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Abstract: The aim of the article is to present streamlining reverse logistics challenging the trends of increased amount costs of packaging and a need to meet sustainable development goals. Analysis of the packaging process has identified increased costs for the purchase of packaging, increased volume of imported and produced packaging material, increased volume of packaging waste and thus high recycling fees (related to producer responsibility). A proposed solution for streamlining reverse logistics processes have been introduced, including workflow of the packaging process, a new packaging registration system and measures for standardisation of the packaging process. The solution's main benefits are economical and ecological: first, cost reduction for purchasing new packaging materials and cost reduction for recycling fees, the second elimination of negative influence on the environment by respecting the waste management hierarchy and principles of the circular economy. Other benefits expected for the company are shorter, more informative, and practical training of new employees, reduced time for packaging process through its standardisation and visualisation, and more efficient separation of reusable packaging.

1 Introduction

The growing interest in sustainable development and the pressure to reduce costs in logistics processes, including the area of packaging, has intensified in recent years. The objective of the paper is to propose specific measures to streamline packaging processes in the company, considering the analysis of the current state of packaging processes, respecting the goals of sustainable development, reducing costs for procurement of packaging materials and packaging technology, reducing the volume of packaging materials placed on the market in Slovakia, and eliminate negative impacts on the environment.

Understanding and defining reverse logistics, the processes, functions, entities are specific in literature and practice. Hedgepeth (2020) considers reverse and forward logistics as parts of the supply chains within products flow and are transported from one place to another [1]. Gnap and Rovňaník (2012) describe a reverse logistics system based on the four basic processes: 1. Gatekeeping represents the entry control and inspection, through which decisions are made on the entry of material and product, representing a passive logistics element into the reverse logistics system. 2. Collection is a process representing the collection and gathering of products and materials for further processing. 3. Sortation and Separation divides materials according to how they will be further processed. 4. Disposition / Re-processing - products are processed according to their nature and why they entered the return flow, they can be repaired, their functional parts can be dismantled, recycled, incinerated or landfilled [2].

Reverse logistics functions (Bigoš et al. 2008) are collection, sorting, storage and packaging, transport, inspection, disassembly, processing, sale/reuse. The logistics chain of the reverse flow system consists of several entities that perform various functions within the process of recovery of products flowing into this chain. These subjects include final consumer, collector/collection company, equipment for material recovery or sorting, processor, manufacturer [3]. Starostka-Patyk (2017) [4] focuses on the groups of entities involved in reverse flow management.

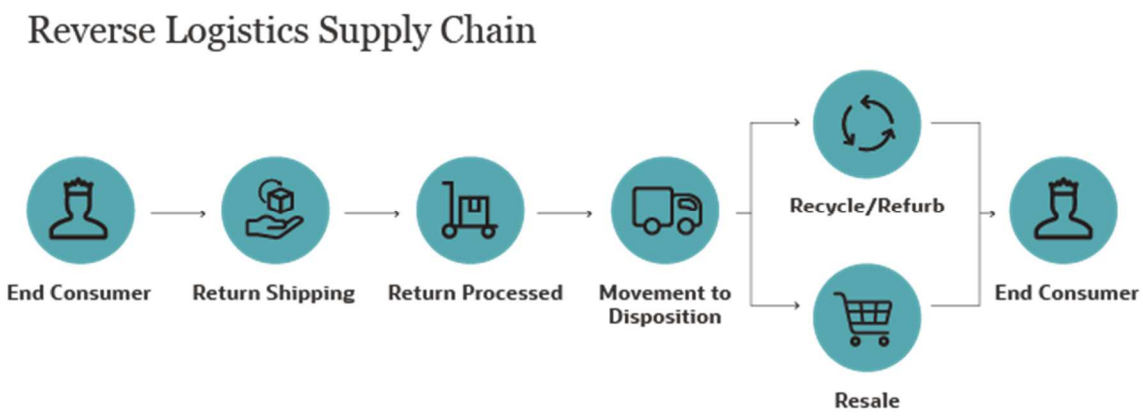

Figure 1 Structure of Reverse Logistics Supply Chain [5]

The reverse logistics supply chain is influenced by the end consumer (customer), then return shipping and return processed follows disposition movement and then either recycling or resale option and again closed by the customer (Figure 1). According to InfinityResearch web portal (2019), adoption of new repair and return policies, improved cooperation between the company and the supplier, reassessment of transport and logistics, optimisation of the reverse logistics process using recent trends, and third parties are four key strategies to improve reverse logistics management, especially in smaller companies: [6]. Mangla et al. (2016) emphasised this as a critical success factor for supply chain management, concluding that global competitiveness is the main factor contributing to the successful implementation of reverse logistics. Regulatory factors, human resources, organisational, economic and strategic factors were also among the essential factors influencing the successful performance of reverse logistics [7]. Reverse logistics is addressed as crucial in achieving sustainable competitive advantage [8-10].

