Reverse logistics as a circular economy model success factor

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Abstract

The article is devoted to the study of the circular economy's basis: reverse logistics. It has been proven that the application of reverse logistics is a key step in determining the value of obsolete goods and promoting the development of reuse and recycling as the main elements of the circular economy. The reverse logistics model RLMM, which describes the characteristics of successful reverse logistics processes in various dimensions, was studied. Three archetypes of reverse logistics and components of the added value formation chain in the circular economy system, which are important for reverse logistics, are considered. The directions of work at different levels of decision-making according to RLMM are outlined.

Keywords: *logistics, reverse logistics, circular economy, reverse logistics model RLMM, components of the chain of additional value formation.*

JEL Classification: *011, L89*

Introduction

As of today, the issue of transition to a circular economy model is no longer purely theoretical. Company managers, economists and other researchers are developing new circular business models and gradually implementing them in various sectors of the global economy. However, a complete transition to a closed-loop model is hindered by certain obstacles.

One such obstacle is the complexity of managing the value chain, which includes managing the return, recovery and remarketing of different product models entering the circular cycle at different times and under different conditions.

In addition, insufficient attention is paid to understanding one of the key building blocks of the circular economy: reverse logistics. These include requirements such as asset tracking, optimized product and material flows, and waste management regulations. Saving the residual value of returned products is also a problem that can only be solved by highly optimized logistics [1].

Logistics is the main factor contributing to the expansion of the approaches implementation to the circular economy in various industries. In a closed-loop economy, along with forward logistics, which enables global trade by transporting materials, goods and information from start to finish, reverse logistics also play an important role.

The application of reverse logistics is a key step in determining the value of obsolete goods and promoting the development of reuse and recycling as the main elements of the circular economy. This activity covers not only the collection and transportation of materials and goods, but also value-added activities such as testing, sorting, recovery, recycling and redistribution [1].

Logistics can manage the circular flow of goods, connect markets and provide transparency between supply chains, however complex they may be. This makes logistics companies, especially those with a global network, infrastructure and expertise in reverse logistics, a key vehicle for accelerating the scale of the circular economy.

