

Green and Reverse logistics as the tools for improving environmental sustainability

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Abstract <p>Logistics plays a very important role in the industrial world. Globalization and population growth made logistics more in demand. Meanwhile the amount of waste from different processes is growing. Recently such concepts as green and reverse logistics have been developing. Therefore the main objective of the thesis was to answer the question: How and in what way the companies can implement green and reverse logistics concepts in order to improve the environmental sustainability?</p> <p>Green and reverse logistics are a complex concepts that encompass various processes and activities. They have a great potential to improve the condition of environment. The adoption of green practices were studied on the example of two companies Kesko and S Group. The results were positive. Both companies adopt various methods and techniques, such as production of renewable energy; control and efficient usage of light, ventilation and air conditioning; route planning and load optimization; efficient usage of vehicles; well designed and optimized packaging; reuse, recycling and proper disposal of waste and returned goods resulting in a positive impact on environment.</p> <p>The result showed that there are many things that still can be improved. Companies should shift from profit oriented way of thinking towards the environmental consciousness. In addition to that governments must provide a proper conditions for green and reverse logistics implementation. The main goal of each organization must be continuous development of its operations and processes for the improvement of environmental sustainability. Only with everyone's contribution the mitigation of climate change and reduction of waste can be achieved.</p>		
Keywords/tags: green logistics, reverse logistics, sustainability, environmental sustainability, Kesko Oyj, S Group, Inex Oy.		
Miscellaneous -		

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1 Introduction

1.1 Background

This topic was chosen because of the author's personal concerns about the environmental impacts of logistics and the awareness of importance of protection of our planet and its resources.

Nowadays logistics plays a very important role in the industrial world. With technological innovations and development, globalization, growth of population, and increasing numbers of goods consumed logistics becomes more demanded. At the same time the wastes which are results of different processes and operations also grow. Logistics processes and operations are an evitable part of every company to make a good and profitable business. However, logistics has a very crucial impact on the environment.

According to Alan McKinnon (2015), first concerns about the damaging effects of logistics were expressed in 1950s, but it is claimed that before 1960s there was very small interest in that field. Green logistics as we know it today takes its origins from 1960s. Since then government and public pressure has forced companies to develop the concept of green logistics. (McKinnon, 2015)

Green logistics is a very wide area and it develops quickly. This term is closely connected with such concepts as green warehousing, green transportation, green packaging, waste managements, reverse logistics and so on. Author of the thesis believes, that green logistics should keep pace with technological innovations and growing demands for goods in order to maintain the balance between the environment, economy and society. However, the ecology and its state should always be in priority. Therefore, the concept of green logistics is a good way for companies to become environmentally friendly and reduce its harmful impacts on surrounding nature.

1.2 Research objectives

The main objective of the thesis is to answer the question: **How and in what way the companies can implement green and reverse logistics concepts in order to improve the environmental sustainability?**

Additional objectives are:

- Define what kind of benefits companies can achieve with implementation of green and reverse logistics
- Find out what kind of drivers and barriers for implementation of green and reverse logistics.
- On the examples of two companies to see how green and reverse logistics are used, compare findings and propose suggestions for development.

1.3 Research methods

The most common way to expand the knowledge about something is to investigate the topic using a research method. In different industries the most common ways of conducting research are qualitative research and quantitative research. (Mora, 2010)

The qualitative research method was chosen as the main method for this thesis, but there will be some features of the quantitative form. The explanation of each method and their comparison is described below.

Qualitative research is claimed to be exploratory. It is mainly used when the expectations are unknown, when the problem must be defined and a proper approach to it must be found. This method is also used to explore the problem from the insight and study different details and nuances related to the main issue. (Surbhi, 2016)

Quantitative research believed to have a close connection with different data that includes numbers. It is also called an empirical research or conclusive and it can be exactly measured. This research also tries to find a connection between the causes and effects of two variables relying on statistics and mathematical calculations. (Surbhi, 2016)

Firstly, the difference between those two is that in qualitative research, a person may only know some small details about what he/she is looking for, while in quantitative form a researchers know clearly what to look for (Surbhi, 2016). In this thesis the author has not so much knowledge about the green and reverse logistics as its relatively new field of study. At the beginning of research the author gathered information related to the main topic- exploring the field. After it the researcher condensed the information in order to find the one which has links to the main objectives of the thesis. It can be claimed that during the research the author was expanding his knowledge about the green and reverse logistics. After it he filtered and condensed the information in order to make the right conclusions achieve the set objectives. As it has been mentioned before qualitative research is exploratory and quantitative research - conclusive. Thus, qualitative form is more appropriate at the beginning of the study.

Secondly, the reasoning method used to synthesize information in qualitative form is inductive, while in quantitative its opposite- deductive. Therefore, at the beginning of research the author was first concentrating on finding the appropriate to the topic data from different sources such as: articles, web sites, books and Internet. After it he collected all the proper data and generalize it. As the author is following bottom up approach, that characterizes inductive reasoning, it can be said that in the theory part the qualitative method is the right one to choose.

Thirdly, the data collected from different sources was mostly text, pictures that is typical for qualitative method, but there was also numerical and measurable information. Thus the combination of both methods was used.

Lastly, in the practical part the author used interviews and questionnaires to collect the appropriate data for achieving objectives. Interviews can be related to both methods- qualitative and quantitative. When comparing two companies and making a suggestions for improvement- quantitative research method was used since the data was measurable and conclusion were made based on it. (Surbhi, 2016)

At the Figure 1 it can be seen what kind of research methods were mainly used and for which part of the thesis.