However, the fundamental factors that influence reverse logistics are sustainability, the environment, actual legislation, the stakeholder's pressure on the manufacturer (environmental awareness of employees and customers). Sustainability focuses on reducing the negative impact of the human factor (production) on the environment by efficient use of available resources, increasing the reliability of these resources, and extending the life of input materials and products. Sustainability issues in logistics and ICT issues are discussed by many authors [11-14] and in human resource management [15].

Environmental, economic and technical aspects influence reverse logistics and waste management processes; it is essential to prioritise the reuse of materials, or their recycling, over the energy recovery of waste. The authors consider waste disposal to be the last available option in waste management [16].

Packaging and waste management are closely linked to sustainability issues in enterprise and include the purchase of packaging, the sorting of packaging, the use of environmentally friendly packaging, the storage of packaging, distribution and take-back, disposal and registration as required by higher authorities.

Several factors influence the choice of packaging through one of the critical decisions if the disposable or returnable packaging might be used. Companies consider returnable packaging to be more economical and environmentally acceptable [17].

Authors indicate a comprehensively positive shift in innovation in packaging, evaluation of smart packaging [18]. However, in the context of sustainable reverse logistics, the function of packaging in business-to-business deliveries doesn't end with the product's safe delivery to the customer anymore. An essential fact in a holistic approach to reverse logistics is that each manufactured product (and its packaging) ends its life cycle, and at that point, the product recovery paradigm should determine the type of recovery and reverse logistics activities.

The context of reverse logistics is defined by reasons for the return and driving forces (Why?), processes (How?), product types (What?), locations (Where?) and stakeholders (Who?) are interconnected with the responsibility of the company as a producer. We distinguish between economic, physical and information producer responsibility. The economic responsibility of producers should include the costs associated with the reduction or by eliminating the negative environmental impacts caused by the product. The manufacturer's physical responsibility is the system of accountability where the manufacturer is responsible for the material handling of the product during its life cycle. The information responsibility of the manufacturer is to provide information about the product (whether the product is from recyclable materials). The connection between these three forms of responsibility is ownership of the product throughout the life cycle, even when the product becomes waste [19].

Producers are responsible for disposing of the product and its packaging even after it has become waste, which is

defined as an extended producer responsibility by the Organization for Economic Co-operation and Development (OECD). Traders use product packaging as an autonomous tool in providing customer care. OECD defines extended producer responsibility as a means of environmental policy that extends producer responsibility for products throughout their whole life cycle, from development to the end of their life cycle [20]. The function of packaging to reduce the impact on the environment and facilitate recycling is becoming increasingly important than, for example, the protective, promotional or storage function of packaging.

In logistics, we distinguish three main stages or levels of packaging as follows: primary, secondary and tertiary packaging. Ekobal (2020) defines the primary level of packaging as consumer packaging. The packaging is in direct contact with the product. The packaging forms the first layer of the packaged product, and the purpose of this packaging is primarily to protect the product. The secondary level of packaging often referred to as group packaging, is mainly used for storage and logistics purposes. Secondary packaging protects and accumulates the primary packaging products, for example, in larger boxes, and expediently facilitates handling the goods and their transport. The tertiary level of packaging is referred to as bulk packaging, and its purpose is to group larger quantities of storage units in secondary packaging during their transport from one point to another. For example, cardboard boxes are placed on a pallet wrapped in foil [21].

The requirements for the packaging process and packaging material depend on the specific features of the products. The choice of suitable packaging ensures that harmful environmental influences on the transported material's quality and properties are eliminated. The choice of the appropriate type of packaging material ought to be made based on product properties, environmental impact, method of transport and handling, method of storage and, of course, business conditions and legislation must be taken into account (Zhu, Guillemat, Vitrac 2019) [22].

