
Standardization of Logistic Units in Terms of Increasing the Efficiency of the Reverse Supply Chain of Returnable Packaging

Submitted 12/05/21, 1st revision 23/06/22, 2nd revision 18/07/22, accepted 30/07/22

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Abstract:

Purpose: The purpose of the research is to investigate the relationship between the types of reusable loading units in reverse supply chains and to identify the potential benefits of changes in the logistics model.

Design/Methodology/Approach: The study was conducted with a comparison of two logistic models using various and standardised types of returnable packaging. On the basis of the study, final conclusions were formulated.

Findings: Packaging standardization in the reusable packaging reverse logistics management model has a positive effect on the entire logistics model supporting the handling of the flow of packaging units.

Practical Implications: The proposed solution may find application in real market enterprises. The implementation of the packaging standard to support reusable logistic units helps to significantly reduce the carbon footprint resulting from a more effective structure of the logistics network.

Originality/Value: The commonly used logistics model based on a variety of reusable packaging supports efficiency increase only in limited scope. The proposed solution based on standardized reusable logistics units makes it possible to reduce the energy consumption of the entire reverse logistics model by minimising level of transport operations.

Keywords: Reverse logistics, logistic of reusable packaging, standardisation of logistics units.

JEL codes: L15, L91, R42.

Paper Type: Research paper.

Acknowledgement: Damian Dubisz would like to thank for funding research under the Implementation Doctorate Program of the Ministry of Education and Science implemented in the years 2021-2025 (Agreement No. DWD/5/0015/2021 of 23/12/2021). Research funded by subsidy (Agreement No. S-5548-0-2022).

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1. Introduction

Contemporary logistics concepts focus on the precise organization of flows, identifying process participants and creating the most effective models for managing the available means of transport, production and warehouse management. However, the role of logistics is not limited only to these areas. The essence of proper data and flow management has been noticed for subsequent reverse logistic models also.

Hence focus on improving connectivity and control parameters in this area is crucial for maintaining constant improvement within existing distribution chains. A similar need is also present in the area of returnable packaging reverse logistics. In this research, we focused on the example of bottle packaging used in logistic of beverages.

2. Literature Review

There is a noticeable role for investors in minimizing contamination caused by the use of disposable packaging of beverages. Emphasis is placed on the role of governments and major business partners in influencing the increased use of reusable packaging in the distribution of beverages poured into plastic bottles (Abdissa *et al.*, 2022). At the same time, economic, social and legal factors that determine the shape of supply chains in certain industries are also noticeable.

Hence the need to conduct an extensive literature study of the publications in the science field of reverse logistics and closed loop supply chains (CLSCs) from 2007 to 2013 by Govindan *et al.* As a result of the surveys carried out in Malaysia, on the basis of regression analysis, the relationship between the pressure of investors, residents and legal regulations on the shape of supply chains and the loading units used in them was shown (Alves and Chau, 2015).

The approach to creating the concept of a supply chain based on environmental considerations is also shown by other industries, such as Automotive. The concept of Green supply chain management (GSCM) indicates the need to take into account the energy consumption of processes as the main factor determining the reduction of the carbon footprint of processes, especially in developing countries (Vanalle *et al.*, 2017).