1. Literature review

In scientific and business literature, different terms are used that have close meaning with the term "reverse logistic" (reverse logistic, RL). In particular, the concept of "return processing" is often used "logistics of reverse flows", "logistics reverse flows", "return logistics" (Logistics of Return), Aftermarket Logistics, Aftermarket Supply Chain, Retrogistics, "recycling logistics" etc. One of the first authors who attracted attention of researchers to the problem of reverse flow management and actually formulated the basic concept of reverse logistics, were P. R. Murphy and R. F. Poist (1989) [2]. They entered the concept of "reverse distribution" as the movement of goods from the consumer to the producer in the existing channels distribution. In 1992 T. L. Pollen and M. T. Ferris [3] drew attention to the fact that flows secondary resources will not necessarily move along the same channel as the reverse flows. P. Guintini and T. Endel (1995) determined the concept of "reverse logistics" as "management organization of material resources, receiving them from customers" [4, p. 73]. Similarly, Horvath et al. (2005) emphasizes on the fact that RL represents a set of programs or competences aimed at the movement of goods in the reverse direction in the supply chain (that is, from the consumer to the producer). The question of whether household waste processing activities concern RL remains debatable in the scientific literature. In particular, J. Hillegersberg, R. Zuidwidge, J. Van Nunen and D. Eijik defined reverse flow logistics as "effective implementation of the process of disposal of products that are absolutely not suitable for sale or obsolete during stay in the supply chain" [5, p. 74]. In 2015, summarizing the different views of researchers from different countries, the Reverse Logistics Association (USA) clarified the definition of reverse logistics as an activity to manage values (both useful in the future and useless) that are formed in the process purchase or consumption of goods or services, regardless of the field and field of use [6, p. 47]. Reflected in a new sense the global trend of growing significance not only of the economic but also of the environmental aspect, that activity must be directed not only to indemnify the company from returns, but also to reduce the impact on the environment. An increase in the amount of generation and disposal of waste causes the deterioration of the environment situation both in individual countries and in the global economy. On the other hand, these wastes contain a significant amount of secondary resources, which could be used in the process of manufacturing new products. This system is essentially aimed at minimization of waste generation by means of repeated involvement of commodity and material values in the production process. This understanding led before the emergence of new business models – circular logistics (circular logistic, CL) and closed-loop supply chain (CLSC). Govindan, K., Soleimani, H., & Kannan, D. [7] analyzed 382 published materials from January 2007 to March 2013 in order to find future directions and research opportunities at RL/CLSC. They came to the conclusion that management decisions in the field of reverse logistics are becoming increasingly complex. They must integrate different levels of decision-making, take a plethora objective factors into account to use new approaches to achieve green, sustainable and environmental goals. Julia L. K. Nußholz (2017) notes that the emergence of closed supply chain models and the development of the circular concept of logistics closes the circuit of management of material (goods) flows in logistics and ensures the sustainability of the natural resources' usage based on closed design supply chains in economic activity. Materials are reused, and not thrown away as waste, creating or looping flows [8]. Application of circular business models and closed supply chains in various industries economy leads to significant ecological, economic and social benefits. Their implementation in the automotive industry, according to estimates experts, will create an opportunity to reduce the consumption of raw resources by 98%; provide energy savings at the level of 83%, decrease in the finished products cost up to 40% and carbon dioxide emissions up to 87% [9]. Based on the above, we believe that reverse logistics is the process of returning from spheres of consumption and return to the spheres of production and disposal of goods and material values that can be subjected to resale, reuse, repair, and – in case the impossibility of carrying out the specified actions – their proper disposal. This understanding reflects the current stage of the evolutionary development of a new direction in logistics, the key idea of which is sustainable development and global greening of production and consumption, that has a significant impact on the processes of the reverse movement of commodity values now and in the future. Application of the logistic approach in management return and reverse flows of goods and material values enables a comprehensive approach to the implementation of key processes and tasks management of reverse flows, provides increasing consumer satisfaction, obtaining additional income and supporting life product cycle. For this, you need to consider the issue of reverse logistics as integral part of a complex mechanism into a single system supply chain and logistics management micro- and macro-level systems.

2. Research methodology, data and hypotheses

The circular approach begins to be applied already at the moment of design, while products are developed taking extended service life, reconstruction, remanufacturing and recovery of raw materials into account. The production process moves from the use of raw materials to the use of recovered components and recycled materials. Such circular value chain requires an established yield management program supported by optimized reverse logistics solutions and infrastructure.

Companies that want to join the circular economy and expand their supply chain to include the return of used products and materials for recovery must understand the requirements and maturity of their reverse logistics infrastructure. Therefore, the Ellen MacArthur Foundation has developed a model of reverse logistics maturity (The Reverse Logistics Maturity Model – RLMM) to support companies on this path [1].

The model describes the characteristics of successful reverse logistics processes in various dimensions. Companies with varying levels of circular economy implementation experience will find the model useful for reviewing, developing and improving existing or planned profitability management processes. RLMM is a unique and powerful tool that helps companies to:

- understand the requirements for return management and reverse logistics according to the product archetypes;
- assess the maturity of planned or existing return management processes;
- improve reverse logistics to increase efficiency and optimize recovery and remarketing;
- establish integrated logistics and, as a result, increasing the sustainability of the supply chain;
- increase the transparency of returned goods and the corresponding demand in secondary markets;
- strengthen and expand the company’s circular approach to use market potential [1].

Return management systems and return logistics requirements are differentiated based on product attributes and business model. Within the framework of the reverse logistics maturity model, experts at the Ellen MacArthur Foundation identified three demand-driven archetypes, depending on the type of product.