Legislation on packaging and packaging waste is addressed by Directive 94/62 / EC of the European Parliament and the Council of 20 December 1994 on packaging and packaging waste, which aims to "harmonise national measures on the management of packaging and packaging waste" [23,24]. To prevent or eliminate the impact on the environment of all Member States as well as other countries, on the one hand, by a high level of environmental protection and, on the other hand, to ensure a functioning internal market to avoid barriers to trade and distortions and the restriction of competition in the' Community'. Packaging waste is also regulated on the national level in the Slovak Republic by Act no. 79/2015 Coll., of 17 March 2015 on waste [25]. This legislative defines waste management as follows: Waste management in general is: collection, transport, recovery and disposal of waste, including supervision of these activities and subsequent care of disposal sites, and includes the actions of a trader or broker. The hierarchy of waste management is represented by Act no. 79/2015 Coll. such as a binding order of the following priorities: a) waste prevention, b) preparation for reuse, c) recycling, d) another recovery, such as energy recovery, e) disposal.

Reverse logistics and its management have four possible benefits for businesses and consumers (Hedgepeth 2020): secondary return on investment, increased public and consumer perception of the company, support for production competition, and increased consumer data protection [1]. However, the disadvantage is the risk that businesses and customers may not be satisfied with the company's partners in the field of reverse logistics and recycling [1].

Managers might get an insight into risks in reverse logistics and understand their relative importance [26] and opportunities such as combining the recycling operations with reusing or remanufacturing operations means for companies to stay profitable Klausner and Henrikson [27]. Crucial identification of critical success factors linked to the implementation of reverse logistics /waste management in manufacturing. Straka et al. point out the relevance of analysis and classification types of waste using descriptive statistics data [28].

Six critical success factors for the implementation of reverse logistics in the context of sustainability (SDGs): reasonable income control, standardised and mapped processes, reduced time cycle, information systems, planned logistic grid and collaborative relations between customers and suppliers. Well-structured and implemented reverse logistics process brings benefits and advantages to companies beyond environmental ones [29].

2 Problem definition and methods

The introduced model of the packaging process is based on analysis of existing literature, presented case study and previous industry practices. It utilises data about packaging amount and trends, average costs of packaging, data about return flows. The proposed solution of optimisation of packaging process has the following steps: Objective definition; Data collection for identification of trends; Defining the optimisation constraints and parameters; Analysis of data about return flows in packaging process (average costs for packaging, volume and amount of packaging); Application of principles of industrial engineering/logistics, sustainable development goals and waste hierarchy; Model of packaging process applying visualisation using workflow management and standardisation.

For visualisation of packaging process and proposed solution are used process flowcharts, diagrams that depict a process, system or computer algorithm. Flow charts can range from simple, hand-drawn charts to comprehensive computer-drawn diagrams illustrating multiple steps and routes. Flow charts represent in graphical form logistics or manufacturing process from beginning to end., help find inefficiencies in a manufacturing or procurement process.

Flowchart consists of rectangles, ovals, diamonds, and potentially numerous other shapes to define the step type and connect arrows to describe flow and sequence. Each diagram must have a starting point. It can have multiple ending points and some loops as well.

Visualisation of the packaging process using workflow is presented in a case study in simplified form with a fixed set of structures. Inputs and outputs are marked with an oval grey colour, while their relationship with processes, i.e. input and output, are marked with a red dashed arrow. Inputs and outputs are marked with two colours, grey represents the document, and brown represents the material. The individual activities are drawn as a sequence of rectangles, and the diamonds in the flow diagram represent the decision-making process.

3 Streamlining the packaging in logistics company

This part of the article introduces a case study concerning streamlining of the packaging process in the logistics company dealing with distribution activities of fasteners meeting the requirements of standards STN, DIN, ISO, UNI, or PLN and GOST on the domestic and foreign markets (screws with metric thread, or UNC and UNF, nuts, washers, cotter pins, rivets, tight springs, pins and pins, blind rivets and rivet nuts, dowels, and fasteners).

