refining and improving the picking process. The article consists of five sections. Section 2 describes the research methodology used. Section 3 characterizes the picking process before and after introducing organizational change in the analyzed logistics centre/company warehouse. Section 4 presents the results/effects of the introduced organizational change as well as features a discussion of the research results. Section 5 summarizes the study and provides suggestions for further research.

4. Research Methodology

The study applied quantitative tools to measure the relationship between the introduction of change and the duration of the picking process. The impact of introducing change on the order picking employee was examined using a qualitative interview and an observation method. The observation method was continuous and included a timing technique. The interview was standardized with the use of a questionnaire and was conducted before and after the implementation of organizational change in the picking process.

A case study was chosen as the primary research method. This method allows for a better understanding of the analyzed issues, occurring phenomena, and the behaviors and reactions of people participating in them. To analyze the impact of organizational change on the efficiency and comfort of human work, a company operating in Poland was selected. The authors' experience in working with companies that provide logistics services shows that they are flexible and proactive in the context of introducing innovations. This approach applies in particular to the functioning of warehouses that operate in the e-commerce industry. The research was carried out in a company providing contract logistics services for a client in the electronics industry. Two types of time were measured in the study:

- time related to the flow of goods, and consisting of the activities: picking goods from the place of storage, transport, putting away the full pallet and taking a new pallet for the same order,

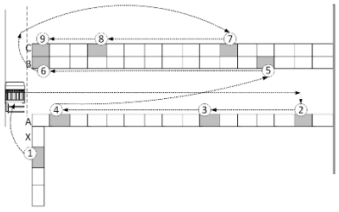
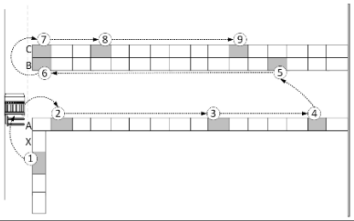
– time related to the information flow in the picking process: printing documents, logging into the barcode terminal, etc.

During the study, the distance between particular places of storing goods was measured.

5. Characteristics of the Picking Process and the Introduced Organizational Change

In the tested facility, loads are placed in standard racks. Due to the height of the racks, employees who pick the order must use side high lift stackers to pick an item from the pallet or to pick the entire pallet. In the warehouse, various orders are handled, from full pallets of one product to goods in piece quantities sent in collective cartons. They are placed on pallet-type unit loads with standard dimensions. The analyzed area handles full-carton products and they are subject to the picking process. Table 1 shows the picking process before changes and after change.

Table 1. *The picking process before and after change.*

Before change	
After making the change	

Source: *Own elaboration*

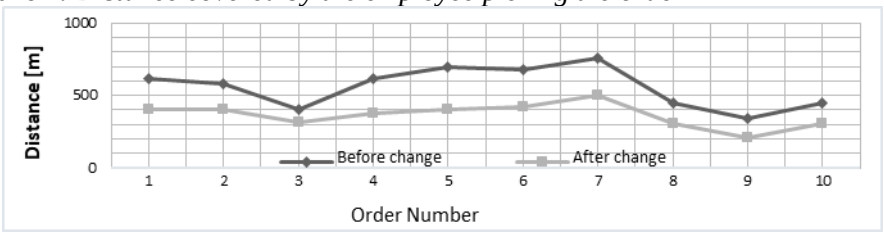
The product picking strategy started with picking goods from visited storage places in rack X, then rack A. The employee started picking goods from the farthest point from the beginning of the rack. In table 1 on the first row, these are individual numbers in rack A, i.e., the picking process started from location 2, then 3 and 4. Then, the employee was directed to rack B, where picking was started again in the same sequence, i.e., from the farthest point of the order. Goods were picked in a similar manner in every aisle. When the warehouse employee finished picking from the first level, he was again directed to rack A to pick goods simultaneously from the second to the fifth level using the same strategy, i.e., in each rack in descending order. At the very end, the completed pallet was set aside (transported) for quality control before the loading process.

As a result of the observations, a change in the way of collecting the goods was implemented. The employee visits rack X first, then rack A - but this time starting in ascending order. In Table 1 it is the second row and the entire picking process is marked with numbers. After the goods have been picked from the rack, he moves to the opposite rack - in this case, rack B, where he starts picking goods in ascending order. In this way, a "U"-shaped picking route in the aisle is created. The picking path is organized in the same manner in each aisle. After collecting all the goods from racks followed by the consolidation phase, and finally, the pallet is left for quality control.

6. Effects of the Introduced Change - Discussion

The analysis covered 10 orders characterized by as many locations visited as possible. In total, 228 different points were visited. The employee completed 13 pallets, having 1084 cartons at his disposal and 116 SKUs. Figure 1 shows the distance covered before and after the introduction of organizational change in the picking process. The differences are visible on each order, and their sum amounts to approximately 1.9 km of saved distance for the warehouse employee. The shortening of the picking route distance is approximately 35% compared to the original situation. The shortening the picking route will also reduce the picking time, which will consequently increase efficiency.

Figure 1. *Distance covered by the employee picking the order*



Source: *Own elaboration.*

The warehouse works in two shifts, with two employees responsible for this area in each shift. In the facility, loads may be picked (put aside) using a means of transport. Sometimes, however, it requires additional human involvement. An important aspect in the analysis of the time of the picking process is also the factor of estimating the travel time of the forklift. They are variable factors that affect speed fluctuations and increase time. These factors were identified by practical observations and classified in three groups, as follows: human factors, mechanical factors, operational factors.

