A C T A U N I V E R S I T A T I S N I C O L A I C O P E R N I C I
DOI:http://dx.doi.org/10.12775/AUNC_ZARZ.2020.1.006 ZARZĄDZANIE XLVII–NR 1 (2020)

Pierwsza wersja złożona 21.06.2020
Ostatnia wersja zaakceptowana 28.08.2020

ISSN (print) 1689-8966
ISSN (online) 2450-7040

*Aleksandra Furtak, Błażej Mach**

# GREEN SUPPLY CHAIN. DEVELOPING LOGISTICS WITH CARE FOR THE ENVIRONMENT

A b s t r a c t: Significant environmental changes over the last few decades have influenced the perception of the supply chain. The increasing awareness of the public has definitely changed the perception of environmental performance, which has motivated entrepreneurs to adapt to new concepts. New methods and tools have been developed to support lower material consumption and reuse.

K e y w o r d s: ecological supply chain, green supply chain

J E L C o d e: O30

## INTRODUCTION

Observed increase in global warming and environmental pollution, cause the compulsion to implement solutions aimed at minimizing harmful human activity.

The analysis of the results showing the pace and scale of the occurring phenomena alerted governmental organizations which, by actively supporting entrepreneurs and informing individuals, lead to an increase in conscious concern for our planet. Grants were introduced to encourage environmentally friendly activities.They had a significant impact on the reconstruction of the business model of entrepreneurs.

Over the last few years, the international organisation Greenpeace has influenced the directions of development in the supply chains of the world's largest companies. Representatives of the organizations took various actions to promote the latest solutions. An example of this is the Kleercut campaign, which has enabled Kimberly-Clark to abandon clearing of ancient forests following its new policy.

* Contact information: Aleksandra Furtak, Błażej Mach, Gdynia Maritime University, Faculty of Navigation, Department of Transport and Logistics, ul. Morska 81-87, 81-225 Gdynia, email: furtak-aleksandra@wp.pl, mach_b@interia.pl

Today, sustainable development policy focuses on using resources for future generations. According to this idea, the environmental impact of a product starts at the early stages of production and not only after consumption. The supply chain covers all logistics processes. This is where the authors of the article decided to focus on presenting the potential of green supply chains as an important tool in the development of ecology.

A closed supply chain gives the opportunity to reuse raw materials that reduce the amount of waste produced.

Due to these economic and environmental benefits, it is no longer only non-profit organisations that are involved in the development of the ecological basis. The society also follows this trend, which forces entrepreneurs to pay more attention to company standards.

## 1. DIFERENCES BETWEEN ORDINARY AD GREEN SUPPLY CHAIN

The main feature differentiating green supply chains from traditional ones is to close the product life cycle as tightly as possible. Trying to maximise the recyclability of materials is one element of their greening.

Due to the differences in the functioning of the presented supply chains, their optimisation overtones are different. The classic flow of information, services and products is based on improving efficiency and maximising benefits for participants, including manufacturers. It is aimed at increasing the efficiency of the services provided, customer satisfaction with the lowest possible economic losses.

The optimisation of green supply chains is based not only on reducing monetary expenditure but also on reducing environmental costs by reducing energy and material losses. An increase in the amount of money spent on ecological processes suggests that it could reduce economic profits, but this thesis is refuted by W.R. Stahel and M. Borlin in which they show that achieving more profits in a circular economy than their opponents in a linear relationship. This has to do with the benefits of reuse and reduction of resource consumption.

Financial benefits also come from the reduction of supply chain elements. Minimising the number of intermediaries not only reduces the amount of money that would be transferred to other companies, but also saves time on service, which would increase as the number of chain elements increases.