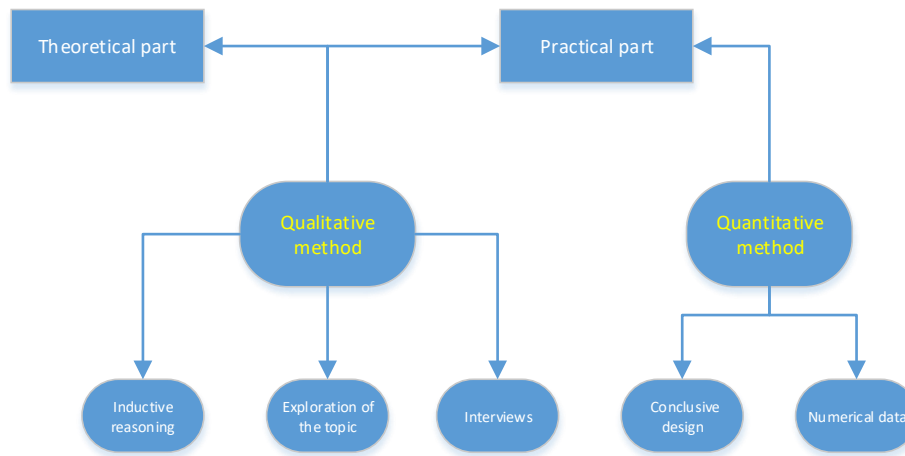


Figure 1. Thesis framework

1.4 Theoretical framework

The theoretical part of the thesis concentrates on the concepts of Green and Reverse logistics. In the beginning of each chapter the concept is described and the step-by-step investigation is done. Bottom up strategy is used to introduce and explain the main ideas and issues to the reader. This approach was chosen to introduce the topic to the reader in the best possible way. It investigates each part of the concept separately and then brings all the important ideas together, thus allowing to answer the set objectives.

In addition, such terms as sustainability, especially environmental sustainability, and green supply chain management will be partially touched, since they have a close connection with green and reverse logistics.

All the data for the theory part was collected from different sources such as: books, articles, Internet web pages.

In order to make a clear view of the whole work, author depicted the main parts of the research in the Figure 2.

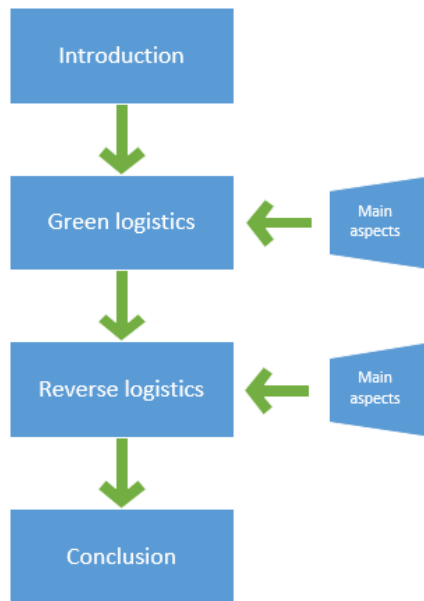


Figure 2. Theoretical framework

2 Green logistics

In this chapter the concept of green logistics will be described. Since the term of green logistics is new in the logistics industry and still developing it is crucial to correctly define the term and find out its meaning. Author also pays a big attention on the connection between green logistics and sustainability, especially environmental.

2.1 Definition

Green logistics as a term consist of two words “green” and “logistics”. In order to get the meaning of the concept more precisely author decided to clarify each word separately, thus to get a deeper imagination about the meaning.

Brewer, Button and Hensher (2008, 339) define logistics as the main component of transportation network whose mission is to organize and control goods movements. According to their words, logistics is an evitable part of modern transportation system and plays a crucial role in the goods movement. Nevertheless, logistics covering a lot more than just a transportation of freight and its control and other definitions are a clear prove of that.

According to Stukalina (2014, 5) logistics is defined as the organization of the flow of products, people, information, energy and resources between the point of origin and the point of consumption in order to meet or exceed the customers' expectations. This definition makes logistics term more clear and easier to understand and encompasses much broader things. From Stukalina's statement it is seen that she takes into consideration not only the transportation of goods, people and information but also resources and energy, which have a close connection with environment and the word "green".

Ronnie Garrett (2012), in his article "The Difference Between Green And Sustainability", defines green as items or services that have no harm to environment and are safe for people.

It can be claimed that logistics is a service in some way, thus combining two words green logistics can be defined as "The management, control and organization of the flow of goods, freight, energy, information and people between the point of origin and the point of consumption with no or minimum harm to environment"

In order to justify researcher's definition of green logistics here is the understanding of it from other writers. Sbihi and Eglese (2007, 99) connect the concept with sustainable production and distribution of goods. Carter and Rogers (2008), state that green logistics includes all activities related to the eco-efficient management of the forward and reverse flows of products and data from the point of origin to the point of consumption striving to exceed customers' demand". It can be concluded that researcher interpreted his understanding of the term correctly.

2.2 Sustainability and green logistics

With the growing concerns about the state of environment such term as "sustainability" become more frequently used. What does it mean? According to Veleva and Ellenbecker (2001), sustainability is the process of creation of goods and services with no harm to environment, minimum usage of energy and natural resources; economically efficient and safe for employees and customers.

The term “sustainable development” officially was presented at the United Nations Conference in 1972. This concept was based on the idea of protecting the environment and develop industries in order to improve their eco-friendliness. Since that time, it is considered that sustainability term is based on ecological roots. However, later the society and economy were included into this concept. (Nagham et al., 2013)

As it has been defined sustainability consist of three pillars: environmental, social and economic performance (Figure 3). According to Mintcheva (2005), green logistics is a broad field that encompasses economic, environmental and social elements.

Thus these two terms are closely related.



Figure 3. Three components of sustainability

If to interpret sustainability as a system a clearer picture can be get. Figure below shows more understandable relationship between three pillars of sustainability.

