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Corresponding author: aleksandra.pavicevic@fpssp.edu.rs

REVERSE AND GREEN LOGISTICS: WAYS ZA IMPROVE ENVIRONMENTAL PROTECTION

Aleksandra Pavićević

Faculty of Business Studies and Law, Union - Nikola Tesla University, Belgrade, Serbia

Abstract: *reverse and green logistics: ways to improve environmental protection*

Green logistics policies represent a strategic advantage over the competition. While adding value to companies and separating them from competitors, they represent a good basis for the company's future business, which must inevitably be sustainable. As a new concept in logistics, reverse logistics has become increasingly important when it comes to a sustainable strategy. The strategic factors that make companies increasingly choose reverse logistics are related to costs, overall quality, customer service, environmental concerns, and the law. The main goal of this paper is to present the logistics activities' impact on the environment and to point out the importance of green supply chain strategies and reverse logistics activities.

Key words: *reverse logistics, green logistics, environment, proactive strategies, fast fashion.*

INTRODUCTION

The non-stop and rapid increase of environmental problems forces companies to approach their business responsibly. Organizations need to actively deal with the issue of environmental protection and take precautionary measures concerning climate change. The government and customers are paying increasing attention to the problems of resource depletion and environmental degradation. All of the above are just reasons why companies must include environmental management and assign importance to it when planning long-term development strategies.

Reactive approaches are no longer enough when it comes to sustainable business, but they are necessary for companies to proactively contribute to this important segment within the daily activities they carry out and thus have a certain impact on the environment. Proactive strategies have a positive impact on the competitive advantage in the market. Also, they have a positive influence on a business's reputation and brand image of the company in the eyes of suppliers or customers. In addition to all of the above, a company has a greater possibility of making a profit in the business through responsible business and thus strengthens its financial position in the market. Recognizing these advantages, companies today manage the environment, and they develop proactive strategies for its preservation. Businesses are constantly facing progressing pressure from society and regulations to show that they operate responsibly and are environmentally capable of protecting the environment. As a consequence, sustainable supply chains emerge as a key parameter for considering whether a company is operating responsibly or not.

For modern society, environmental problems are not a new thing that appeared on the market overnight. The influence of certain factors, caused by the decisions of humanity, only gains importance much later when it comes to the environment and its harmful impact on it. More and more information is available every day, which helps to see the current environmental problems with the bigger picture and thus make them easier to understand. Today, the factors that have left the most devastating effects on the environment are known and are most often interconnected. For that reason, it is important to look at the negative factors together and keep track of the changes that are felt by their influence on a global level today.

Reverse logistics is quite a new concept in logistics, and it has proven to be a significant part of the business, contributing to a higher degree of profitability and sustainability. These are the main reasons why reverse logistics is gaining more and more attention. Reverse logistics emphasizes reducing and replacing resources over reuse and recycling. The strategic factors that make companies increasingly opt for reverse logistics relate to costs, overall quality, customer service, environmental concerns, and the law. According to the traditional approach, a product is developed through production and goes through a supply chain to be sold to a customer, as the final destination of the supply chain. However, supply chains constantly integrate more activities than those that deal only with supply, such as services and product renewal.

The paper focuses on the renewal of products, components, and materials, through reverse logistics. In addition, the paper represents the impact of logistics on the environment, and an example of the approaches in the “fast fashion” industry when it comes to environmental protection.

1. THE LOGISTICS IMPACT ON THE ENVIRONMENT

Companies around the world often turn to promote “green” business to increase their brand image and improve public relations, rather than doing something radical about the harmful impact on the environment. The easier way is to have “green” messages that protect the brand’s reputation, without concrete actions. When viewed from a business perspective, the most important goal of sustainability should be to maintain the physical environment, so that it contributes to a high level of economic activity in the long run [6].

