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TRADE OF RETURN PACKAGING IN THE PROCESS OF DELIVERY OF RAW MATERIALS ON THE EXAMPLE OF KICO-POLSKA SP. Z O.O.

Tomasz Legiędź
University of Zielona Góra, Institute of Management and Quality Sciences, Department of Logistics and Information Systems, ul. Podgórna 50, 65-246 Zielona Góra, Poland, EU, tomek.legiedz2@wp.pl
Katarzyna Huk
University of Zielona Góra, Institute of Management and Quality Sciences, Department of Logistics and Information Systems, ul. Podgórna 50, 65-246 Zielona Góra, Poland, EU, ORCID 0000-0002-4476-6062, k.huk@wez.uz.zgora.pl (corresponding author)

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Abstract: An effective enterprise means correctly implemented processes. Today, logistics plays an important role in the company, and it influences the processes carried out in production companies, ensuring the implementation of its most important function - production. The article analyses the processes of trading in returnable packaging. The optimisation of these activities was carried out on the basis of a program for simulating logistics processes. The main purpose of the article is to identify the impact of the processes of material delivery and packaging turnover on the functioning of a production company. The article is based on a case study of a manufacturing company. In the discussed case, the FlexSim program was used to simulate logistic processes. The situation presented in the article allows to shorten the time and reduce costs that were necessary for the accepted materials to be made available for processing by introducing returnable packaging, adapted to be transferred directly to production. Suppliers providing them with materials will allow you to bypass the unnecessary process. Such activities also result in the circulation of returnable packaging.

1 Introduction

Comprehensive cooperation with suppliers is a very important aspect of management. Thanks to such cooperation, aimed at minimising costs and reducing the time necessary to carry out the processes, it is possible to achieve measurable benefits. To obtain such results, it is necessary to identify the sites where suboptimal activities are taking place that have a negative impact. The supply system, the element of which is the process of supplying materials, is a pillar that ensures the continuity of the production company. Depending on the characteristics of the materials and the conditions agreed with the suppliers, they are delivered in various packages. However, these processes are not always optimal. This introduces the need to carry out an additional repackaging process, which generates additional costs and increases the time needed to prepare materials for production. Their elimination and introduction of changes in this area require detailed analyses and simulations.

The continuity of effective work of a production company requires effective management of material flows. The necessary raw materials, elements or semi-finished products, most often purchased through trade, are most often delivered in containers. They are designed to ensure safety in transport, but not always their physical characteristics enable the most optimal storage. You may need to repack them. Unfortunately, this is an additional process that slows down the flow of materials. Repackaging can be solved by carrying out such a process directly at the manufacturers. However, the introduction of such a solution requires the implementation of returnable packaging turnover.

Companies want to eliminate such unfavourable processes as repackaging. For their analysis, programs allowing for their modelling and simulation are used. This allows for efficient decision making.

The main purpose of the article is to identify the impact of the processes of material delivery and packaging turnover on the functioning of a production company. The article was based on an analysis of the literature on the subject, a case study and the simulation method using the FlexSim program. The case study was based on a manufacturing company operating in the automotive industry.

Optimal supply chain management is very important to gain a competitive advantage. This is possible thanks to the effective cooperation of all partners in the supply chain. Connecting all its participants leads to a phenomenon in which the effective operation of the last link, and so to satisfy its needs, also has a positive effect on the others. All companies involved in the supply chain should show the greatest commitment because, in the event of ineffective operation of one of the links, this may disrupt the operation of the entire system, leading to financial and image losses and even loss of market position. The supply chain itself can be defined as "mining, production, trade and service companies cooperating in various areas and their clients, between which stream of products, information and financial resources flow" [1].