3.1 Packaging process in the logistics company

First, the responsibility for the packaging processes is covered by the company's storekeepers, and the warehouse department handles the process of packaging and return of packaging. The company's packaging process begins by identifying the products to be sent to the warehouse. According to the documentation from the economic department, the goods are collected by the warehouseman for dispatch. When searching for and preparing goods for shipment, the warehouseman checks the status of each item. According to the types and quantities of ordered goods, the warehouseman chooses the appropriate variety of packaging material. In the case of weighed types of goods, the storekeeper selects the proper size of the package, usually a cardboard box or, in the case of smaller ordered quantities, a plastic closable bag. If the customer requests a number of goods corresponding to the contents of the package in the warehouse, the warehouse keeper will use this package but will first check its contents, find out whether the number of pieces fits and whether the goods are undamaged. After content control, it is necessary to affix a label to the box, which describes the contents of the package and the name of the company. The inspected, flawless goods are then secured in the selected packaging by closing the box. The company used adhesive tapes to close boxes or prevent the box from opening during transport and handling. After completing the box, an envelope with an invoice or a delivery note is glued to the box using adhesive tape. For some types of goods, especially for more oversized products, warehouse keepers use binding tapes to ensure the strength and stability of the products. Using binding tapes prevents an unnecessarily large packing box, i.e. an excessive amount of packaging waste. Orders are picked up on pallets, on which all goods are placed according to the order.

The role of storekeepers is also to adequately place goods on pallets, either based on the size or weight of the package. After putting all the order items on the pallet, the warehouseman must also ensure the stability of the complexly picked goods for shipment. It will do so most often with the help of stretch film, which will ensure that during the handling and transport of goods to prevent unwanted movement of goods on the pallet or possible damage to boxes and another packaging. The packaged goods are first transferred to a platform scale through a pallet truck, where their weight is measured and recorded on a picking sheet, which the warehouseman then returns to the economic department to issue an invoice. The goods are moved on a pallet from the platform scale for further loading directly into the car intended for transport. Warehouses can use two options when sorting goods on a pallet, they can transport a pallet around the warehouse using a pallet truck in search of a specific product and store it directly on it, or they can use a transport platform truck on which they keep the goods and then unload them on a pallet, which is prepared at the scale. After weighing, the pallet is moved to where the goods are loaded directly into the transport truck. The logistics company sends packaged goods ready for dispatch to the customer through two transport companies in multi-layer cardboard boxes in larger quantities on pallets. The workflow of the packaging process is in figure 2.

Second, we analysed the trend in packaging quantity in tonnes placed on the Slovak Republic's market and calculated the company's packaging costs. The amount of packaging (paper and cardboard, plastics, and wood) has increased from 2017-2019, the only year 2020 due to the covid crises and less demand of customers (Figure 3).

The logistics company marketed over the last three years through imports, on average around 28.77 tonnes of packaging per year and through production on average around 4.05 tonnes of packaging materials per year with a trend of increased costs excluding the specific year 2020 (Table1).

Following the hierarchy of waste management and the goals of sustainable development, the solutions for streamlining, the packaging is introduced to reduce the amount of packaging that the company markets and thus reduce the financial costs associated with this issue.