Logistics is responsible for various external effects, including air pollution, noise, accidents, vibrations, land occupation, etc. [13]. As climate change is one of the biggest, if not the biggest, challenges facing the human population globally, truck emissions are a key segment of environmental pollution that needs to be addressed. There are two levels of environmental impact on logistics and they can be classified into first-class and second-class impacts. When it comes to first-class environmental impacts, they are directly related to freight transport, storage, and material management. On the other hand, impacts that are classified as secondary include those impacts that are the product of first-order operations. Globalization has made it possible for the necessary products or raw materials for products to be delivered from parts of the world that are less developed. This has led to an increase in freight traffic in such places, the need to increase road infrastructure and as a consequence, there are adverse effects on the environment [7].

Logistics plays an important role when it comes to achieving a competitive advantage in the market. The integration of logistics processes and functions enables the company to achieve efficiency in the organization and raise the business to a higher level. As a consequence, there are several options for approaching problem solving within logistics activities [2]. Figure 1 shows a diagram of the relationship between economic, environmental, and social goals in terms of logistics.

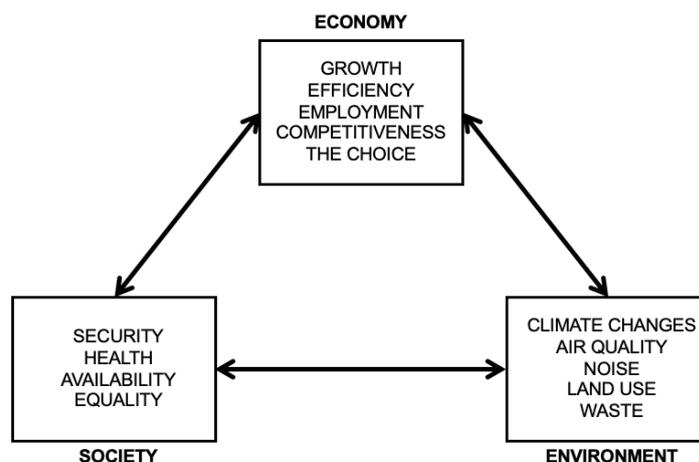


Figure 1. Balance between economic, environmental and social goals in terms of logistics [2]

Ecological sustainability is reflected in the ability of the environment to constantly and continuously maintain the level of accuracy. As two main goals, environmental sustainability should lead to minimal damage to the environment, and in the event of a process that destroys

the environment, stop and eliminate that process. On the other hand, the term economic sustainability refers to the mechanism of achieving economic growth, with strict respect for environmental constraints [2]. Logistics has a direct impact on the environment through [2]:

- Choosing the proper type of transport;
- Preference of suppliers with shorter routes;
- Use of trucks that produce less harmful gasses;
- Use of returnable containers;
- Use of recyclable packaging or those with biodegradability.

Indirect logistical impacts are related to [2]:

- assessment of the approach of environmental contractors;
- use of technology without harmful effects on nature;
- use of low-toxic materials and large recycling of products and raw materials.

When describing the transport, warehouse, and management of products, the term commonly used for these activities is logistics. Raw materials are monitored from entry into the warehouse or in the production process, until the final delivery to the point of sale or the customer. Although the importance of logistics for business performance has always been known, only in the last few decades has this topic been intensively discussed, through academic studies and papers. Studies from the beginning of the development of logistics terms focused on its contribution to business profitability, as the only goal of conducting logistics activities. Only at the end of the XX and from the beginning of the XXI century logistics has been discussed in a different context, without maximizing profits [12]. Certainly, the impact of logistics on the environment is the main reason for concern and a new angle of view of logistics activities. Air quality is impaired by distribution logistics activities, transport vehicles produce noise and vibrations, accidents are possible when transporting goods. All of the above further contributes to global warming. Green logistics is also called sustainable logistics, and its main task is to reduce the harmful impact on the environment, which occurs as a product of the movement of raw materials, semi-finished products, or finished products. On the other hand, green supply chains aim to reduce the negative impact through the redesign of the procurement, distribution, and reverse logistics management processes. This is achieved through redefining the routes, keeping the vehicles moving as little as possible, eliminating any inefficiencies in the process, and managing the waste disposal process.