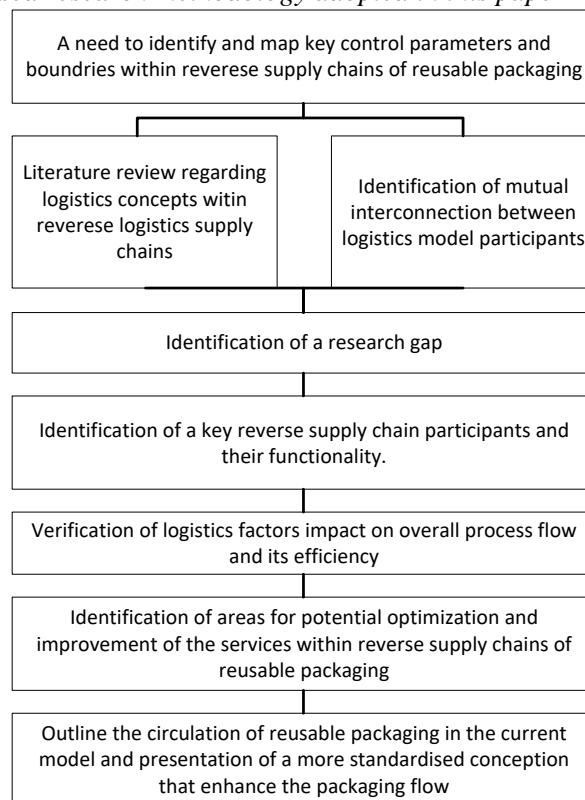
Based on the analysed literature, a research gap related to the standardization of packaging types in reverse logistics organization has been identified. It remains to be verified how standardizing beverage unit packaging will improve the efficiency of the entire supply chain and minimize its energy consumption and associated carbon footprint.

3. Research Methodology

This publication should be considered as an analysis of the current, most common logistic model supporting the flow of returnable packaging between the commodity producer, packaging manufacturer, wholesalers, retailers and the end customers. The adopted research methodology is presented in Figure 1. In connection with a study on reverse logistics in supply chains, the first step is to define the boundaries within the current logistics models and determine the control parameters that influence various processes in them.

The literature study was conducted in the context of the functionality, purpose and limitations of the main participants and the identification of mutual interdependencies within current models. Based on the literature review, the research gap was identified. The key participants of the logistics process in the organizational-process dimension and information flow were identified. Based on this, areas were identified that represent the potential scope for optimization and implementation of the proposed solution. In the next step, the concept of standardized pre-packaging was presented, which due to its universal nature increases network throughput and streamlines the entire process.

Figure 1. Proposed research methodology adopted in this paper



Source: Own creation.

4. Current Logistics Model Participants

The current model of logistics services identified in the conducted research is based on the five basic participants in the process. The final recipient is the final customer who makes the purchase decision. The behaviour of the end customer and their purchasing decisions affect the performance of the entire model and all its participants. At the same time, a feedback loop between the sender and the final customer can be observed. Each participant in the process interacts to varying degrees and can influence the nature of the flow of goods within the model (Al-Babtain, 2010).

When analysing the logistics model and the essence of implementing solutions based on reusable packaging example and logistics in general, it is also worth taking into account the marketing aspects that influence logistics chain design and determines supply chain utilization level (Shin and Thai, 2016). The retailer is the direct link between the end customer and the wholesaler's distribution centre. These include small local shops or retail chain sellers (Tibben-Lembke and Rogers, 2002).

Wholesalers are another important linkage within the supply chain. From the functional perspective, they have the centre of gravity related to the proper supply of stores, determining the frequency of deliveries. It is also crucial that wholesalers maintain proper communication which is the basis of a well-coordinated supply chain.

The next link in the flow of goods and information is goods producer - manufacturer. Its main task is to focus on the production of goods and in cooperation with wholesalers control production volumes based on the actual market demands (Kimura and Terada, 1981).

There is close communication between goods producer and the next participant in the process - packaging producer. His main functional goals within a model are based on production forecasts and rapid exchange of information with other business partner.