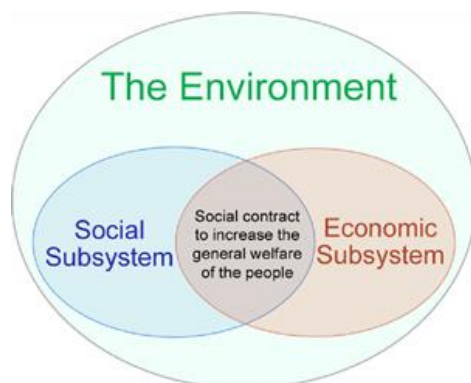


Figure 4. Sustainability as a system (Twink.org)

According to the writers, the largest system is environment where humans live in. It has two main subsystems represented by society and economy. When people agreed

to form a government they formed a social contract to increase their general welfare. This contract serves as a connecting link between the social and economic subsystems. (Twink.org)

The whole picture of the system shows that wellbeing of people and the productivity of economy are linearly connected to the welfare of the environment. Thus the environmental sustainability must have the highest priority. (Twink.org)

This thesis is going to concentrate on the environmental sustainability, but if to consider that environment system include social and economic parts they are also partially taken into account.

What is environmental sustainability? According to business dictionary, it is maintenance of the factors, processes, activities that contribute and affect the quality and state of the environment on the long term basis (BusinessDictionary). Thus, the main focus of the thesis was to investigate how companies are adopting the green logistics and what is the current effect of their activities on environmental sustainability.

2.3 Green supply chain management

Green logistics has a very close relationship with green supply chain management. In order to prove that the concept of green supply chain will be partially introduced.

Green Supply Chain Management has been created as an approach for enterprises to make their businesses environmentally sustainable. According to Seuring and Müller it is the management of the flows of materials, information and capital as well as cooperation between parties along the supply chain while taking into consideration of all three pillars of the sustainability: economic, environment and social which are a requirements of customers and stakeholders. (Seuring & Müller, 2008)

The goal of green supply chain management is to concentrate on the design, lifecycle and disposal of an item in order to lessen waste and pollution. (Rehman & Shrivastava 2011, 345).

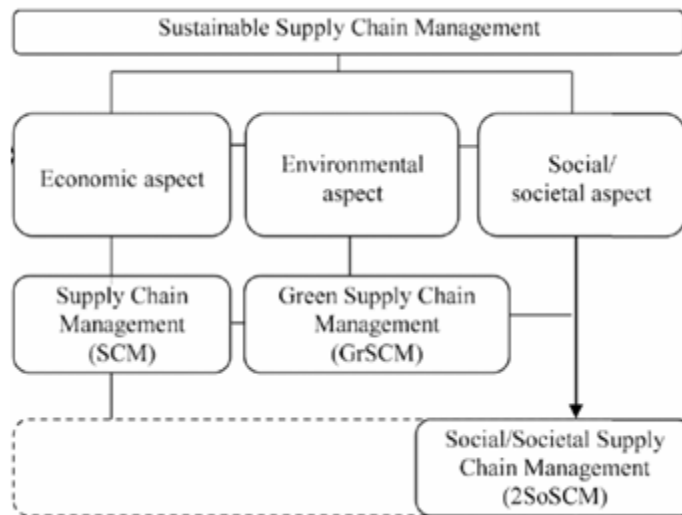


Figure 5. Green supply chain as a part of sustainable supply chain (Joëlle, 2013)

Referring to the Figure 5 from the Joëlle's book (2013, 58), it can be claimed that green logistics and green supply chain management are both dealing with being eco-friendly. Moreover, it depends how those terms are defined and interpreted. Some writers even consider those concepts to be as one same thing.

2.4 Environmental standards and regulations

2.4.1 European emission standards for trucks

There are many standards related to different types of vehicles. However, author decided to consider the heavy-duty vehicle emission standards as an example of European emissions standards.

The following table contains a summary of the Euro emission standards. The dates in the table indicate the establishment of new engine types. (TransportPolicy.net.)

Table 1. European Union standard for heavy-duty diesel engines, g/kWh

(TransportPolicy.net)

Tier	Date	Test	CO	HC	NOx	PM	Smoke	
Euro I	1992 (< 85 kW)	R-49	4.5	1.1	8.0	0.612		
	1992 (> 85 kW)		4.5	1.1	8.0	0.36		
Euro II	October 1996		4.0	1.1	7.0	0.25		
	October 1998		4.0	1.1	7.0	0.15		
Euro III	<i>Voluntary EEV (October 1999 to January 2013)</i>		<i>ESC & ELR</i>	1.5	0.25	2.0	0.02	0.15
	October 2000		ESC & ELR	2.1	0.66	5.0	0.10 0.13 ^a	0.8
Euro IV	October 2005	1.5		0.46	3.5	0.02	0.5	
Euro V	October 2008	1.5		0.46	2.0	0.02	0.5	
Euro VI	January 2013	WHSC	1.5	0.13	0.4	0.01		

Notes: a – for engines of less than 0.75 dm³ swept volume per cylinder and a rated power speed of more than 3000 min⁻¹

EEV – enhanced environmentally-friendly vehicles

The main objective of all those Euro standards is to improve the health and wellbeing of the European population and the state of environment. Other objectives include improvement of air quality by reducing amount of emissions from road transportation by the implementation of the emission limits for all vehicle categories. Also setting of harmonized rules on the construction of motor vehicles and providing easy access to vehicle repair and maintenance information. (RSA)

2.4.2 ISO 1400 standards

ISO 14000 family of standards set guidelines and rules for companies and organizations from different industries to manage their environmental responsibilities. For example ISO 14004:2016 sets the guidelines on how to develop an environmental management system (EMS) and link environmental management with an organization's complete business-management system (International Organization for Standardization). Environmental management system (EMS) encompasses all the activities that allow companies to minimize harm to the environment and increase efficiency of its operations. (Environmental Management Systems).