2. DEVELOPMENT OF REVERSE LOGISTICS

Due to environmental problems that are growing exponentially every day, reverse logistics is becoming an area that is gaining importance in many organizations. Laws, consumer pressure, competition, and corporate social responsibility also have an impact on changing the behavior of companies in terms of environmental protection. Reverse logistics includes the process of collecting already used products by customers, so that they can be reused, repaired, enter a new production process, or simply be responsibly disposed of [9]. On the other hand, traditional logistics is characterized by a one-way flow from the entry of raw materials into the production process, to the finished product, without feedback. All participants in this process act independently and individually, without exchanging information with others. Flexibility is not a characteristic of traditional logistics, which requires companies to have a large amount in stock, as the only form of defense against changes or volatility in demand. This approach, due to the turbulence of the modern market, has been shown to pose a great risk and unfavorable conditions for the survival of the companies that apply it [5].

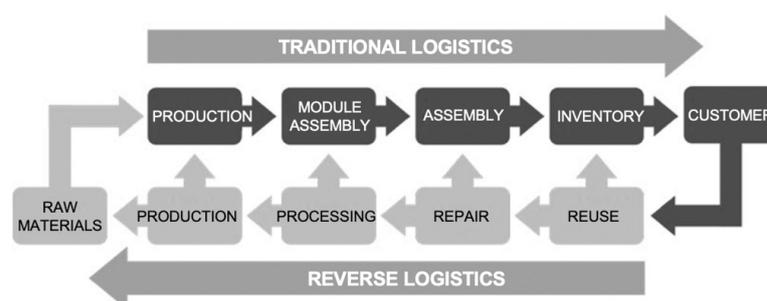


Figure 2. The difference between traditional and reverse logistics [5].

One of the main goals of reverse logistics is the collection and replacement of materials, and thus the promotion of significant economic gains and the addition of greater environmental values to the product. Reverse logistics has a significant presence in actions aimed at protecting the environment with the aim of sustainable development. Effective planning of this process has become essential for companies and society, as solid waste is becoming a problem for many cities around the world. This reverse process is directly related to the recycling process, and thus a large percentage of the waste is again given the chance to become a raw material and enter a new production process. Materials that enter the reverse logistics process can be categorized into two groups. They can be products or packaging. In the case of products, it is necessary to carry out repair, recycling, or disposal activities on them, after the customers have returned them.

There are four main reasons for implementing reverse logistics [9]:

- a) legal issues that require institutions to have answers to problems arising from waste disposal;
- b) environmental awareness, where the process of reverse logistics contributes to the spread of awareness among all those involved in the process and among customers;
- c) strategic differences contribute to the company to improve its brand image, responsiveness, and level of quality in meeting customer requirements;
- d) lower costs and higher income are a direct consequence of the use of materials that are not discarded but reused.

Reverse logistics aims to simplify the use of the remaining usability of the product, which is on the reverse side within the green supply chain. The key stakeholders in the return process are companies hired by the manufacturers. They carry out the product disposal process itself after the life cycle is over.

Resellers, developers, and consultants of reverse flow management technology, infrastructure, and software are also paying increasing attention to reverse logistics in practice. Resale, modification, reuse or production, recycling or disposal of products - these activities may include attempting to recover the product [4].

2.1. Main activities of reverse logistics

Within reverse logistics, there are three main activities, which will be described below: collection inspection and sorting, and recovery of products [8].

2.1.1. Collection

The collection is considered to be the first very important element within reverse logistics. It refers to all activities that enable the availability of used products and their physical movement to a point where further treatment for product modification is carried out. Collection in some countries is imposed by law, for certain products, such as packaging materials in Germany and white and brown goods in the Netherlands.