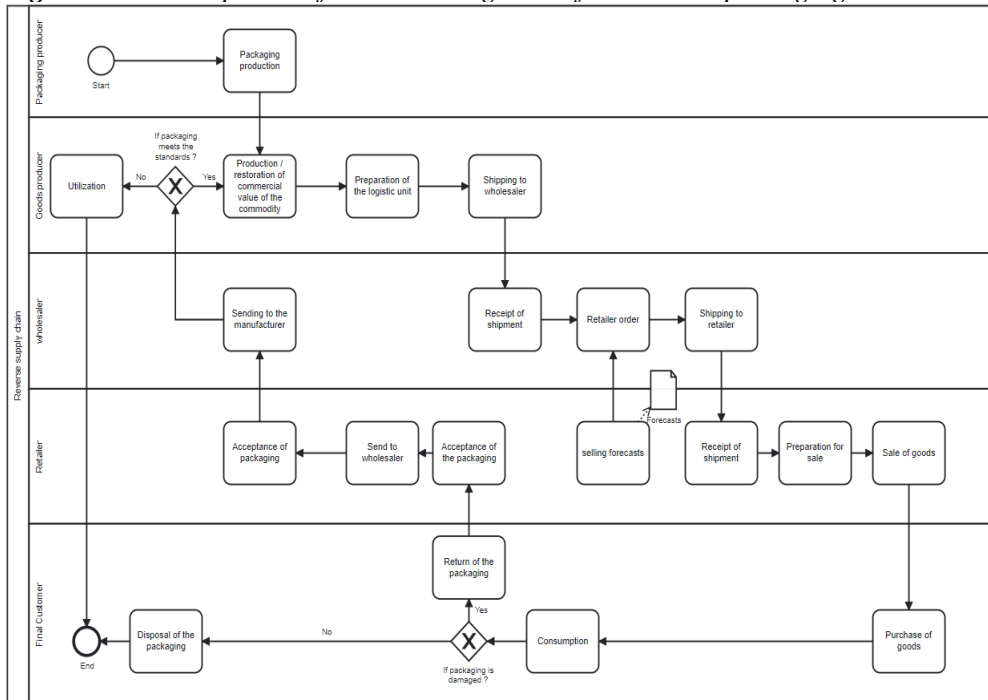
5. Indication of the Functional Scope of Participants within the Logistics Chain

The tasks of the packaging manufacturer include the delivery of packaging of the type and standard specified by the customer, in accordance with his individual production schedule. Maintaining security buffer in stock within the production area is acceptable however the production of packaging has to be controlled and correspond to the actual demand needs of the market (Dhouib *et al.*, 2010). At this stage, the key to maintain a quality data and packaging flow is proper communication between business partners preferably based on communication with EDI interfaces (Stefansson, 2002).

6. Main Issues within Current Reverse Supply Chain Designs

The current logistics model points to problems identified at the process stage and information levels. In terms of enhancing flow of information improving the quality of forecasts can positively affect the production planning of both the goods themselves and reusable packaging. From this point of view it is the most important to maintain close relation between the participants within the process and communicate accurate information in a dynamically changing supply chain.

Figure 2. Current process flow within logistics of returnable packaging



Source: Own creation.

In this scope identification of the main participants in the model and precisely define their functionality is crucial from further optimization perspective. This approach allows to look for ways to optimize at the unit level of reusable packaging flow within the proposed logistics conception.

In the current model different types of returnable packaging are in use. This causes extra tasks for all model participants. The retailer is the first stage in identifying the returned packaging and classifying it properly in reverse chain perspective.