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The concept of supply chain management began to appear in the literature on the subject only in the 1980s. In the literature on the subject, you can find a definition that it is "the process of planning, implementing and controlling the efficient and economically effective flow and storage of raw materials, work-in-progress inventories, finished products and related services, and relevant information from the place of origin to the place of consumption (including transport to and from the organisation inside and outside the organisation) in order to satisfy customers' requirements" [2]. Due to the close links between the entities in the chain, the relations between them become important. In order to achieve a competitive advantage, it is essential that all companies work together transparently to meet customer demand. Ewa Kulińska notes that "supply chain management is always burdened with some risk because in such a complex structure you can often come across events and phenomena bearing the hallmarks of randomness, which cannot be fully foreseen due to the unknown reasons for their occurrence." [3].

The material delivery process is part of the supply logistics, which is part of the entire logistics system of the company. Its mission is to organise the flow of materials, so it includes "activities related to the flow of materials from the warehouses where they were stored to the production hall, and more specifically to the first production station where these materials will be used." [4]. Effective planning is essential for the successful management of delivery processes, which should "be based primarily on enhancing cooperation. The cooperation reaches such a level that suppliers become team members, providing professional assistance in the development phase of new products and models." [5]

"The process of supply connects participants in the supply chain and ensures the desired quality created by suppliers in this chain. The quality of materials and services' entering' the system affects the quality of 'outgoing', and therefore customer satisfaction and the company's income" [2]. It is worth noting that "when choosing the right procurement strategy, it is necessary to analyse the position of the company and its freedom as well as the possibilities of operating on individual markets. Diverse operating options require different behaviours in terms of selecting a sourcing strategy." [6]

Analysing the literature, it can be concluded that supply logistics is responsible for enabling production continuity. The availability of the materials needed for production is necessary for the production to function. "The physical flow of products in the economy is often conditioned by the use of appropriate packaging" [7]. Depending on the contract with suppliers and the physical characteristics of the materials, they are delivered in various types of packaging. "Since the first organised by the business people, the choice of packaging was an important decision, affecting among other things, on the profitability of the company's activities." [8] "The role of packaging in the flow of materials and products along the supply chain is unquestionable. Commercial packaging, but also collective packaging, including pallets and various types of containers and containers, rotation packaging and used packaging (disposable or damaged as waste) fit into the area of interest of ecology and green supply chain" [9]. Due to the fact that their main task is to protect the load during transport and storage, they are not always optimal for making them available directly for production. One of their characteristic types is returnable packaging, which requires the packaging to be marketed. It is part of reverse logistics, which is described as "the application of a logistics concept to residues to thereby result in an economically and ecologically efficient residual flow, with simultaneous spatio-temporal transformation, including change in quantity and species." [10]. One of the elements that can be distinguished in reverse logistics is packaging turnover [11]. This is undoubtedly a reverse flow in the supply chain, where after delivering products to the supply chain partners, returnable packaging circulates between them.

Logistics tools give us many opportunities to improve logistics processes [13-14]. One of them are simulations of logistics and production processes, which are becoming more and more popular nowadays [15]. The development of technology gives the opportunity for the development of Industry 4.0. It is in line with this idea that the automation of production and logistics is created. This is possible thanks to new technological solutions, IT, knowledge and innovation, as well as the possibility of process simulation. The latter undoubtedly affect the success of the applied solutions and the possibility of their prior checking and adaptation to the organisation's capabilities prior to their physical implementation in the enterprise [16-19]. However, it should be noted that any development in this industry should be in line with sustainable development [20-22]. This is one of the ideas that should build a new form of industry operation - Industry 4.0.