The traditional supply chain seems to be simpler to build, with the potential result of increased ease of use and a lower maintenance price. This is only a short-term perspective. Research indicates that in a longer analysis it is ecological solutions that bring greater benefits. In addition, companies using renewable energy sources rely on a raw material that is produced anew as opposed to fossil energy. Despite such broad benefits, company presidents are still delaying the

introduction of innovative solutions. This is due to the fact that the introduction of ecological supply chains requires not only large changes in the company's operations during their introduction, but also constant monitoring and maintenance of the introduced processes at an adequate level. Another aspect that does not convince entrepreneurs to revolution is the prospect of profit in the long term. Nowadays economics is understood by the balance of profits and losses occurring here and now, which effectively discourages companies from trying to reduce the environmental impact of their activities. The classic logistics solution is so eagerly promoted, despite such negative long-term effects, due to the possibility of simple and transparent evaluation of its effectiveness and functionality.

That is why it is so important to assess the effectiveness of the green supply chain, which is one of the most important tests of supply chain management. It covers not only the internal functioning of the company, but also the interaction between entrepreneurs, suppliers and producers. An exemplary indicator to determine the nature of the chain is the KPI. It allows to measure the effectiveness of work, and through the results determine the most practical and important elements that should form the basis for the functioning of the company.

When analysing green supply chains, the most important factor will be the environment. The factors determining the indicator are four areas: cost, quality, flexibility and time. There are interconnections between them, which together form a supply chain measurement network. The KPI consists of three basic levels of measurement: strategic, tactical and operational.

Table1. Selected supply chain KPIs

| Area | Subcategories | Meter / indicator name |
|---|---|---|
| Cost | Total cost | Total supply chain cost |
| | Main processes | Cost: delivery, production, distribution, procurement |
| | Supporting processes | Information flow index; transport cost index, material flow index, procurement cost index, innovation process index |
| | External costs | External costs (environmental) |
| Time | Leadtime | Leadtime: orders, handling processes, manipulation, manufacturing, production, delivery |
| | Reaction time | Reakcyjność, gotowość dostawy, szybkość przepływu informacji |
| | Punctuality | Reliability of delivery |
| | Rhythmicity | Periodicity |
| | Reliability | Delay rate, downtime, average delay time |

| Area | Subcategories | Meter / indicator name |
|---|---|---|
| Quality | Customer satisfaction | Product availability, complaints, completeness of deliveries, openness of information, accuracy of communication |
| | Infrastructure | Level of computerisation, technical infrastructure, environmental performance |
| | Processes | Processes of adding value, improving process execution, planning precision |
| Flexibility | Risk | Accuracy of forecasts, spare capacity indicator, process execution risk, information availability |
| | Service | Flexibility of supply, availability of supply |
| | Specifics of the market | Seasonality, nature (characteristics) of the product |

Source: Tundys B., (2016), *Mierniki i wskaźniki w ocenie zielonego łańcucha dostaw*, Research Gate.

## 2. CHARACTERISTICS OF GREEN SUPPLY CHAINS

Green supply chains may be introduced through local supply chains or in global networks covering several regions. Local networks are relatively easy to implement into the market due to the lack of need for specialized methods. For this reason, this solution is particularly popular with food producers with low production capacity. This idea is beneficial for both the environment and the entrepreneurs themselves, as it aims to introduce a minimum number of cells, which are key people throughout the product life cycle. This solution enables the use of the latest logistics solutions available to the public. This solution is based on direct delivery of products in boxes by farmers to the door of the house, purchase of products at local fairs or festivals. The people who have produced the goods become marketers, suppliers and managers.

Urban centres that try to support the development of local agriculture offer the purchase of agricultural produce from local farmers and pass it on, for example, as snacks for the youngest children. In countries such as France and Italy, many schools, hospitals and nursing homes provide their pupils with fully balanced meals by using this method. On the other hand, however, suppliers are required by law to deliver their products within a limited period of time, which usually includes a few days. Thanks to this, food products maintain the highest quality by reducing the use of preservatives and eliminating the freezing process. This is a typical solution beneficial for both the environment and farmers. This saves the farmer on storage and electricity costs associated with keeping the stock in good condition. On the other hand, the carbon footprint is reduced by reducing energy consumption.