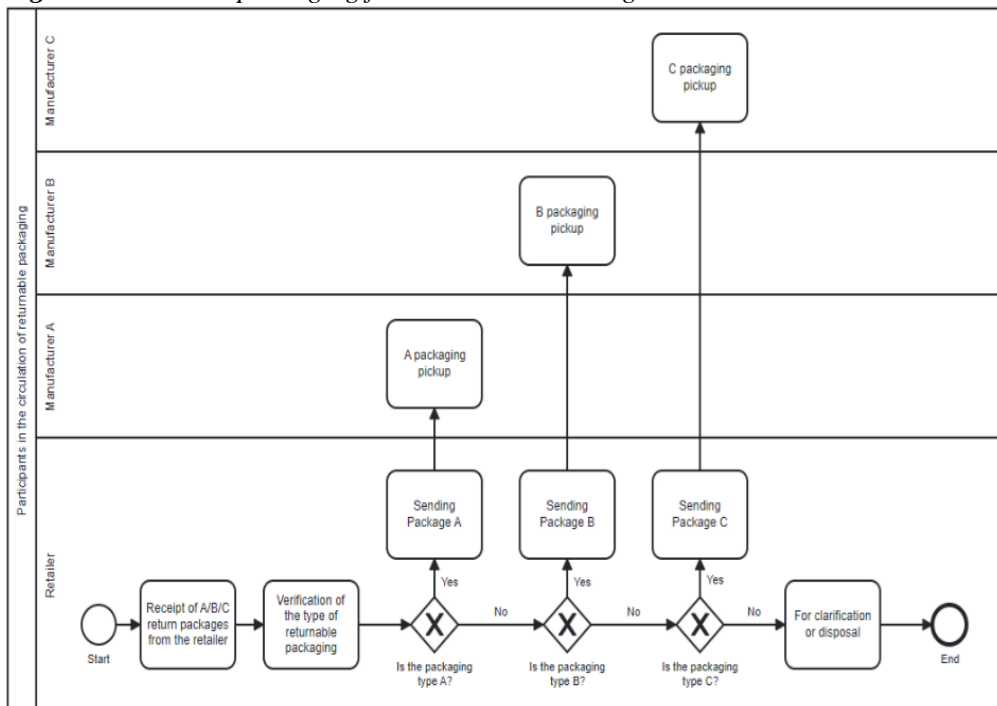
According to this concept shown on Figure 3 there are many different types of reusable packages in circulation that causes the reverse logistics processes even more complex. The retailer's role is to collect the packaging from the end consumer

and pass it through the reverse chain for reprocessing or reuse. The risk that exists in the current model is the mixing up of packaging and sending the incorrect types of them back to the wrong processing units. In current reverse flow conception supply chain design tends to increase the need for transportation, which is clearly unjustified and exposes the entire model to the generation of a loss.

The retailer, in addition to the need of classifying the packaging, transferring it for reuse to distribution centre and cooperating with a wholesaler, is also responsible for deciding whether to send it for disposal. This shape of model and design of processes also indicates the need to define precise quality requirements for returned unit packs.

The rules should be easy to apply under conditions of real-world environment of large quantities of returnable packaging as high volume flows can even cause more challenges within entire reverse supply chain. With reference to the literature review, the need to support the process from the information flow side is also noticeable. Along with the sending of returnable packages, information should be sent specifying the amount of returned packages to processing centres in advance. This will support manufacturer and packaging producers in terms of planning shifts and workflow within their operational units.

Figure 3. Reusable packaging flow within current logistics model



Source: Own creation.

7. Proposed Changes within Current Logistics Models

Taking into account the limitations resulting from the shape of the existing logistics models, it is necessary to focus on the elements that enable the improvement of the efficiency of the supply chain within the resources available. The limited impact on the shape of the reverse logistics of reusable packaging identified so far indicates the need to improve this section of the supply chain.

During the conducted research, great potential for optimizing the process was noticed related to the logistic unit for the transport of beverages. By standardizing the types of packaging within several beverage producers, it is possible to influence the shape of the logistics network and minimize its energy consumption, which in turn will translate into mitigation of carbon footprint within a SC.

This potential is related with the ability to reroute flow streams to the nearest production site accepting the returnable packaging within a model. Standardized reusable packaging can be processed at packaging manufacturer reprocess-centres regardless of the type of packaging and its original owner. Thanks to this, the routes of vehicles transporting empty bottles or other reusable logistics units can be planned taking into account the distance factor, and not according to the type of packaging used.