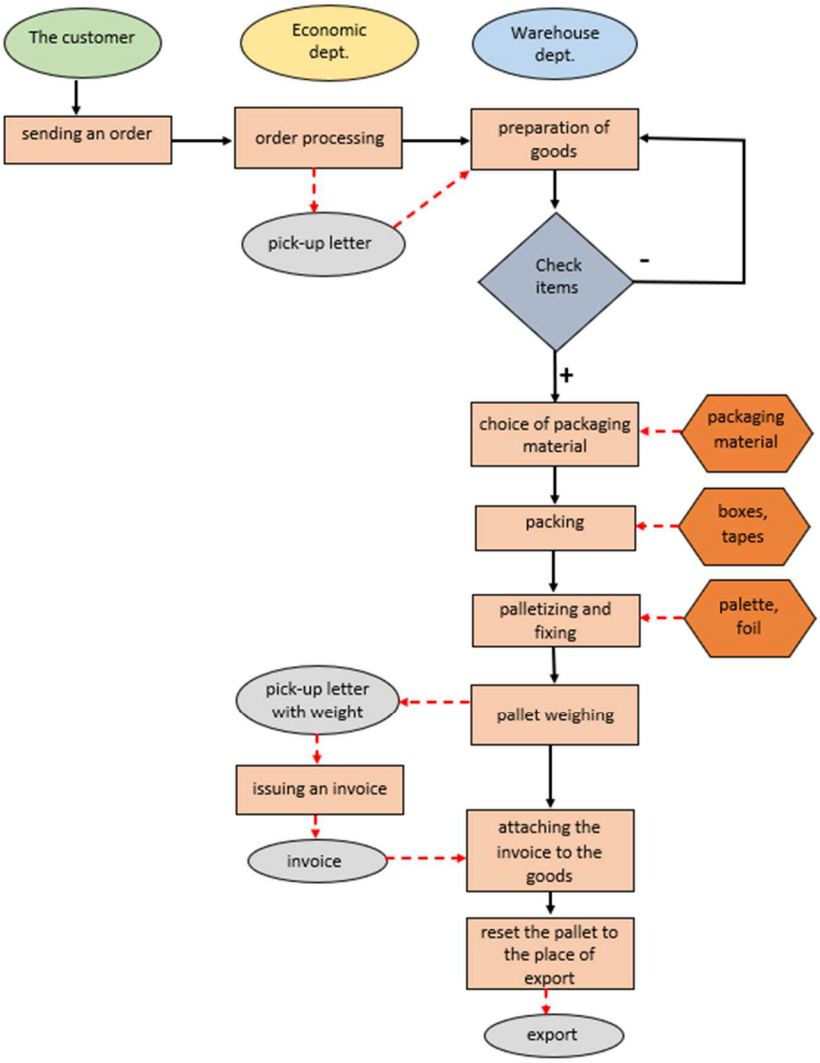

Figure 2 Workflow for the packaging process

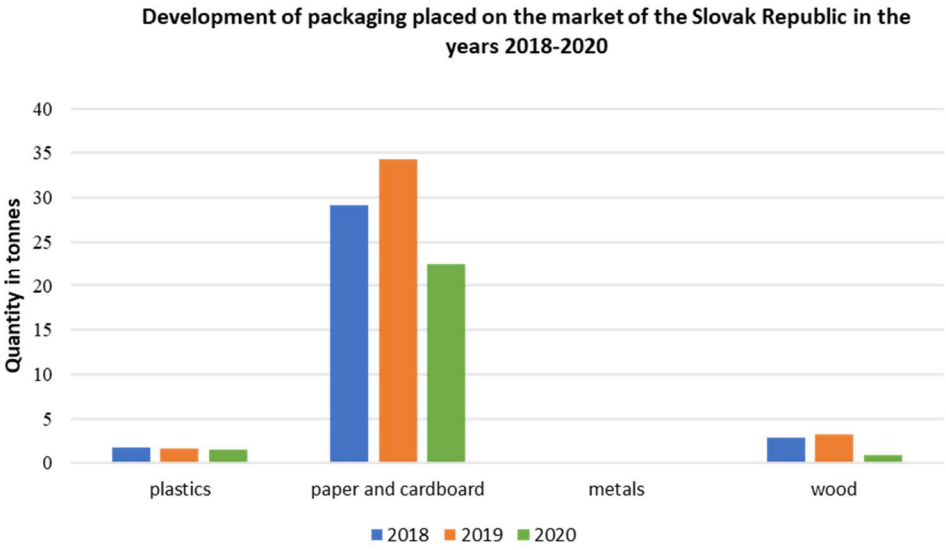

Figure 3 Trend in packaging quantity placed on the market by company in the years 2018-2020

Table 1 Increase in the costs for the packaging waste in logistics company

YEAR	TYPE OF PACKAGING	QUALITY PURCHASED (pcs)	PRICE (€)
2018	Pressed Palette INKA - small	200	664.45
	Stretch foil	270	1166.40
	Tape	1152	857.09
	EUR Pressed Palette - dark	50	330.00
Total price			**3017.94**
2019	Pressed Palette INKA - small	601	1999.93
	Presses Palette INKA - big	1	7.2
	EUR Pressed Palette - dark	50	330.00
	Stretch foil	404	1391.59
	Box 192/128/111	10000	1524.00
	Box 130/100/80	10000	1128.00
	Tape	470	355.32
	Closable pockets	54000	405.60
Total price			**7141.64**
2020	Pressed Palette INKA - small	640	2470.47
	Stretch foil	460	1606.32
	Tape	660	498.98
	Box 192/128/111	3800	656.64
	Box 130/100/80	3000	370.80
	EUR Pressed Palette - dark	3	25.20
Total price			**5628.39**

The increase in the amount of packaging placed on the market through production could be caused by several factors such as the purchase of packaging material from Slovak suppliers for stock or poor management of warehouse workers with packaging material. After using empirical analysis methods, by analogy, observation, interviews and study of documentation, the conclusion is that the main identified problem is an increase in the volume of packaging marketed through production, which is caused mainly by insufficient training of warehouse workers. However, the training of newly hired warehouse employees consists primarily of getting acquainted with the registration system in the warehouse and short demonstration of their work activities, which is considered insufficient and after a more extended period, this is reflected in the costs.