Each archetype sets its own requirements for reverse logistics systems and has its own set of criteria that lead to success. For ease of use, archetypes contain the following information:

- product attributes;
- product examples;
- requirements and consequences of using reverse logistics;
- a prototype solution along the main components of the circular supply chain;
- key success factors by group: network design, return stimulation and remarketing opportunities [1].

The first archetype is extended producer responsibility with low cost. Such features as mass production, distribution through retail networks, and relatively low residual value at the end of the product's life cycle are inherent in goods of this type.

Examples include tires, shipping pallets, consumer electronics, etc.

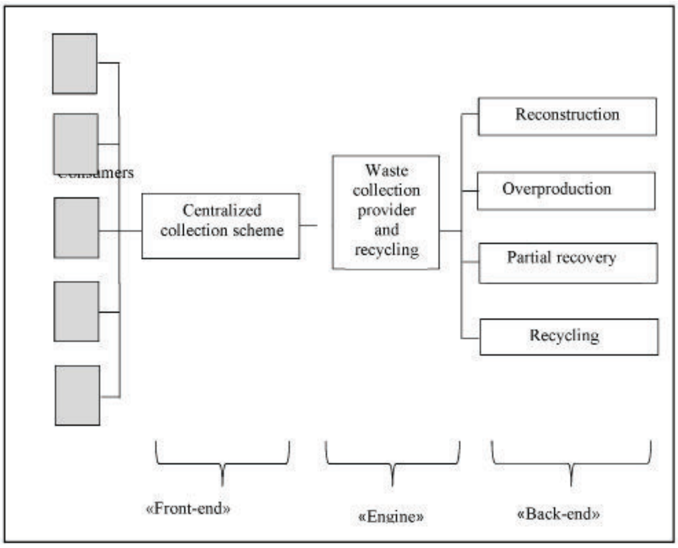
The requirement for this archetype is to strengthen the legislation on the extended producer's responsibility, especially for consumer electronics.

For the best preservation of value at minimum costs, it is necessary to maximize returns and standardize the reverse logistics process [1].

The first archetype involves the use of a centralized collection scheme with consolidated processing of returned goods through a waste collection and recycling service provider (Fig. 1):

Centralized scheme of international collection of used goods

Fig. 1



Source: built by the author with data from the Ellen MacArthur Foundation

The key factors in this scheme's success are:

- consolidation of returned goods to increase the economic efficiency of collection from large geographical regions;

- involvement of existing and not fully utilized direct logistics systems to ensure recovery of returned goods and waste (for example, packaging);

- adaptation of reverse logistics solutions to different geographical areas and regional conditions (market conditions, legislation, cultural aspects) for maximum efficiency;

- creation of cooperation programs to increase returns;

- introduction of incentives for consumers to return products (easy accessibility and transparency of issue points);

- pre-sorting of goods, so that only usable materials are filled in reverse logistics flows;

- outsourcing processes of returned goods to providers of this service in order to release materials to the secondary market outside the business model of the primary company [1].