2 Management of returnable packaging in KICO-Polska sp. z o. o.

The process of accepting materials, discussed later in the article, was presented on the basis of KICO-Polska Sp. z o.o. Established in 2005, the company is located in Świebodzin. It is a company that specialises in the production of articles that require assembly. Since 2015, it has been part of the KICO Kunststofftechnik GmbH group having four factories on two countries. Since then, he has also specialised in the plastics processing sector. For many years, the company has been responding to growing customer requirements and quality requirements, which allowed for establishing cooperation with many commercial vehicle manufacturers and system suppliers. The company operates in the automotive sector, which is one of the most developing industries. Effective operation in its scope requires not only constant investments in the latest technologies, but also the constant implementation of more and more optimised solutions in the field of logistics management. It is even more important when the company effectively implements one-day production schedules and uses the 'Just in time' philosophy. This means that production is only planned for the next day ahead. The efficient functioning of the supply system is therefore crucial to maintaining the continuity of production. Enterprises shall take comprehensive measures aimed at effective management of supply processes. After the production schedules are drawn up, KICO immediately reports its need to the suppliers. It is worth paying attention to the importance of communication in these processes. In the event of any communication disruptions, the delivery of materials may not proceed properly. Deliveries go to the supply warehouse. There, they are collected by the entrance logistics department. Each delivery is verified with the attached and required documentation. These processes include quantitative and qualitative control. Pallets with materials are sent to a designated zone, where they will be waiting for further development in a high-bay warehouse. Materials for the enterprise are usually delivered in metal containers (Figure 1) and in cardboard boxes secured with GITTERBOX packages (Figure 2).

Figure 1 Metal container for materials

Figure 2 GITTERBOX packaging securing large cardboard boxes with materials

The delivery of materials from the supply warehouse to the production hall, however, becomes problematic as the bulk containers in which they are delivered are not optimal to be located directly in the production hall. They are large and unwieldy, which makes it difficult for employees to further process materials. The KICO- Polska Sp. z o.o. company therefore uses the processes of repackaging the delivered materials into smaller plastic containers. Currently, RL-KLT 3215 (Fig. 3) / RL-KLT 4315 / RL-KLT 4329 / RL-KLT 6429 packages are used in the internal circulation. Later in the article they will be called "returnable packages" due to their circulation in the chain supply.

Figure 3 Container RL-KLT 3215 with dimensions of 297x198x147.5 mm

3 Methodology and results

A repackaging area is a place that generates a suboptimal repackaging process that slows down the flow of materials. The solution introduced by the company is repackaging at one of the three main suppliers. To analyse the effectiveness of the new system, it is necessary to perform simulations before and after the planned changes. In the discussed case, the repackaging process before and after its change was presented using FlexSim. The solution is new tools adapted to many areas of transport, including those that reduce the negative impact on the environment [12].

3.1 Simulation of the current process of product delivery and repackaging into appropriate returnable packaging – before the changes

Determining the initial data is necessary to perform the simulation. The repackaging zone works in a three-shift system and leaves it daily on average from 1,500 - 2,300 containers with repackaged materials. In order to present the maximum efficiency of the zone and for its analysis, the upper limit of this range was adopted. The repackaging area has 3 workstations and a total of eight employees. Two shifts work using all positions, while the third shift has two employees. This means that the duty of eight employees to obtain the baseline in the number of materials repackaged to 2300 containers (returnable packaging) - this gives 287.5 per container. After rounding, the number 288 was assumed. Taking into account the employees' break and preparation of the position before taking action - 7.5 hours of permanent work at the workplace were assumed. This means that the worker needs, after rounding, a maximum of 93 seconds to produce one repackaged container.

Summary of the output data:

- expected maximum efficiency of the repackaging area - 2300 repackaged returnable packages,
- expected efficiency of one employee - 288 repackaged returnable packaging,
- the maximum time to obtain one repackaged returnable packaging - 93 seconds.

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Having such data, it should be proceed to the preparation of an appropriate model in FlexSim, which will allow you to visualise the current work of the repackaging zone, both during shifts of three and two people. The figure below (Figure 4) shows a schematic of the process.