The collection process also includes assigning locations to collection centers. There are several models developed to determine the optimal number of collection and recovery centers, as well as hazardous product disposal sites. There are three ways to collect [8]:

- collection from Original Equipment Manufacturer (OEM);
- collection at sellers;
- collection from independent suppliers.

2.1.2. Inspection and sorting

After the products are collected, the following process is to inspect and sort them. These two processes involve a series of operations that serve to analyze whether a particular product can be used in re-production or not. If the analysis determines that this is possible, it is still necessary to define the extent to which the product can be used.

From the point of view of the location of the inspection and sorting activities, it is possible to conduct them in a centralized or decentralized location. If it is carried out in a centralized location, then it is usually a process of recycling construction materials or carpets. The disadvantage of a centralized location is the fact that the right information on the amount of waste will be available after everything is transported to the facility where the testing is performed, and the transport of these materials itself requires high costs. On the other hand, decentralized sorting and inspecting sites can be used more often in the case of paper recycling, renewal of machinery or equipment. The great advantage of such a system is that waste is identified in the early stages and thus transport costs are reduced. The most important

requirement of such systems is an investment in their technology and reliability to adequately implement the given activities.

2.1.3. Recovery of products

Product recovery is an important reverse logistics activity for managing the flow of products or parts intended for remanufacturing, repair or disposal, and resource efficiency. It is usually conducted to restore hidden value, to meet market demands, or to meet government regulations.

As part of the product recovery phase, product repair, reuse, product renewal or reprocessing, recycling or disposal are carried out. When a situation arises where a product is returned to the organization from which it came to market, it can conduct a recovery process for that product. Seven recovery options have been identified: reuse, repair, recovery, recycling, return, and disposal [11].

If the product life cycle is not over, it is possible to sell the product as used, at a lower price than the original. Another option for such a product is to repair and bring the product to a suitable shape, by replacing parts that do not work. Also, there is an option to resell the product, but now as a refurbished unit. In that case, the product returns to a satisfactory level of quality and does not lose its originally established identity. It is also possible to replace some obsolete parts with new ones if the technology has changed in the meantime. It is possible to decide to re-enter the production process. This includes its disassembly into parts and reassembly and preparation for re-entry into the market. The option that can be said to be under number five, concerning the previous ones, implies the selection of parts that have a higher value, and are part of the returned product. In the case of recycling, the product can later be used as a raw material for the production of some other products. The last, seventh option, is product disposal. This decision is made if there is no way to use the product after processing. From an economic and environmental point of view, recovery is a way to achieve many sustainable development goals.

2.2. Waste management

Local governments and agencies are forced to pay attention to strategic planning of solid waste collection and disposal. This topic occurs as a consequence of the increase in production, where solid waste is exited from production processes. The main task is to adequately manage waste, especially solid waste, to prevent the spread of negative impacts on the environment.

2.2.1. Hazardous waste

Dangerous and harmful substances, which can harm living beings, can be found in use in everyday life, whether in companies or households. This type of waste is classified as hazardous waste, which requires special treatment and handling, to prevent further spread of harmful effects on the environment. Typical examples are paint products, solvents, some batteries, household cleaners and pesticides. If this type of waste ends up in a landfill or there is no adequate management of hazardous waste, the consequences for the environment can cause great damage. For this reason, some regulations cover how this type of waste needs to be managed. During transport, it may be necessary to take into account the risks of hazardous waste, as well as the economic aspects.

Several different models have been developed for the management of hazardous waste disposal and their management. Each target model has the following [10]:

- minimizing total operating costs;
- minimizing the overall perceived risk;
- equitable distribution of risks among the population;
- impartial distribution of hazardous waste caused by the operation of the treatment plant.