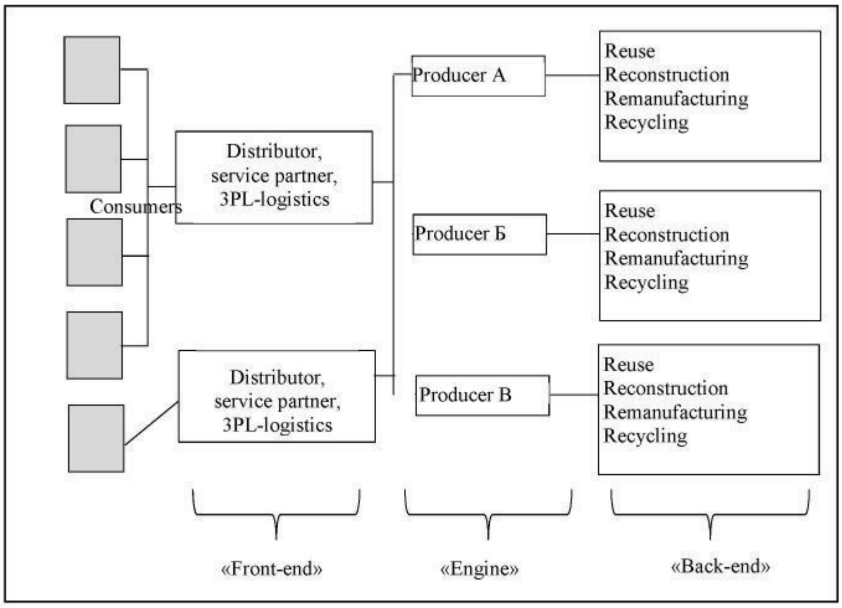
The second archetype is the logistics of spare parts, which is usually applied to such goods as machinery, equipment, machinery, car parts, etc. The characteristic features of these goods are relatively higher residual value with moderate expected rates of return, as well as a constant need for them to ensure uninterrupted production or provision of services.

Such logistics system must combine the return of used parts with the supply of new or refurbished parts to ensure seamless replacement of spare parts, and there is a need for highly optimized transport flows [1].

The operation scheme of the second archetype consists in the existence of a certain number of service providers for the collection and recycling of goods, which they receive from consumers, sometimes with the help of special vehicles (Fig. 2).

The scheme of international operation of spare parts logistics

Figure 2



Source: built by the author with data from the Ellen MacArthur Foundation

The key factors in this scheme's success are:

- tracking of spare parts and their condition at the stage of use for return and replacement planning;
- implementation of combining methods the delivery of new spare parts with the collection of parts and packages;
- partnership with logistics service providers for integrated delivery and reverse logistics;

- providing customers with a simple process of returning and exchanging parts;

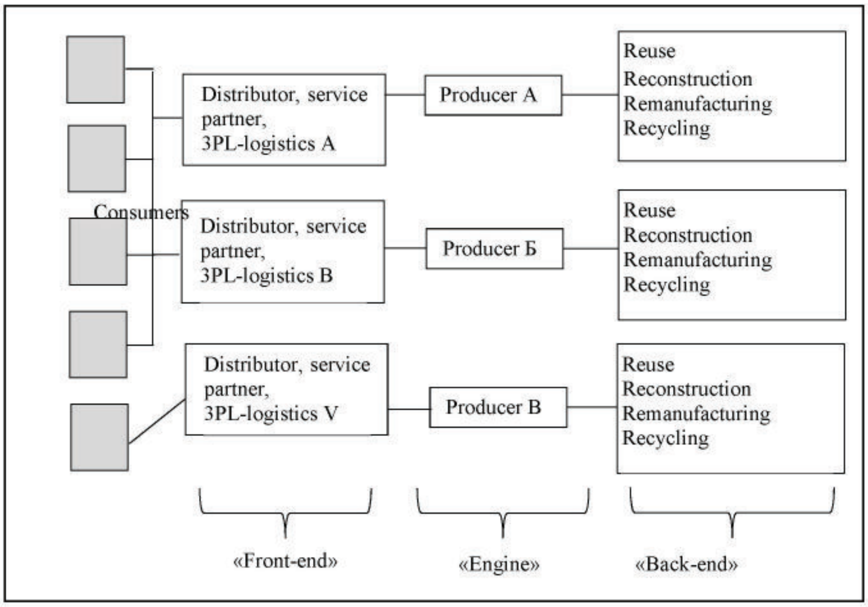
- expansion of the transport system to additional logistics services, such as installation, uninstallation and packaging;

- outsourcing the processing of returned products to recycling companies for the secondary market, except for new original parts [1].