In addition ISO 14004:2016 describes how employees from different levels of the company are involved through the interconnected aspects of environmental management. Depending on the industry where the organization is, the standard recommends to find out and review the factors that affect the enterprise and how the company affect them. (Croner-i Ltd)

ISO 14004:2016 can be applied to any company. Standard sets a template for firms to consider the environmental effects of activities, products and services that should be

influenced during a life cycle perspective. (International Organization for Standardization).

2.4.3 WEEE and RoHS directives

In February 2003 European Union adopted its Directive 2002/95/EC, The Restriction of Hazardous Substances Directive, (RoHS 1); and Directive 2012/19/EU, The Waste Electrical and Electronic Equipment Directive (WEEE Directive). (Directive 2012/19/EU)

The WEEE Directive sets out the responsibilities of electrical and electronic equipment (EEE) producers for the collection and recycling of their products at the end of their lifecycle. (Export.gov)

The main objective of RoHS Directive is to ban manufacturers to use in their products lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE) which are harmful for human health and are hard to recycle. (Directive 2002/95/EC)

Both Directives set collection, recycling, and recovery targets for all types of electrical goods. In addition, they impose to create infrastructure for collecting EEE waste free of charge. Moreover legislations strive to contribute to the protection of society and environment. (Export.gov)

2.4.4 BREEAM and LEED

BREEAM (Building Research Establishment Environmental Assessment Method), first published by the Building Research Establishment (BRE) in 1990. (BREEAM)

BREEAM method is using various sustainability metrics and indexes that covers a range of environmental issues. It helps clients to manage their performance during planning, design, construction, operation or refurbishment in a sustainable way. This method allows to evaluate and assess company's energy and water use, waste and pollution management, health and wellbeing, transportation operations, use of resources and impact on the ecology. (BREEAM)

In addition, it strives to raise the awareness of the importance and benefits of the environmental sustainability, among owners, occupiers and designers. BREEAM allows to implement sustainable solutions in a most efficient way which result in an increased attractiveness and market recognition of BREEAM certified buildings. Besides, it minimizes the negative effects of construction and development on the environment. (BREEAM)

Another similar to BREEAM method is Leadership in Energy and Environmental Design (LEED) - it was invented and launched by the United States Green Building Council (USGBC). The main goal of LEED is to assess the environmental performance of a building and motivate managers for adoption of sustainable principles in the industry. (LEED)

LEED is not compulsory program, but LEED certification gives the company many benefits and gives positive environmental image to the people. Those benefits can be seen in energy and cost savings over the life of the structure, better air quality and more usage of daylight. This programme's goal is to help building owners and operators to be environmentally responsible and use resources efficiently. (LEED)

2.5 Drivers for practicing green logistics

In recent years there has been an increasing number of concerns about the impact of humanity on the environment. Therefore many companies are trying to find ways how to decrease the amount of waste and greenhouse gas emissions that comes from their supply chains. The implementation of green logistics is affected by different drivers and barriers. According to Niemann and others (2016, 978), Jain and Sharma (2014) defines drivers as "the forces motivating organizations to implement green supply chains whereas barriers are those forces hampering its implementation". It is very important to know and define all the drivers and barriers in order to improve companies' environmental impacts. In the next paragraphs the researcher will go through and describe some of the main drivers and barriers for "becoming green".

2.5.1 Governmental regulations and legislations

With the growing awareness of the importance of the environment condition, many governments have rules and legislations concerning the implementation of green logistics. Pressure that comes from the regulations and legislations considered to be one of the most crucial among reasons for practicing green supply chain (Rehman & Shrivastava 2011, 317). Referring to Routroy (2009, 23) the governments can be as a driver for the companies to make their activities green in three aspects:

- the government need to take a crucial part in the creation of regulation and companies' engagement in them;
- the government should create a good conditions for the development of innovative ideas in the most significant areas of green logistics;
- the government needs to launch some educational programs that will increase the environmental consciousness of ordinary citizens.

At the same time governments should offer a good financial incentives for decreasing emissions and improving energy efficiency. Different companies can use these incentive programs to reduce their carbon footprint, thus in its turn it will return in internal and external logistics benefits. (Emmett & Vivek 2010, 124-125)

Lastly, governments can apply lower taxes for the companies that are practicing green ways of doing business. Moreover, the modern buildings with eco-friendly technologies could be built as a motivation for different firms. (Lee 2008, 191)

2.5.2 Social and environmental factors

Satisfying customers' needs and requirements is the primary goal of every organization. Nowadays people become more concerned about the things that they buy. Customer wants a product to be made from recyclable and safe materials. Thus a companies' reputation and brand undertake a huge pressure when talking about environmentally friendly products. In order to strengthen its reputation different corporations often publish online different report, for example sustainability report, in order to show how their business is running and what they have done concerning the environment.

Hansen (2011, 8) claims, that social media plays a crucial role when talking about the adoption of green logistics. Television, newspapers and other sources inform and educate people about the environmental degradation. Therefore customers starting to think more about the environmental issues at an increasing rate. In this case it has a big impact on the way the organizations are doing their work.

Another important reason why more and more companies are motivated by the concept of green logistics is that different significant environmental issues emerged as a result of globalization, growth of economy and growing demand for production. Such things as rapid disappearance of rain forests, the depletion of the ozone layer, the pollution of air and water, and the scarcity of landfills are becoming more serious every day. The most crucial impact on environment has transportation, an evitable part of logistics. In addition CO₂ and other greenhouse gases which are produced by the transportation vehicles and manufacturing facilities have a big tremendous contribution on the global warming effect. (Maurer et al., 2014)

2.5.3 Economic and market advantage

The main target of each business organization in the world is to make profit. With implementation of different concepts of green logistics companies can achieve great savings. The results of good and well planned green system could lead to the waste reduction, less transportation costs, less energy cost, less material usage and in a result increase the profit, which is a big motivator for the firms to make changes. In addition such things as increased customers satisfaction, stronger market position, new market possibilities and competitive advantage could be reached. (Borodin, 2013).