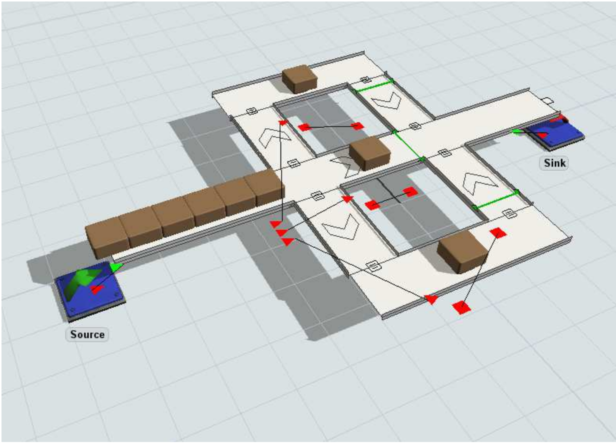

Figure 4 A model analysing the work of the repackaging zone with the active participation of three workstations

It is important to avoid unnecessary complications in the operation of the simulation. After the model was developed, all data necessary for the analysis were used. The boxes are characterised by returnable packaging that must be filled at workstations. As planned, the source was programmed to release 864 of them. The duration of the process at each station has been set at 93 seconds. It includes both the preparation of the employee to start repacking and its implementation (filling the packaging with materials). After a correctly configured model, you should start analysing the obtained results. The assumption was to present the maximum efficiency of the zone. Therefore the expected results will indicate the maximum use of human resources. This will make it possible to refer to and compare loads of specific stations after introducing changes consisting in reducing the number of materials required for repackaging, and thus also the requirements for the stations, as shown in the following data (Figure 5).

Dashboard

Throughput

Object	Input
Workplace 1	288
Workplace 2	288
Workplace 3	288

Figure 5 Three-person shift capacity, number of packages repackaged

To analyse the effects of a shift in which only two workstations are working, the same model should be used, excluding one of the paths for the process and reducing the number of multipacks generated by the source to 576 (see Figure 6).

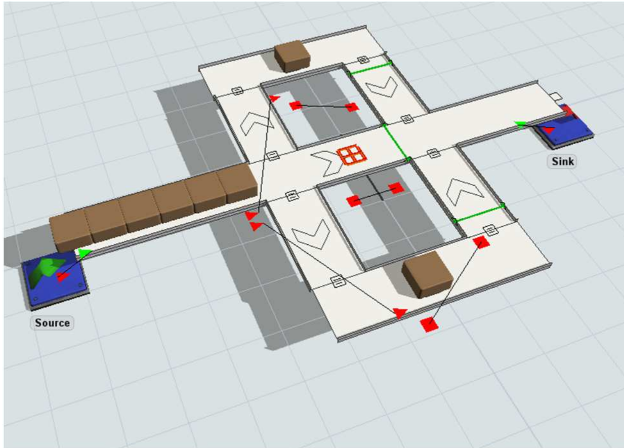

Figure 6 A model analysing the work of the repackaging zone with the active participation of two workstations

As in the case of the simulation with three workstations, we expect their maximum effectiveness to be presented. This will allow you to refer to and compare the workloads of specific positions once changes are made. The changes consisted in reducing the number of materials required to repackage and thus also the requirements for the stations (see Figure 7).

Dashboard

Throughput

Object	Input
Workplace 1	288
Workplace 2	0
Workplace 3	288

Figure 7 Two-person shift capacity, number of packages repackaged

The data obtained from the simulation system are presented in the table below. The table will be used to compare the performance of all workstations after the changes have been made (Table 1).

Table 1 shows the effectiveness of workstations during shifts in the three-person and two-person composition. The company works in a three-shift system, consisting of two shifts with three and one with two employees.

Table 1 Analysis of the effectiveness of repackaging products – situation before the changes

Work efficiency of a three-person shift					
Workstation	**Maximum possible effectiveness of the position**	**Number of repackaged containers obtained**	**Efficiency of the position**	**Effective working time of the position**	**Time of inactivity of the station**
Position 1	288	288	100%	7 hours 26 minutes	4 minutes
Position 2	288	288	100%	7 hours 26 minutes	4 minutes
Position 3	288	288	100%	7 hours 26 minutes	4 minutes
TOTALITY	**864**	**864**	**100%**	-	-
Work efficiency of two-person shifts					
Workstation	**Maximum possible effectiveness of the position**	**Number of repackaged containers obtained**	**Efficiency of the position**	**Effective working time of the position**	**Time of inactivity of the station**
Position 1	288	288	100%	7 hours 26 minutes	4 minutes
Position 2	-	-	-	-	-
Position 3	288	288	100%	7 hours 26 minutes	4 minutes
TOTALITY	**576**	**576**	**100%**	-	-