The competence of employees and the selection of packaging material by warehouse workers seem to be very uneconomical; thus, according to information from the economic department, warehouse workers choose unsuitable types of packaging material or use too many packaging materials, which will be reflected in the economic as well as the environmental sphere. Another cause for an increased amount of packaging waste is the import of material from the company's suppliers. However, this problem can be eliminated, for example, by the proposed solution of reusing undamaged packaging materials from suppliers and the registration system.

3.2 Packaging registration system

As mentioned, one issue is introducing a new system of registration for the packaging material, specifically packaging material made of paper and cardboard, which represents the largest share of packaging. The comprehensive approach of records consists of the following parts: Records of all cardboard and cardboard packaging from suppliers of goods; Inspection of registered packages and their manual sorting into two groups; Evidence of usable packaging and their sorting in Microsoft Excel; Records of the balance of available boxes in stock; Insertion of a collection/storage container for usable packaging; Training of warehouse workers for a given type of work. A sample of records used to register packaging materials from suppliers of goods according to the group of usability is presented in Table 2.

Before registration, manual sorting and visual control by warehouse workers are required. After control, the box is assigned to the usability group (Table 3), specific quantities of usable packaging are recorded in the record sheet, and the stock balance /quantities of boxes according to the waste category are calculated using a function in Microsoft Excel.

Table 2 Records of the paper and cardboard packaging from suppliers of goods

Date	Amount of packaging (pcs)	Usable (pcs)	Waste (pcs)
19.3.	25	15	10
19.3.	27	10	17
22.3.	41	27	14
22.3.	29	16	13
22.3.	41	27	14
25.3.	35	21	14
26.3	40	21	19

Table 3 Records about sorting of usable packaging

Registered				
Date	small < 150mm	medium < 250 mm	large > 250 mm	Total pieces
19.3.	5	7	3	15
19.3.	3	1	6	10
22.3.	7	12	8	27
22.3.	9	4	3	16
22.3.	12	9	6	27
25.3.	6	12	3	21
26.3.	10	5	6	21
SUM	52	50	35	137

The cardboard boxes are in groups according to their sizes and dimensions into the following groups (table5): The next step is the registration of the balance of usable packaging (boxes) in the warehouse, which, together with the previous actions, will create a comprehensive system of registration.

Table 4 Records the balance of used boxes in stock

Used			
Date	small < 150mm	medium < 250 mm	large > 250 mm
22.3.	3	1	9
22.3.	2	15	3
23.3.	1	2	1
26.3	5		

The quantities of boxes consumed are recorded in the columns of the table according to size. The interval for recording box consumption data is individual, and it is recommended to register for the day/change worked. Based on the formula formatted in the stock balance table, the quantities of boxes entered in the consumed table are automatically recalculated in the stock balance table, thus subtracting the used amounts from the total stock quantity and evaluating the balance.

Table 5 Stock balance of packaging according to the size

Stock balance			
small < 150mm	medium < 250 mm	large > 250 mm	Total stock
41	32	22	95

The next step in this proposal is to purchase and place containers for the separation and disposal of packaging entering the company. As part of this step, two alternative solutions are as follows: The first alternative is the purchase the three types of boxes/containers for storage of usable boxes: Plastic box perforated 700 litres; (Intended for box packaging size larger than 250 mm); Plastic container 520 litres (designed for boxes size smaller than 250 mm); and in the smallest package with a volume of 300 litres. The second more environmentally friendly and economical alternative is using large boxes from the suppliers of goods, but have no other use and become waste for the company. This solution would be more efficient for the company from the economic point of view, as the company has long-term suppliers of goods, from which it has a constant purchase of goods. The company might cyclically change these boxes to newer ones if they were worn out over time.