Market factor effects the decisions of various businesses dramatically. Nowadays, manufacturers needs to comply with different environmental standards and requirements of different companies in order to sell their products in that area. Thus, green logistics is a way to follow those standards and stay strong and competitive in the business world. (Kim, 2010)

It can be assumed that some companies are following green tendency not to improve their environmental impact but in order to gain competitive advantage among rivals. The implementation of green logistics will create a value for an organization that in

its turn will result in a formation of different benefits that can be counted as an advantage in the market.

After defining the reasons that effect the decision of green logistics implementation, author has depicted on the Figure 6 the most important of them and came up with the conclusion that the most crucial factor is economic benefit, since making high profit it's the most important goal of many companies nowadays.

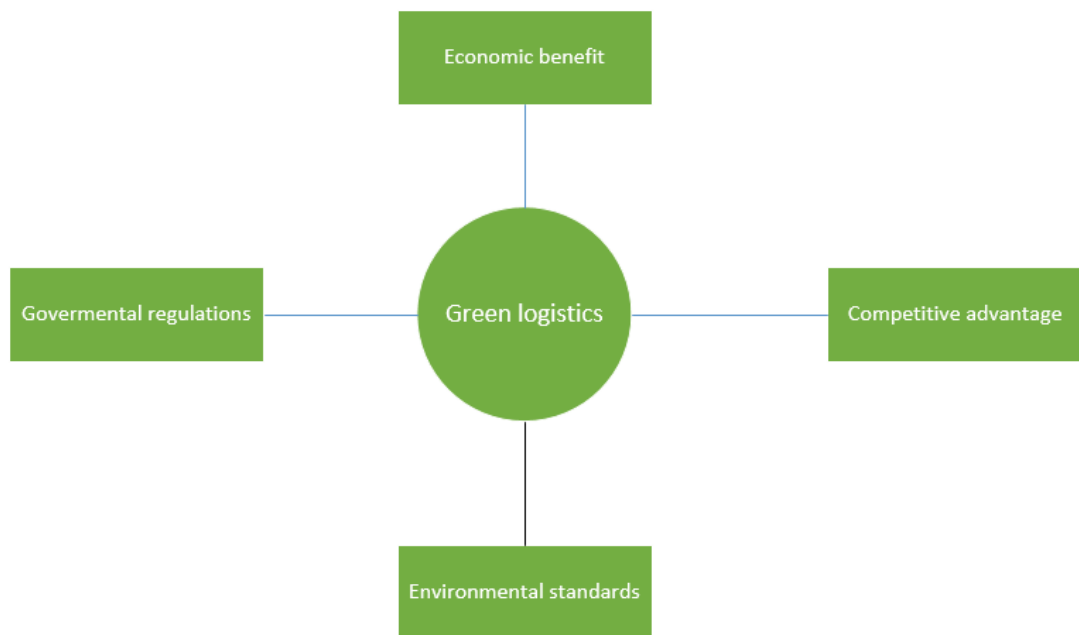


Figure 6. Most crucial drivers for green logistics

2.6 Barriers for green logistics implementation

In addition to drivers there are some barriers that are preventing or slowing the integration of the environmentally friendly solutions into logistics operations. Canadian Center of Science and Education (2012) depicts different barriers for adoption of green tendencies as a hierarchical system (see Figure 7). Further some of the barriers will be presented and explained.

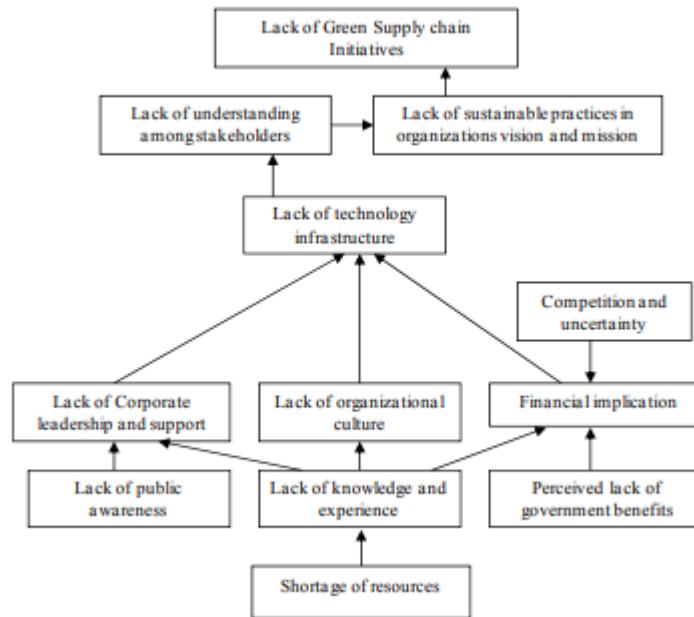


Figure 7. Hierarchical system of the barriers to green logistics (Canadian Center of Science and Education)

2.6.1 Costs

Adoption of green logistics concepts into the supply chains of different companies require a huge initial investment. Many organizations have very narrow vision when considering the usage of green practices. They do not look into the future and cannot see all the benefits that could arise from the implementation of green logistics. This is particularly seen when the companies have limited budget and need to prioritize their expenses according to urgency rather than importance. (Walker, Di Sisto & McBain 2008, 80).

High costs are a real problem when talking about the small and medium sized enterprises. In the opinion of Revell and his colleagues (2010), 75% of the small and medium enterprises think that high investment costs are the main barrier for them to implement environmentally sustainable methods into their operations. Paradoxically, in that report also stated that 53% of those companies are aware about the benefits which could be achieved with green logistics.

Srivastav and Gaur (2015, 8) claim that such things as purchasing of advanced and modern technologies, teaching employees through different educational programs and training or even hiring already qualified specialist will require huge expenses. At

the same time green practices could have a low return on investment in a short period which is not good for some firms.