3.2 Simulation of a new process of product delivery and repackaging in the right returnable packaging without unemployment reduction – after changes

The company cooperates with one of the three main suppliers to implement the project, which will consist of the process of repackaging the materials at the manufacturers. Delivers from this company averages 30 - 40 metal containers with materials per day. Each of these containers is 22 filled returnable packages. This means that assuming an upper limit of 40 metal containers will reduce the required daily capacity of the repackaging zone by 880, which will now be 1420. Currently, eight employees are working on repackaging, which means that the efficiency of one employee will be reduced to 177.5 full returnable packagings. So the number of 178 packages per person was assumed. The time needed to complete the process must remain the same as the process itself remains the same, allowing us to observe changes in the burden on human resources. The model source will now generate 534 fill bags for a three-person shift and 356 for a two-person shift.

Summary of the output data:

- expected maximum efficiency of the repackaging area – 1420 repackaged returnable packages,
- expected efficiency of one employee - 178 repackaged returnable packaging,
- the maximum time to obtain one repackaged returnable packaging - 93 seconds.

We use a previously created model to carry out the research. Thanks to the statistics (Figure 8 and Figure 9) obtained, it will be possible to create an analogous table (Table 2).

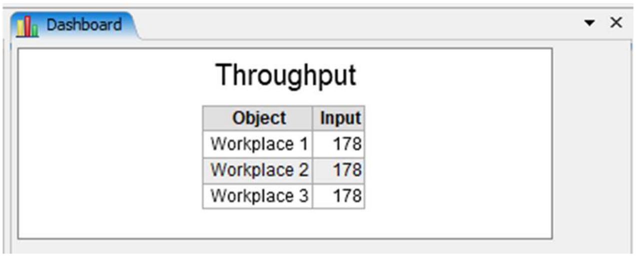

Figure 8 Efficiency of a three-person shift after implementing the project, number of packages repackaged

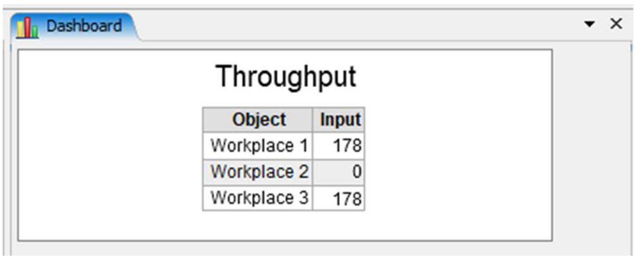

Figure 9 Efficiency of a two-person shift after the implementation of the project, number of packages repackaged

Table 2 Analysis of the effectiveness of repackaging products – situation after the changes

Work efficiency of a three-person shift					
Workstation	**Maximum possible effectiveness of the position**	**Number of repackaged containers obtained**	**Efficiency of the position**	**Effective working time of the position**	**Time of inactivity of the station**
Position 1	288	178	62%	4 hours 36 minutes	2 hours 54 minutes
Position 2	288	178	62%	4 hours 36 minutes	2 hours 54 minutes
Position 3	288	178	62%	4 hours 36 minutes	2 hours 54 minutes
TOTALITY	**864**	**534**	**62%**	**-**	**-**
Work efficiency of two-person shifts					
Workstation	**Maximum possible effectiveness of the position**	**Number of repackaged containers obtained**	**Efficiency of the position**	**Effective working time of the position**	**Time of inactivity of the station**
Position 1	288	178	62%	4 hours 36 minutes	2 hours 54 minutes
Position 2	-	-	-	-	-
Position 3	288	178	62%	4 hours 36 minutes	2 hours 54 minutes
TOTALITY	**576**	**356**	**62%**	**-**	**-**