In our country, this way of delivering products with a short shelf life is also widespread. The special popularity occurred during the outbreak of the coronavirus pandemic, when freedom of movement was restricted. One such platform is lokalnyrolnik.pl, where you can purchase products from local producers through online orders. The creators of the platform themselves point out that shops which buy goods from a farmer and sell them to the target customers, thus increasing the price, do not work in this way. The solution is limited to the role of a virtual marketplace, where farmers can offer and sell their products through modern contact with the customer.

The benefit of such solutions is financial transparency, which is clearly defined by a limited number of intermediaries. Due to the local character of the solution, purchasers often know the manufacturers personally, so they know what is the ratio of production price to product sales. In addition, consumers also know how the products offered to them are obtained and what their quality is. Thanks to the use of a short supply chain, the host needs relatively little money to saturate the market.

Such supply chains exist only at the stages of their implementation. Only 1% of food products on the Finnish market are introduced via short chains. The European leader, France, which introduces agricultural products using the method described above is 16%. The most important thing to develop the trend is to change the way consumers think and open up to the local market. The activities of local governments in this field encourage recipients to use offers that are friendly to both the environment and the local entrepreneur, but the final choice is up to the client and it is his decision to define the direction of development of this method.

The environmentalist model used in companies with large capital expenditure is closed supply chains. Their main idea is to close the chain in whole or in parts. For this reason, this solution differs from short supply chains in the way it reduces the negative environmental impact. Short chains focus mainly on distribution and less on the production of goods. Closed chains are designed for the reuse of elements such as packaging or used components of larger systems. However, the construction and functioning of this type of chains is much more complex and is not limited to just one fragment, but covers the entire cycle.

This is why they are implemented in large corporations, whose logistics processes also form a complex network of connections. Although the main objective is to reuse the materials used, chain closing starts already at the production stage. In ordered to put the material back into operation, it is necessary to prepare it properly and sometimes even change the material used. The simply reactivating waste to the market is also an ambiguous and gradable process.

One of the basic factors for closure is the reintroduction of products already on the market as they are. An example of such a phenomenon can be shops

offering second-hand clothing or the vehicle aftermarket. A chain that intervenes more in used products is characterised by the fact that damaged waste returns to the manufacturer, who makes repairs and sells it again. The ultimate way to close the product's life cycle is to reuse the waste produced during exploitation. For example, bottles which, when they are emptied, return to the producer, where they are cleaned or remelted and reused as packaging.

Another way to close the cycle is to reduce energy expenditure during production and also distribution of products. In order to achieve the greatest possible savings, companies are increasingly looking for details in terms of reducing the consumption of parts and energy. The method of managing the conditions in the warehouse using pro-ecological methods includes such aspects as the use of appropriate, energy-saving light bulbs with a built-in system manipulating the level of brightness; appropriate configuration of the arrangement of windows increasing the amount of light coming in. These types of elements make up the final result, which allows to save considerable financial resources as well as reduce the negative impact on the environment. Based on the synergy of systems to optimise the use of resources in warehouses, the objective is to create a building with near-zero energy consumption. According to the assumptions, such a building, apart from low energy needs, is to be characterized by maximizing the use of energy from renewable sources.

The introduction of the latest solutions related to ecology is connected not only with revolutionizing the functioning of the company, but also with considerable financial outlays. This process is only beneficial in the long term, which is another reason why only companies with significant capital have the opportunity to introduce it. Despite considerable financial outlays, as well as a long wait for the growth of investments, more and more companies decide to introduce such solutions. Thanks to pro-environmental policies, businesses are better perceived by consumers, who are increasingly paying attention to economic growth based on ecological means. Companies that contribute to the promotion of green attitudes have a strong marketing argument whose value is constantly growing.