2.6.2 Lack of a good IT system

Nowadays almost everything is done using computers and internet. Without a proper IT base it is very difficult to manage processes within and outside organization. Referring to the study done by Dashore and his colleague Sohani (2013), implementation of IT technologies is fundamental for every company and it is like a spine that keeps everything together. They also mention that IT is also crucial during different data and information exchange processes. It serves like a link between the customers, company and suppliers.

Researcher believes, that well-structured and planned IT system could also be a good solutions for small and medium enterprises. As it has been mentioned, for those companies costs and limited resources are the main obstacle. Thus, IT software can optimize all the inputs and outputs of the organization. With this strategies companies can minimize their concentration in some areas and focus on the most important and beneficial things that bring the value to the enterprise.

2.6.3 Lack of top management involvement

Lack of top management support is considered to be one of the most significant among other barriers. The owners and main shareholders of the company are the one who set the main targets and goals of the organization and decide what kind of methods of working and which tendencies are going to be followed.

Srivastav and Gaur (2015, 7-8) claim that the duty of every person from the top of the firm is to increase employee commitment and knowledge, motivate and encourage them, make an appropriate working surrounding and change the culture insight the organization towards green oriented. All of these can be achieved through various bonuses, easy and efficient communication within the company and productive trainings.

From the poor top management commitment derives poor organizational structure. In such enterprise employees are passive and impassioned regarding the promotion of sustainable environmental methodologies. (Lin & Ho, 2008)

2.6.4 Lack of governmental legislations and corruption

The absence of regulations, laws and legislations and support systems from the government are considered to be one of the crucial barriers to the implementation of green practices. Huge bureaucracy systems, time consuming regulatory requirements, high fees and taxes, limitations for business opportunities also demotivate and discourage companies to adopt environmental sustainability in their business activities. In addition, minimum governmental support for new innovations and ideas is another crucial barrier. (Srivastav & Gaur 2015, 7).

In some countries corruption inside the governmental system act as a barrier for sustainable development. It leads to the wrong and inefficient allocation of the resources. Even though there are regulations for firms to follow green tendencies, they can be easily neglected by simply bribing the officials.

2.7 Structure of Green logistics

Green logistics encompasses all the activities which are related to the environmentally friendly management of the forward and reverse flow of product between the point of origin and the point of consumption with a goal to meet or exceed customers' expectations. Green logistics implements the eco-thinking tendency into the organization's system, in order to maintain a balance between customers demand and environmental sustainability. (Carter & Rogers, 2008)

The scope of green logistics is very broad. Together with reverse logistics and closed-loop supply chain management, green logistics deals with environmental management and sustainability. Figure 8 depicts these three concepts and their main activities. (Zongwei 2011, 335)

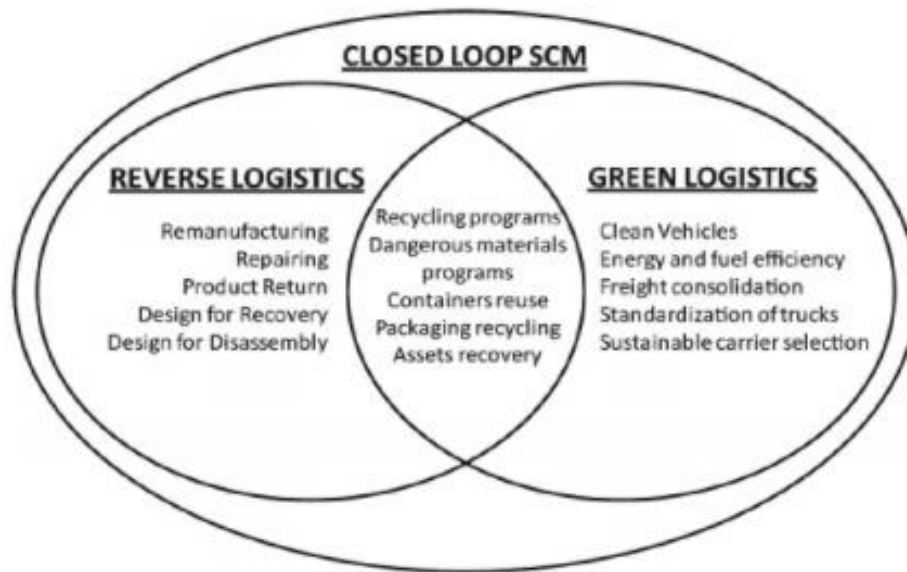


Figure 8. Green logistics and reverse logistics in closed loop
(Zongwei 2011, 335)

Thiell (2011), defines the main components of the green logistics system as: green transport, green warehousing, green packaging, green logistics data collection and management, waste management and reverse logistics (see Figure 9).

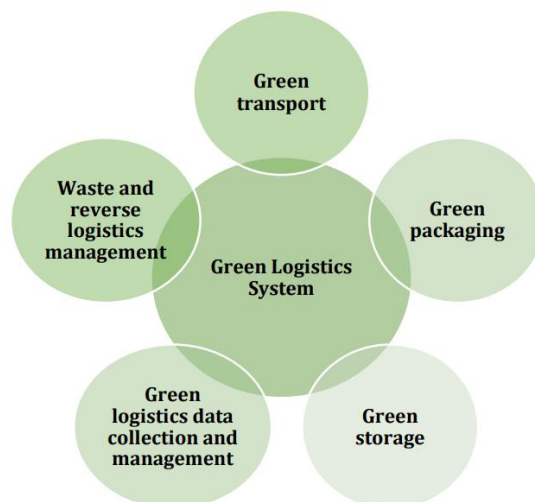


Figure 9. The structure of green logistics (Thiell, 2011)

Some activities of reverse logistics are overlapping with green logistics considering the environmental sustainability issues. However, author reviewed the concept of the reverse logistics in the separate chapter, in order to more deeply understand the effects of both concepts. Further in this chapter, the description of the main points of green logistics and their effect on the environment are presented.