After changing the data in the model, can be observed drastic changes in the efficiency of workstations. When the project is implemented, the human resources of the repackaging area will be only 62% effective. It also means that assuming that employees maintain the maximum pace of work, they will not be assigned any tasks for nearly 40% of working time. Therefore, immediate action should be taken for the reduction of unnecessary workplaces. Therefore, immediate action should be taken to reduce redundant jobs. After making a simple calculation consisting in multiplying the number of inefficiently used human resources (38%) by the number of all employees (8), the result is 3.04. Rounding this number down to 3 we get the number of jobs to be reduced. Employees will therefore be able to be transferred to other departments that also require support and would need more staff in the future. Reducing three jobs can bring considerable financial savings in the long term. The company cannot afford to reduce the entire shift because the repackaging processes must be ongoing and respond to production demand. This means that the reduction of employees on each shift must be even.

Table 3 Number of jobs before and after the change (after project implementation)

Shift	**Number of employees before the implementation of the project**	**Number of employees after the implementation of the project**
Shift 1	3	2
Shift 2	3	2
Shift 3	2	1

In order to confirm the expected effects after the reduction of employees, the last analysis in the FlexSim program should be carried out.

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3.3 Simulate the new process of delivering products and repacking them into the correct returnable packaging with a reduction in employment – after the changes with reduction of jobs

The previously created model will be used to perform the simulation. This time, however, only solutions with the use of two or one workstations should be considered. Currently, the entire repackaging area will have five employees. This means that with a requirement of 1420 repackaged returnable packaging, this equates to 284 per person. The time needed to obtain one repackaged package remains the same.

Summary of the output data:

- expected maximum efficiency of the repackaging area - 1420 repackaged returnable packages,
- expected efficiency of one employee - 284 repackaged returnable packaging,
- the maximum time to obtain one repackaged returnable packaging - 93 seconds.

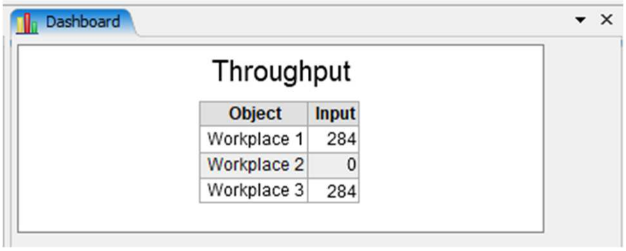

Figure 10 Efficiency of a two-person shift after the reorganisation of work, number of packages repackaged

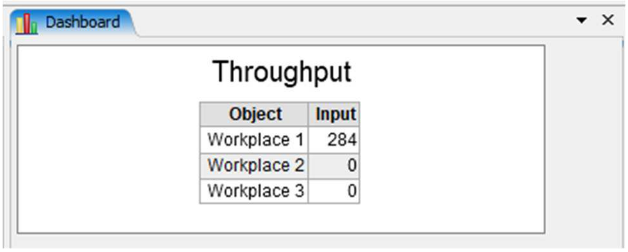

Figure 11 Efficiency of a one-person shift after the reorganisation of work, number of packages repackaged

Then, for the last time, we prepare a table (Table 4) aimed at presenting the effectiveness of the use of workstations.

Table 4 Analysis of the effectiveness of repackaging products – situation after the changes with reduction of employees

Work efficiency of a three-person shift					
Workstation	**Maximum possible effectiveness of the position**	**Number of repackaged containers obtained**	**Efficiency of the position**	**Effective working time of the position**	**Time of inactivity of the station**
Position 1	288	284	99%	7 hours 20 minutes	10 minutes
Position 2	288	284	99%	7 hours 20 minutes	10 minutes
Position 3	-	-	-	-	-
TOTALITY	**576**	**568**	**99%**	-	-
Work efficiency of two-person shifts					
Workstation	**Maximum possible effectiveness of the position**	**Number of repackaged containers obtained**	**Efficiency of the position**	**Effective working time of the position**	**Time of inactivity of the station**
Position 1	288	284	99%	7 hours 20 minutes	10 minutes
Position 2	-	-	-	-	-
Position 3	-	-	-	-	-
TOTALITY	**288**	**284**	**99%**	-	-