## 3. PRACTICAL EXAMPLES OF SUPPLY CHAINS

For marketing purposes, Polpharma is willing to use environmental aspects. On the main page there is a bookmark entitled „social responsibility", which includes, among other things, a presentation of environmental initiatives taken by the company. One of its elements is to present the functioning of ecological supply chains in Polpharm. An example of introducing ecology into the company's operations is the use of vehicles characterized by high durability of parts, as well as the use of elements recovered in recycling processes. The supply chain

is also closed at the production level, where the company works to maximise the reuse of solvents and other substances used in the production of medicines, as well as the use of biodegradable packaging. The company also declares the use of hybrid or green fuel vehicles.

The changes in supply were also introduced by Danone, which after analysing the supply routes decided to reduce them, resulting in a reduction in production of 6 g CO2/kg of product per year. The packaging of their products has also been modified so that it weighs less and as a result generates less waste. As the successful introduction of closed and green supply chains, more and more companies are also selecting collaborators and subcontractors that meet not only business but also ecological and social requirements. Before starting cooperation, Danone conducts an audit of the potential collaborator to check whether the company meets the requirements of the dairy producer. A similar strategy was introduced by Nestle. The company requires its suppliers to take care of the natural environment, especially water resources, as well as to improve the sustainability of resource use.

Kompania Piwowarska, like Nestle, also controls its business partners, which requires that its employees have appropriate standards regarding CO2 emissions, water and energy consumption. In addition to the requirements, Kompania Piwowarska also supports its partners in improving their sustainability processes and finding weaknesses and gaps in this area. The producer also works for the environment as well as the local economy through short supply chains. Approximately 85% of the raw materials needed to weigh the beer come from local suppliers.

Due to the nature of its activities, Ringier Axel Springer Poland has introduced *Six Forest Standards*, which concern development in the areas of sustainable development. The following are those that are directly related to environmental issues:

- *It is forbidden to cut down more trees than the reforestation of the land is expected;*
- *Biodiversity: forest management should not threaten the extinction of any plant or animal species;*
- *Control: the paper manufacturer should provide publicly available environmental indicators for its operations;*
- *Training: the paper manufacturer should provide basic environmental knowledge and education to its employees and subcontractors;*
- *Information: the paper manufacturer should keep the public informed of progress and possible risks to the environment.*

Partnership cooperation is also important not only to maintain established standards, but also to generate new ones. Especially when attempts are undertaken to optimise logistic processes taking into account the details of your business. An example of this is Coca-Cola, which in an attempt to reduce the amount of

water used in the production of 1 litre of beverage from 3 to 2.5 litres, thanks to cooperation with the World Wildlife Fund, has reduced water consumption by changing the way reed fields are irrigated from flooded to drip irrigation.

American management theorist: Peter Senge believes that in an era of increasing environmental awareness of the public and analyzing the study contained in The Living Company, he presents a thesis that the key to the survival of companies in the market is to understand the community character of the company. According to the expert, this workplace is first and foremost a cooperative community of people, and only in the second place is it a creation that generates funds. This trend is becoming more and more popular among companies that care about eco-development. This affects the mutual support of companies, as well as the growth of care not only for capital, but also for the environment. Nowadays, companies make demands on this matter not only on themselves but also on their business partners, which positively influences the development of ecological attitudes. Additionally, non-governmental organisations, thanks to their non-commercial character and high level of knowledge and experience, advise companies learning to modify their business model to a greener one.

This also has a positive impact on the development of the economy, as the reverse flow of goods creates companies that collect, export and treat waste.

## SUMMARY

The introduction of the green supply chain requires changes from the lowest level of business operations, but also constant monitoring and maintenance of processes at the highest level. The results of the adapted action are only visible after some time, so it discourages introduction. However, the attributes of closed supply chains are worth noting.

The changes that are being introduced on the largest scale affect merchants, farmers and society as a whole. They are one of the greatest motivations for continuously modernising the supply chain. Extending the life cycle of products serves everyone.

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