2.2.2. Household waste collection

The issue of waste collection is a naturally complex process, due to numerous factors and limitations that need to be covered. To develop a precise model of hazardous waste management, it is necessary to have information on the following items [10]:

- expected quantity/weight of the waste category to be collected and the seasonal variability factor;
- the current system according to which waste is collected on a daily/weekly / monthly level and opportunities that may arise as the potential for the future;
- collection frequency;
- territorial orientation of waste collection centers and factors that may affect the restriction of access to these sites;

- places available for disposal, management, and their working hours;
- places available, vehicles are parked and their working hours;
- capacity and number of available vehicles;
- request for the labor force and work shift plan;
- restrictions concerning road networks, where the aim is to avoid traffic centers and traffic jams;
- costs related to waste collection and disposal.

The biggest challenge facing local environmental agencies is how to conduct the hazardous and solid waste collection, especially when it comes to urban areas. This refers to the issue of defining routes for waste collection, transport capacity, number of employees, etc.

2.2.3. Routing problem

If we have an undirected graph and denote it as $G = (V, E)$, the notation V represents a set of nodes, while the notation E is for the number of branches. The number of nodes within a graph can be represented as a vehicle capacity of n nodes. The number of vehicles can be a fixed number or it can be a variable value. A subset of t branches requires vehicle servicing. There is no limit to the number of passes through the branches. Each branch bears costs marked c_{ij} and claims marked k_{ij} . The goal of the problem is to solve which set of routes contributes to the minimum costs, and each movement starts and ends in the depot. Total demand does not exceed V .

This is the problem of routing capacity, and the main goal is to reduce the total movement costs. Another requirement is to reduce the total routing time, in which case it starts from reducing the longest route.

2.3. Information flow in the reverse supply chain

The exchange of information between companies has long been recognized as a competitive weapon that improves company performance. The type of information exchanged typically includes production planning, inventory levels, occupancy rate, forecast accuracy, promotion performance, pricing, sales data, and timely delivery. This type of information exchange enables a higher level of operational efficiency within reverse logistics and enables a better angle of view of activities within the supply chain. As a result, lower costs, improved inventory management performance, higher revenue, profit, and ultimately a higher level of customer satisfaction occur. Also, the exchange of information appears as an important precondition for the implementation of successful cooperation. When there is a built-in trust and a well-established network for the exchange of information, there is a greater chance that companies will share among themselves how the supply chain could be improved.

A more important issue that managers may notice is that companies need to consider the context of reverse logistics to successfully invest in information technology. Information technology is a key segment that managers need to focus on and see organizational issues and issues related to human resources in the company.

Within reverse logistics, there are three ways to provide support through information systems (IS). They can be defined as capability, compatibility, and technology [11].

Capability within an information system refers to the accuracy and availability of information. Compatibility represents the level of simplicity/complexity of the system for use, and technologies include automated material handling equipment, bar codes, EDI, and radiofrequency. Also, managers need to ask whether investing in IT can improve the operational attributes of reverse logistics, such as efficient monitoring and efficient planning [11].

Operational processes tend to support each other - improving one leads to improving the other. So, for example, if a company efficiently plans reverse logistics, it will lead to more efficient business. This effect can be called the domino effect and is an encouraging discovery for further steps and any manager within reverse logistics. Improving one area of business has a positive effect on improving other areas. In this way, managers have reason to seek greater investment in reverse logistics from top management.

3. REVERSE LOGISTICS IN FAST FASHION

In order to see the importance of reverse logistics, it is important to follow market developments and successful examples of companies operating globally, with a sustainable development strategy incorporated into it. The world of fast fashion has dramatically changed

consumer expectations and increased the production cycles of the retail industry, which has left a significant impact on the environment. The number of garments purchased annually increases by 60%, and the product life cycle is half as long as 15 years ago. As consumer behavior is constantly changing, and requirements are becoming more complex, this trend has not bypassed the fast fashion industry either. Many companies within the fashion industry, to meet all the consumer needs, at the right time and with the right products, have neglected the harmful impact on the environment in the process. The length of the product life cycle within fast fashion has significantly decreased, and it is an incredible fact that 60% more clothes are bought annually today, for which a large amount of chemicals and water is consumed in the production process. As consumers' awareness of climate change grows, they are now more willing to set aside larger sums of money to buy from companies that operate responsibly towards the environment. In this way, companies can gain a competitive advantage in the market.