2.7.1 Green transportation

Transportation is one of the main logistics activities and has the biggest impact on the environment. According to European commission (2015), transportation sector accounted 28.5% of total CO₂ emissions in EU-28 in 2015 (see Figure 10).

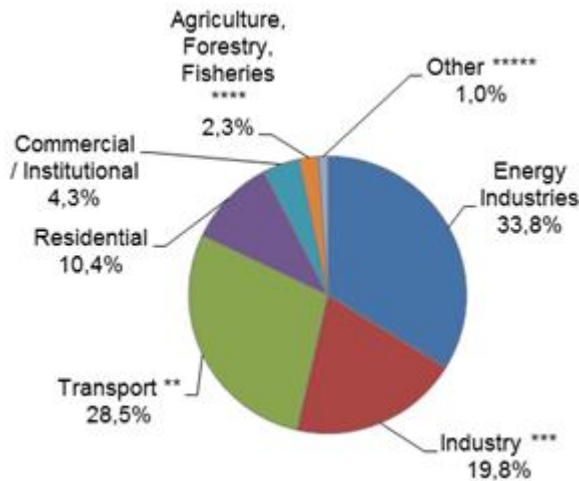


Figure 10. CO₂ Emissions by sector in EU-28, 2015 (European commission)

International transport forum (2015) believes that 30% of CO₂ emissions from fuel combustion are due to the international freight transportation, and it is more than 7% of global emissions. Freight transportation considered to be one of the main areas to implement green practices. The main goal of green logistics is to reduce emissions and energy consumption. Further some methodologies of how the companies can decrease their emissions will be introduced.

2.7.1.1 Modal choice

Choosing a right and most appropriate mode of transport is very crucial in terms of cost reduction and environmental impact. Companies should try to use the most efficient and effective means of transport in order to decrease their effect on the environment. Sea transport should be considered as the choice number one for firms. Despite the fact that it is the slowest mode, it has the least emissions numbers. The next choice should be rail and then road and air transport. As shown on the Figure 11 the most g of CO₂ per ton-km has air mode with 552 g CO₂/ton-km and least sea transportation with 6.04 g CO₂/ton-km. (Emmett, Stuart, and Vivek Sood 2010, 133)

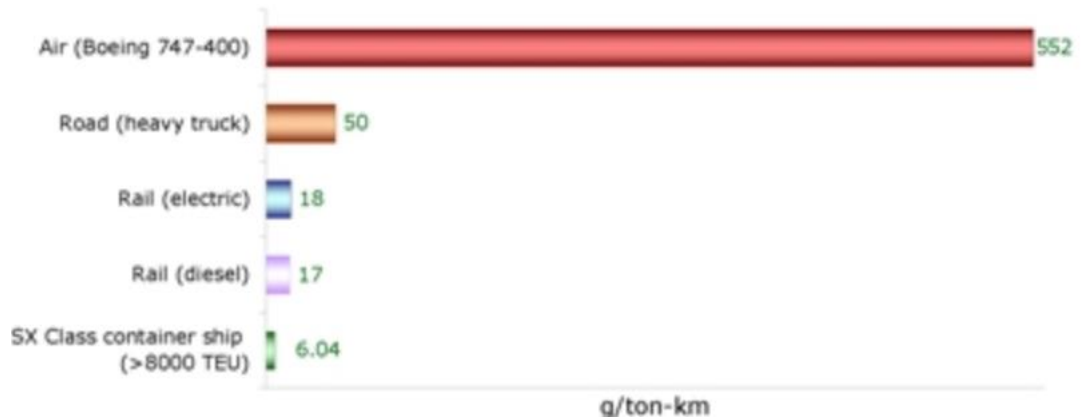


Figure 11. CO2 emissions of different freight transport modes in g/ton*km (Network for transport and the environment)

2.7.1.2 Modal split

Road transportation is one of the most commonly used methods of goods transportation in Europe. According to European commission (2015) road transportation accounted 72.9% of total transport greenhouse gas emissions in EU-28 in 2015, while rail mode only – 0.5% (see Figure 12).

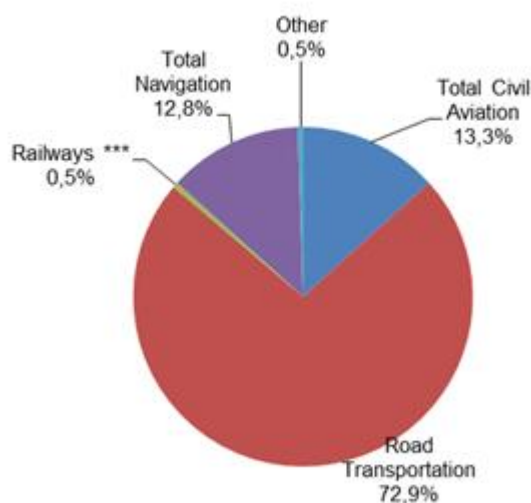


Figure 12. Share by mode in transport greenhouse gas emissions in EU-28, 2015 (European commission)

Without shifting to rail freight transportation there will be dramatically growth of greenhouse gases emissions in the future. In addition, changing the tendency in favor of rail will allow to cut down the energy consumption and lower the dependence on

fossil fuels. According to CargoBeamer (2016), 318 bn.tkm are transported by road, while on rail only 6 bn. tkm (Figure 13.).