The proposed change in packaging processes represents a streamlining of the whole process through the following changes: records enter the process of choosing the type of packaging material, a new decision-making process is also emerging, the priority of which is the choice of reusable packaging. The original packaging process in the company (Figure 1) and the new packaging process in the context of waste hierarchy with new evidence/ records of packaging entering the company from suppliers of goods are introduced applying the flow chart (Figure 4).

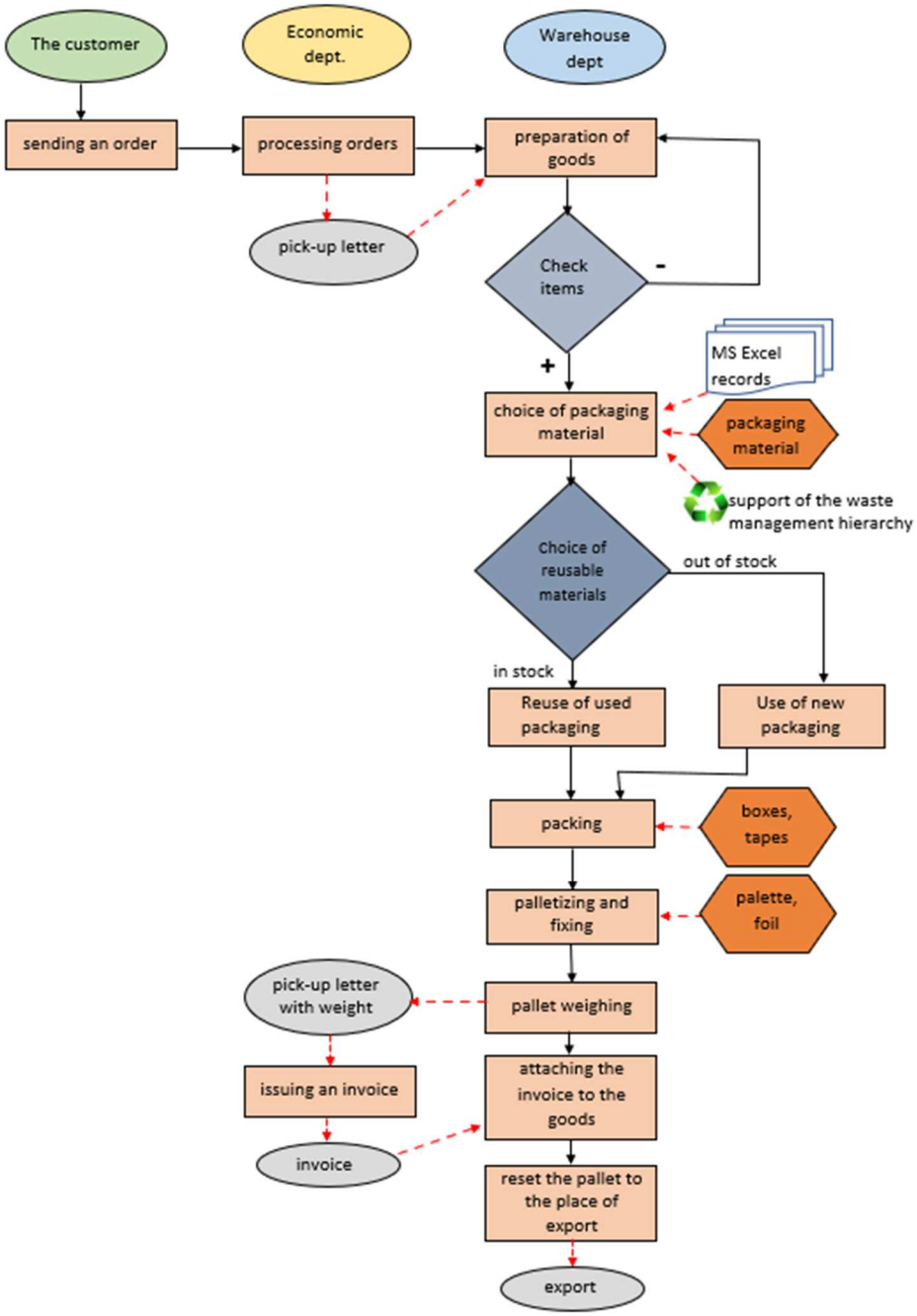

Figure 4 Workflow for streamlining the packaging process

The creation of a standardised workflow supports the visualisation of the proposed solution as a support for change. This procedure can serve as a system available at sites designated for sorting and registering reusable packaging material (Figure 4).