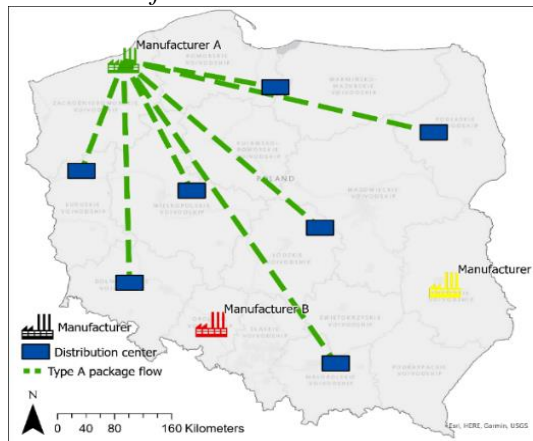
Hence it is possible to manage the packaging pool much more efficiently and optimize transportation operations. Figure 4 below shows the perspective of producer A within as-is scenario using not standardised packages.

A distribution centre (DC) shown on the map is a packaging manufacturer reprocess-centres that accepts reusable packaging from wholesalers and a retailer. Due to the outsourced nature of the construction of modern distribution chains, we do not strictly attach DC to a single participant in the process, and we condemn this term more to the functional scope and the logistics and transport services provided by this entity.

The current as-is model with manufacturers using unique returnable packaging requires re-delivery of the packaging to its original manufacturer. So called “type A” packaging was in this example shipped from north to south across country. In addition Manufacturer B, cannot accept and use type A packaging because of its own logistics units standard based on a different returnable packaging type B.

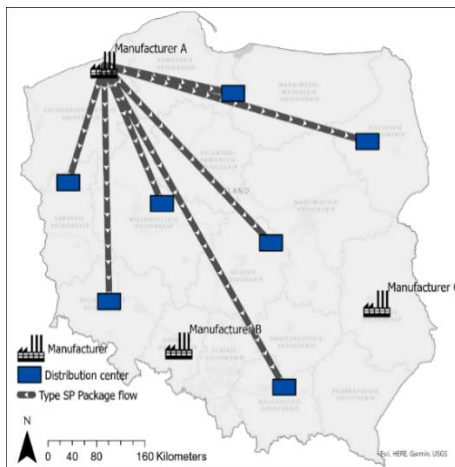
Proposed to-be model based on single standard package (SP) allows then to be processed by all manufacturers within the network. It does influence both production processes at goods producers by minimising the distance between packaging manufacturer and in terms of reverse logistics flows. A key differences in proposed model can be observed on Figures 5 and 6 where linehaul routes are clearly shorter in compare with previous reverse supply chain design.

Figure 4. Current as-is logistics model based on various non-standardised packaging among various manufacturers



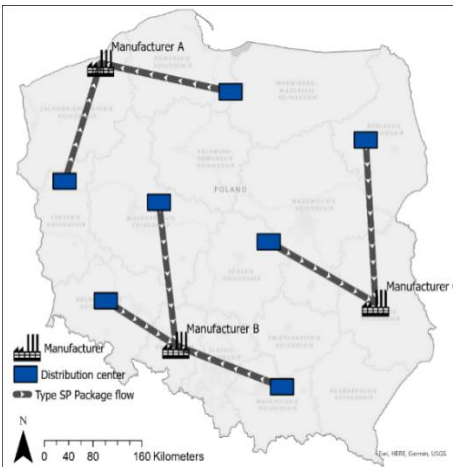
Source: Own creation.

Figure 5. Proposed model to-be downstream flow of type SP packaging



Source: Own study.

Figure 6. Proposed model to-be reverse flow of type SP packaging



By using standard packaging, it is possible to significantly optimize the return flow of reusable packaging, the potential depends on the location of production sites and the types of assortments produced. There is a loss of some marketing value when implementing standard packaging, and this should be taken into account. Manufacturers often distinguish their products by the shape of the packaging, hence there is a risk of applying the concept of common packaging between different manufacturers.