H&M, based in Sweden, was the first on the market to make radical changes in the functioning of the fast fashion industry. CEO Carl-John Persson stated that behind H&M is a vision that they want to lead a change towards the recycling process and renewable fashion. The golden goal that the company has set is to create a climate-positive value chain by 2040, through the use of energy from renewable sources and the reduction of energy consumption in all phases of business.

The first steps that the company has already taken, to achieve its goal of using 100% renewable energy, have been largely realized during 2015 and 2016. At the end of 2016, the company has 96% of the energy that comes from renewable sources. Also, when it comes to carbon dioxide, as another major pollutant, the percentage of this gas in 2016 decreased by 47% [3].

In terms of recycling, H&M has developed a platform for collecting clothes that customers no longer use. Through this mechanism, customers are encouraged to get involved in the company's environmental goals, through coupons and vouchers for discounts of 15% [3]. The donated clothes are reused in the production process. This strategy of the company has contributed to reducing the harmful impact of the manufacturing sector.

The company has committed to including the following items in its supply chain by the beginning of 2030 [3]:

- In terms of raw materials, the company has committed to using exclusively 100% sustainable cotton, recycled material, or other sustainable materials in production by 2020;
- For the production process, the company aims to achieve zero emissions of harmful and hazardous chemicals, reduce process waste and introduce modern production technologies that consume less water;
- The goal for physical stores where products are sold is to reduce electricity use by 25%.

Many believe that the goal for 2040 is optimistic. A company the size of H&M has a great challenge ahead of it to eliminate carbon dioxide from the business. The shortcoming of H&M's strategy is reflected in the fact that the focus is on preventive measures, and the missing part is the focus on current problems with climate change. They are the ones that can have consequences on the company's business. Today, temperature changes, rising sea tides, and natural disasters are the most prominent influences on a business. All of the above can increase the costs of raw materials, transportation costs, and production operations of the company.

The role that H&M could take on the market very quickly is to be a leader in terms of sustainable fast fashion. Reverse logistics and sustainability are still a concept in the business of the new area and provide a competitive advantage, soon this will not be the case. Sustainable business will become a part of every company, regardless of which industry it belongs to. H&M is making a big step forward by meeting the goals for sustainable business, and in the future, it can transfer its "green" practices through the entire supply chain and the parties involved in it. The education of employees, suppliers, all associates of the company and customers, is a big step forward that the company is ready to make, to expand awareness of environmental protection.

CONCLUSION

The implementation of green logistics and supply chain management strategies, in general, is an important component of sustainable development. Companies are located between two goals, which cannot be mutually exclusive if the activities are managed adequately. On the one hand, the goal is to reduce the growth of climate change and the need to reduce the social and

environmental footprint of logistics, and on the other hand, to continue to maintain a profitable business. The ultimate challenge is to integrate these goals into one.

There are several problems with recycling, reuse, recovery, or proper disposal of products. The primary obstacle to the practice of reverse logistics programs in some organizations is the lack of knowledge and misconceptions. Although reverse logistics is a term that has been appearing more and more frequently in the literature in the last few years, in practice it is still not widely spread, due to all the challenges that the application of this concept brings with it. In addition to the constant increase in external pressures in the distribution market, it is worth considering all the advantages of reverse logistics. It is already obvious today that reverse logistics will play a key role soon. The quality of the process within reverse logistics will have a great impact on the competitive position of the company in the market. Thus, through business, companies will have an impact on the sustainability of supply chains and the entire industry.

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