The third archetype of reverse logistics is designed for advanced industrial products, namely information and communication technologies (ICT), medical equipment, etc., which are relatively complex to manufacture and have high residual value with relatively low returns. Such products require high standards of safety, responsibility and careful handling and must retain and maximize their return value [1]. The functioning of this type of reverse logistics is based on the direct collection of products from consumers, or through trusted companies that provide the following services (Fig. 3):

The scheme reverse logistics for high-tech products international functioning

Figure 3



Source: built by the author with data from the Ellen MacArthur Foundation

The key factors in this scheme's success are:

- establishing control over forecasts and stocks of returned products to ensure rapid redistribution and resale;
- tracking the condition of products during use and return;
- correct processing and packaging of returned products;
- partnership with logistics service providers for integrated delivery and reverse logistics;
- direct or trusted delivery and returns for customers;
- expansion of the transport system to additional logistics services, such as installation, uninstallation and packaging;
- using the results of tracking the state of products during use and return for product design and production planning [1].

Having considered the various archetypes and the logistical requirements they entail, it is worth looking at the components of the circular economy value chain that are important for reverse logistics. For a structured assessment, the reverse logistics maturity model focuses on three key components: front-end, engine, and back-end. "Front-end" includes reverse logistics processes and processes with corresponding planning and monitoring.

"Engine" deals with the recovery of returned products, including recovery strategy, inventory control and material evaluation. "Back-end" refers to the remarketing of recovered products on secondary markets, starting from the development and planning of relevant markets and ending with the monitoring of recovered products [1].

Since reverse logistics design requires a holistic approach, components such as the "engine" and "back-end" are included in the reverse logistics maturity model, even though they are not directly related to the process. Such integrative approach supports the transition from process management to a comprehensive perspective of business model development.

Each of the three components of the RLMM is characterized by three elements that reflect different levels of decision-making in the company: strategic, tactical, and productive. This framework allows businesses to create the necessary capabilities to address return, recovery, and remarketing issues at a strategic and tactical level, while simultaneously addressing relevant performance issues to support monitoring, planning, and execution of return management [1].

At the "front-end" stage, the maturity of the logistics strategy, its main drivers, as well as business and functional integration are considered in the strategic dimension. In the tactical dimension, the model considers the reverse structure and planning of logistics networks as well as defining requirements and goals for returning products. As for the productive dimension, it measures the responsiveness and visibility of returned items in the reverse logistics flow [1].

At the "engine" stage, at the strategic level, reflect the recovery strategy and its alignment with business goals. At the tactical level, the model helps to evaluate the process of inventory control of returned materials. The productive level considers the process of evaluating the returned material and how it affects the recovery process and product design [1].

The "back-end" stage includes the evaluation of information on the remarketing of products in secondary markets at the strategic level and the planning of remarketing and pricing of remanufactured goods at the tactical level. The performance level includes an assessment of the availability and use of demand and remarketing data in secondary markets [1] (Table 1).

Directions at different levels of decision-making according to RLMM

Table 1

Components RLMM	Levels of acceptance decisions	Directions of work
«Front-end»	Strategic	Reverse logistics strategy
	Tactical	The structure of the reverse logistics network
	Productive	Responsiveness and visibility elements in the flow of reverse logistics
«Engine»	Strategic	Recovery strategy
	Tactical	Control of stocks of returned products
	Productive	Evaluation of the returned material
«Back-end»	Strategic	Remarketing in secondary markets
	Tactical	Remarketing planning for secondary markets
	Productive	Remarketing data

Source: compiled by the author with data from the Ellen MacArthur Foundation

Conclusions

Logistics is a major factor contributing to the expansion of circular economy approaches in various industries, namely the reverse logistics model, which covers not only the collection and transportation of materials and goods, but also value-added activities such as testing, sorting, recovery, recycling and redistribution.

The Ellen MacArthur Foundation has developed a reverse logistics maturity model that helps companies understand the requirements and maturity of their reverse logistics infrastructure in order to join the circular economy and expand their supply chain.

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