The proposal to introduce a standardised workflow as part of the visualisation of portions is intended to help guide the workers assigned to in their work, with the comprehensive registration system introduced in the first proposal. Visualisation helps to understand the meaning and interconnection of requirements by presenting them in a simple and easy-to-understand format [30, 31].

A more important benefit of the presented proposal is the prevention of time wastage in terms of lean management. The standardised workflow consists of simple, concise and clear instructions, which is suitable for any reader. The introduction of a standardised workflow will reduce time loss due to demands in the implementation of records, more accessible training in hiring a new employee, prevention of inappropriate separation of reusable packaging, and ensuring systematisation and order in the warehouse department.

4 Conclusions

Sustainable reverse logistics is closely connected with waste management in companies and helps meet objectives of sustainable development and the requirements of the law at the same time [32]. Efficiently carried logistic processes condition the quality of the product at every stage of the flow, starting with obtaining the raw material, ending with creating inventories and delivering the finished product to the customer [33]. Studying the issues of reverse logistics even in the developed logistics systems is still considered an area that has to be continuously researched with the aim of optimising the entire supply chain [34].

The quality and competitiveness are crucial specific implications for implementing sustainability in reverse logistics for companies with the guidance to apply sustainability in reverse logistics [35,36]. Incorporating the three pillars of sustainable development (environmental, social and economic) in packaging supports the innovative solution [37]. The proposed solution in sustainable logistics is to reduce the volume of paper and cardboard packaging placed on the market through production and import, which represents a significant part of the total packaging. The aim is to reduce the cost of recycling fees to organisations responsible for the production and eliminate the negative impact on the environment in line with implementation objectives and sustainable development. Introducing a system for registering packaging from suppliers will provide knowledge about the amount of packaging that flows into the company from suppliers. An essential part of records are records of the amount of reusable packaging. Following the introduction of a registration system, the company can determine the exact quantities of reusable packaging, indicating stakeholders' preferences in packaging. Subsequently, after the proposed registration system's data collection and analysis period, it is possible to predict the amount of packaging received from suppliers and quantify the usability percentage. Information about usable packaging in stock and the amount of new packaging material needed will make it easier and more accessible for logistical management.

We also see a positive aspect of the environment; the proposal respects the waste management hierarchy in the Slovak Republic in two areas. The first area of the waste hierarchy supports waste prevention by establishing records to map the quantity and control of all packaging from suppliers, thus reducing the risk of evaluating packaging that can be used for waste. The second area respecting the waste hierarchy is preparation for reuse through inspection, registration and separation of packaging from suppliers. A summary of the expected benefits of the solution for the introduction of a system of registration of packaging from suppliers is as follows: reduction of costs for the purchase of new packaging materials - cardboard boxes, costs reduction for fees to producer responsibility organisations for placing packaging on the market of the Slovak Republic, information about the quantities of reusable cardboard boxes in stock and promoting the national and European waste hierarchy, support for the company's circular economy and sustainable development goals (Sustainable industry). The costs associated with this proposal are minimal.

In mapping packaging processes and introducing a registration system for reusable packaging, the main requirement was a waste management hierarchy in terms of sustainability. By implementing a new decision-making process whose priority is reusable packaging, colour visualisation of elements supports a simplified view and clarity of processes and their owners, simplifying the management and implementation of possible changes and innovation. A simplified view of the packaging process in the context of sustainable development goals helps to understand its essence. It is a tool for warehouse workers - it contains the composition, availability on the test site and evidence of usable packaging. The result is streamlining and unifying new or recurring training, prevention of conflicts in the workplace, and preventing inappropriate sorting of packages evaluated as reusable and a prerequisite for better warehouse organisation.

Future research in sustainable packaging will introduce more innovative solutions for industry using smart packaging and more complex solutions to enhance sustainable development goals. One of the critical scopes identifying and analysing the contributors to circular economy/sustainability and its evolution from three broader perspectives: sustainable development, environment, and economic growth [38]. In a more complex view, the sustainable reverse logistics network needs to enhance considering circular economy [39] and the framework Triple Bottom Line which considers three strategies: economic, environmental, and social [40].

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