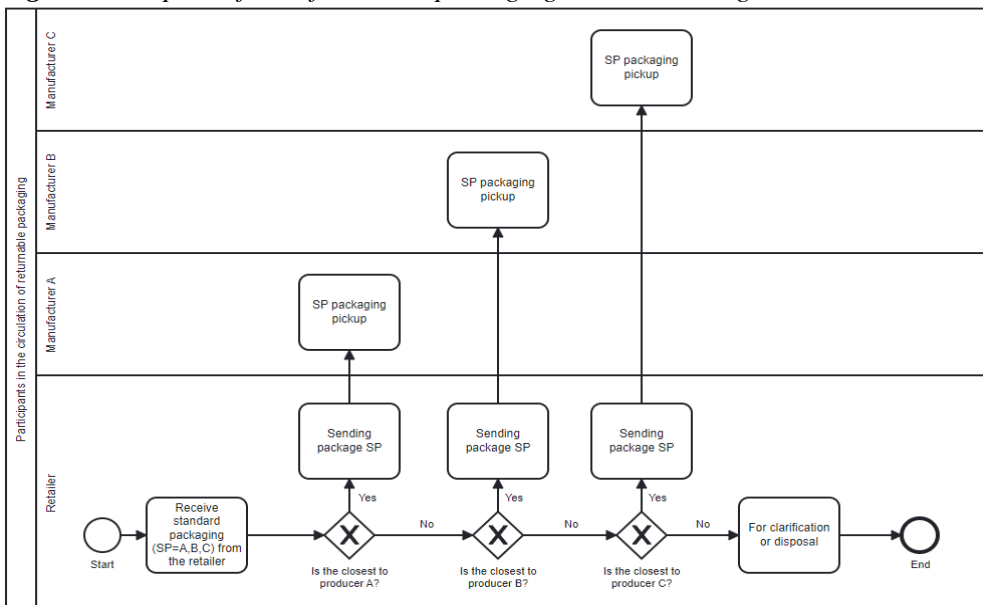
Therefore the focus was on a group of manufacturers under a common brand. Such a change is more likely there, and it is followed by an ecological rationale to which customers are increasingly paying attention. The key argument for the implementation of this solution is also the minimization of costs, which has a significant impact on the shape of production, transport and warehouse processes (Yang and Zhu, 2013).

8. Conclusions

In order to assess the effectiveness of the introduced model, a series of measurements should be carried out based on the KPI set adjusted to the specifics of returnable packaging. The results should be validated on the basis of the existing logistics models to demonstrate the increased effectiveness of the proposed changes to the model.

The solutions proposed in the to-be model provide an opportunity to improve the efficiency of the process. Attention is paid to increasing the efficiency of flows and reducing their energy intensity, thus minimizing environmental impact. With the implementation of standardized packaging and the elimination of each manufacturer's individual packaging types from the network, local distribution centres have the opportunity to send returnable packaging to the nearest packaging manufacturer. This means that the determinant influencing the shape of the return route is no longer the type of packaging, but the distance that separates the wholesaler's distribution centre from the manufacturer.

Figure 7. Proposed flow of reusable packaging within to-be logistics model



Source: Own creation.

Key benefits to the entire supply chain and product owner related to the proposed model conception:

- Improved flow management within the entire logistics model.
- Minimization of the carbon footprint resulting from the logistics service of many types of packaging.
- Improved control of the entire process and product life cycle, also after consumption stage.
- Increasing the share of reused packaging, which is in line with sustainable development principles.
- Better process control, minimization of losses and more effective planning of transport and production processes based on ecological solutions.

This approach is in line with the European Green Deal environmental perspective defined indicating the minimization of the carbon footprint resulting from the logistics handling of processes (EC, 2019). In parallel, proposed approach is consistent with the approach outlined in closed-loop supply chain concept where the greatest challenge is related with accurate synchronization of material flow (Golinska *et al.*, 2007).

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