The obtained results show that the reorganisation of changes in the repackaging area is necessary after the implementation of the project. This will maintain maximum efficiency positions. Repackaging nearly 40% of the metal containers for returnable packaging at one of the main suppliers, and bypassing this sub-process at

KICO- Polska Sp. z o.o., resulted in a reduction of three jobs, which will bring financial savings in the long term. It is worth noting, however, that the implementation of the project also involves the implementation of returnable packaging marketing in supply chain management.

4 Discussion

A suboptimal process has been identified in the company that negatively affects the entire system. It is repackaging materials collected from suppliers from metal containers to returnable packaging. Implementation of a project to carry out part of the repackaging at one of the three main suppliers requires the introduction of the returnable packaging. However, this introduces many new challenges to supply chain management. The solution itself allows to improve the whole system, but it is also demanding. Rotation of returnable packaging means putting them into permanent circulation. This means that they must also have the material manufacturer and, in some variants, also the carrier. This is so important that the solution to the problem of repackaging is significant from the entire supply chain for only one company – KICO-Polska Sp. z o.o. Neither the carrier nor the material producer receives any direct benefits from the introduction of such a system. It is therefore particularly important for the receiving company. The returnable trade-in packaging introduces additional requirements and tasks for producers, and in some cases, also for carriers. The manufacturer of materials uses universal packaging, and the conclusion of the following agreement obliges him to make changes in his work organisation. The first important change is due to the necessity to store returnable packaging. The material producer may therefore require the recipient to cover the operating costs associated with this activity. In addition, it is the recipient's responsibility to ensure the availability of containers for all companies that participate in the supply chain, which also involves additional costs related to their purchase. The next challenge after the introduction of returnable packaging is their quantitative registration. Efficient packaging recovery is becoming an important measure that allows costs to be kept to a minimum. Keeping records allows you to efficiently locate where they are held and secure them against theft.

Designing processes in an enterprise is primarily mapping processes according to the Business Process Management (BPM) methodology. The aim of the article was to show that also designing processes in programs for their simulation can bring tangible benefits to the organisation. This article describes how to increase business efficiency and save costs by introducing improvements. This methodology can bring many benefits to manufacturing companies, including:

- saving costs and time,
- higher efficiency,
- analysis of processes in terms of their effectiveness,
- finding production and logistics bottlenecks,
- better and more efficient adjustment of processes,
- the ability to model across the enterprise, not just focusing on processes.

The last benefit of modelling the entire enterprise, and not just focusing on selected processes, is possible, although very labour-intensive and requiring large investments. Hence, it is often worth considering the possibilities and creating simulation variants for selected processes and activities.

5 Conclusions

The use of process simulation programs allows for the analysis of their effectiveness, which can be used to optimise them. Visualisation of the operation of individual activities can be used as an aid in assessing the changes that the company is planning to introduce.

When returnable packaging is introduced into the supply chain, many new obligations and challenges arise for logistics management. New flows related to the flow of returnable packaging between cooperators may complicate the operation of the entire system. Effective management of the turnover of returnable packaging is crucial to avoid financial losses and maximise the benefits that result from its use.

The article presents the packaging turnover process based on the implementation of deliveries on the example of a manufacturing company operating in the automotive industry. The paper presents an analysis which facilitates the process of receiving products from the supplier and their use in the production of the examined enterprise. A change was proposed - materials at the main supplier (one of the three) will be packed into returnable packaging provided by the manufacturing company. Thanks to this, in the analysed organisation, it is possible to reduce up to 3 jobs, which will translate into a reduction of the company's costs.

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Review process

Single-blind peer review process.