For this reason, an average speed of the means of transport was adopted in further considerations. The employee needed 55 minutes and 51 seconds to pick 10 orders before shifting to transport only. After the implementation of the change, the duration was 36 minutes and 3 seconds, which means it decreased by about 35%. In the studies by Lu, McFarlane, Giannikas, and Zhang (2016), which used a dynamic

algorithm, the picking time was reduced along with decreasing the size of the picking device – the picker. It should be noted, however, that although the study was carried out on data from the company, the solution itself was not implemented. Moreover, the reduction of time after the introduction of organizational change in the company did not result in a loss in the number of orders picked, which is a positive aspect for the company.

For the aforementioned orders is approximately 19 minutes and 48 seconds. The average transport time before the change was 5 minutes and 35 seconds, while after the implementation of innovation it was 3 minutes and 36 seconds. In the studies by Pan, Wu, and Chang (2014), the element subject to optimization was also the picker's travel time in the warehouse for various routing and storage methods. The differences indicated by them between the analytically predicted values and the simulation results they amounted to approximately 5.62%. In the analyzed case, before and after the change, the difference in transport time is also small.

However, the researchers used simulation for the study and relied on randomly generated data, thus presenting a model for estimating the travel time. In the case of the data analyzed in this article, they come from real environment and organizational change was introduced. When picking is supported by some means of transport, additionally to the travel time, there is also time spent on turns, etc. Time necessary to carry out other activities during picking (scanning, logging into the IT system, etc.) is also important. The total time of the entire picking process decreased, which is shown in Figure 2.

Figure 2. *Order picking time*

Source: *Own elaboration.*

Before the change, to complete the entire pallet the employee needed approximately 17 minutes. After the implementation of the change, the picking time decreased by about 35% and is now on average about 11 minutes. Therefore, answering the research question RQ1, the introduced change had a positive effect on the picking time.

According to the International Energy Outlook 2019 (2019), there is an increase in electricity consumption in industry, and energy-intensive activities - such as picking - require to be more thoroughly analyzed. Since the company uses high-bay transport equipment, the study also covered the amount of energy consumed. The battery capacity in the warehouse truck is 465 Ah. The annual energy consumption for charging the battery before the change was 10,091.52 kWh.

After the implementation of organizational change in the picking process, this value is 6,722.78 kWh. As a result, it allowed to reduce the costs of electricity by approximately 34% and currently amounts to PLN 3,697.53 / year. Thus, reducing energy consumption also leads to significant environmental benefits. A significant amount of energy needed, for example, for heating or cooling surfaces, lighting, and also for transport equipment, accounts for about 20% of the total logistics costs in warehouses (Carli *et al.,* 2020). Warehouses consume huge amounts of resources. Therefore, processes should be reorganized to become more environmentally friendly and at the same time efficient and economical. Hence, responsible resource management is also pivotal to fulfill the Goal 12 UN SDG (Golińska-Dawson *et al.*, 2021).

The results of introduced change are usually evaluated in two dimensions, technological and economic. Including a human factor in the implementation of innovative solutions is also important. In connection with the above, a survey consisting of an interview with employees was also conducted. It included questions about physical stress and comfort before and after the implementation of organizational change.

The employees unanimously indicated that their comfort and mental stress had improved. They do not have to cover the same distance again and again, which may be associated with a lower level of weariness in performing repetitive activities. The change in the order picking route also increased the number of visits to locations to collect SKUs. Before the change, the employee needed about 56 minutes to visit 228 different locations. After the change it takes about 36 minutes. Employees work 8 hours in one shift with a 20-minute break. Thus, during one shift, employees could visit 1,812 different places on average. After the implementation of the change related to the employee's route during picking, the average number of locations increased by about 35% throughout the shift and now amounts to an average of approximately 2,808 locations. By analyzing these data, employees can visit more places to pick a given item in order to complete the order. This means that their chances of receiving additional remuneration for completing more orders are increased.

Therefore, answering the research question RQ2 the implemented change in the organization of the picking process has a positive impact on employees. Being motivated for higher salary, on the one hand, the employee will want to do more, but on the other hand, is forced to remember about the procedure, safety and quality,

which may be associated with increased stress levels. The authors' doubts could be dispelled by carrying out detailed research on a larger sample. The implemented organizational change has an impact on several factors that are summarized in Table 2.

Table 2. *The impact of introducing organizational change on the picking process*

Factor influenced by change	The impact of the introduced change + has an impact - has no impact	Commentary
Picking employee	-/+	
Picking time	+	Picking time decreased
Number of locations visited for collection	+	The number of places visited increased
Annual energy consumption for battery charging	+	It decreased
Annual electricity costs	+	Costs decreased

Source: *Own elaboration.*

7. Summary

The paper presents problem of improving the picking process in the warehouse by introducing organizational change. From the practical point of view, finding the shortest route is extremely important during the picking process. Thus, in warehouses, instead of complicated optimization methods, it is worth using simple solutions that are faster and easier to implement. The article examines the impact of organizational change on the efficiency of the picking process. The results indicate that the introduced change has an impact on the efficiency of the process, cost of electricity consumption, and work comfort of employees who are directly related to the picking process.

The conducted research indicates the need to identify factors in a human aspect, which are influenced by the introduction of organizational innovation. Taking into account the above-mentioned factors in the industrial context allows for better "fine-tuning" of organizational changes - not only in terms of increasing the efficiency of the warehouse process, but also adapting these changes to employees in the company. Another important aspect affected by the change is the reduction of electricity consumption. The energy consumption associated with the increasing use of electric trucks is important both from the economic and environmental points of view.

Therefore, when introducing organizational innovations, one should also pay attention to these aspects. Energy management in warehouses plays a vital role in determining the strategies of companies that aim to be more efficient in terms of their process efficiency, competitiveness, and sustainability.

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