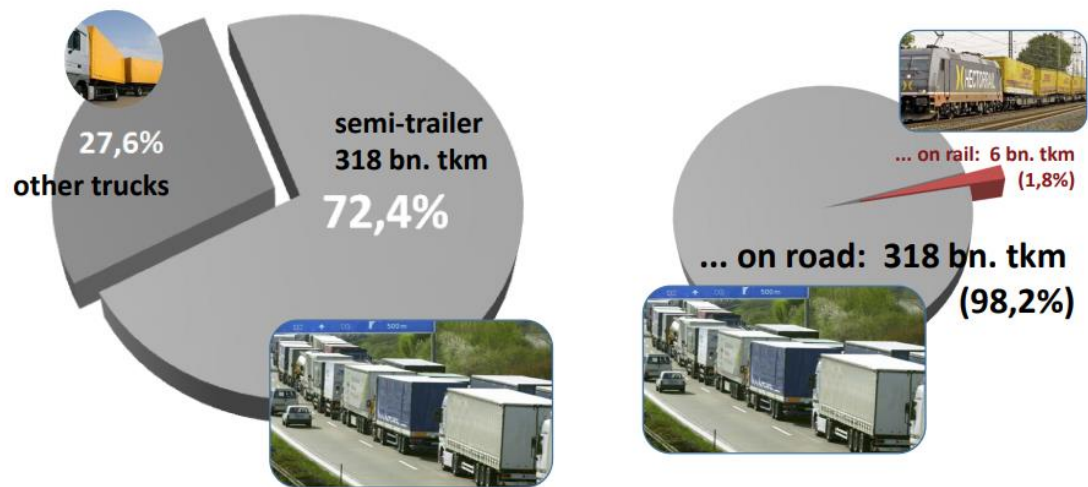


Figure 13. Transportation of semitrailers (CargoBeamer, 2016)

Moving of semi-trailer by rail or using a combination of two modes will allow to achieve good environmental results. Figure 14 shows that using rail mode of transportation can lead to 70% reduction in energy usage, 74% less CO₂ emissions and minimize NO_x emissions by 95%. (CargoBeamer, 2016). Thus, modal split is essential point in achieving the environmental sustainability and becoming more environmentally friendly.

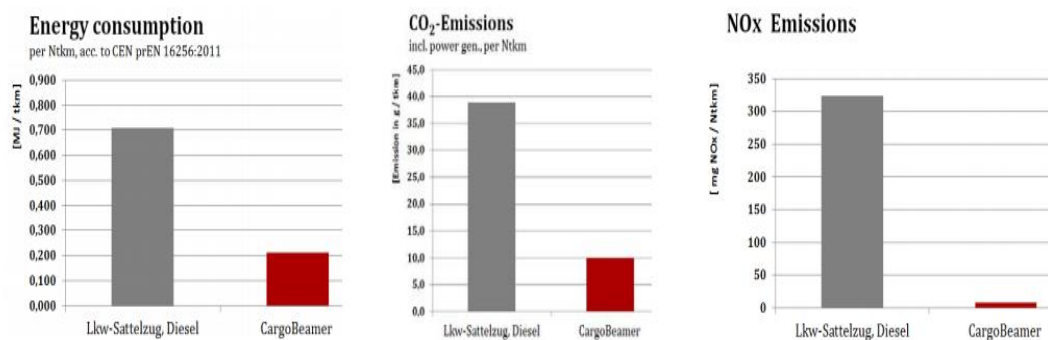


Figure 14. Truck vs rail semi-trailers transportation benefits (CargoBeamer, 2016)

2.7.1.3 Efficient fleet and personnel management

Planned and effective fleet management has a crucial role in the reduction of the environmental impact of freight transportation. Some of the actions that should be taken are turning off the engines during pick-up and deliveries, appropriate vehicles

speed, proper tire pressure all of these can reduce emissions. (Emmett, Stuart, and Vivek Sood 2010, 134)

Another important thing is good and regular maintenance. It ensures that there is no leaking fluids from different parts of the vehicle, the air pressure in the tires is good and all measuring equipment functions well. In addition use of biofuels, fuel catalyzers, and by-pass filters can also help to can reduce break-downs and lower fuel consumption and emissions. (Zongwei 2011, 338)

Moreover, drivers training and route optimization can also reduce fuel consumption. Various companies provide different bonuses and rewards for those drivers who achieved decrease in fuel usage. According to UK major fleet operators by good fleet management reduced driving distances by 15% and CO2 emissions by 23%. (Emmett, Stuart, and Vivek Sood 2010, 135)

2.7.1.4 Freight consolidation and load optimization

One of the most important thing is to use fully the carrying capacity of the vehicle, both on the weight and cubic meters basis. Sometimes many trucks drive back empty or half full, which is not efficient in terms of fuel consumption. Better load planning should result in incensement of transported volumes by one journey, resulting in less environmental impact.

Freight consolidation is another crucial tool of green logistics. Distribution centers (DC) allows companies to reduce driving distance and thus CO2 emissions. All the suppliers should transport the goods to one central warehouse, were goods are sorted and consolidated. Hence, all the goods with same destination will be transported in one truck, decreasing the number of movements through supply chain.

2.7.1.5 Other methodologies

Standardization of truck size also result in better environmental performance of the company. It will help company to planned and optimize its load and number of trips. In addition it will make easier and more efficient maintenance of trucks. Moreover, standardization is a requirement in the multimodal transportation that allows to save cost and CO2 emissions. (Zongwei 2011, 339)

Additionally, companies can outsource transportation. In order to green their services firms try to include environmental sustainability criteria in the carriers evaluation and selection processes. (Zongwei 2011, 339)

2.7.2 Green warehousing

Warehouses are an essential components in each industry, especially in logistics. It's not just a place to store goods and raw materials. Distribution centers and warehouses play vital role in each supply chain. It is very important how companies perform their warehouse logistics. Implementation of the sustainability into warehouses and distribution centers is a good way to be eco-friendly and sustainable. There are many ways how companies can greener their warehouses. Furthermore, some of them will be described. (Furtado Efacec, 2015).

2.7.2.1 Use of energy in warehouses

Energy is a vital component in every process in the warehouse. Every distribution center require a lot of resources in order to operate. According to statistics, energy amount needed for lighting and heating is 76% of total energy use in non-refrigerated-warehouses in USA (see Figure 15). (Business Energy Advisor)

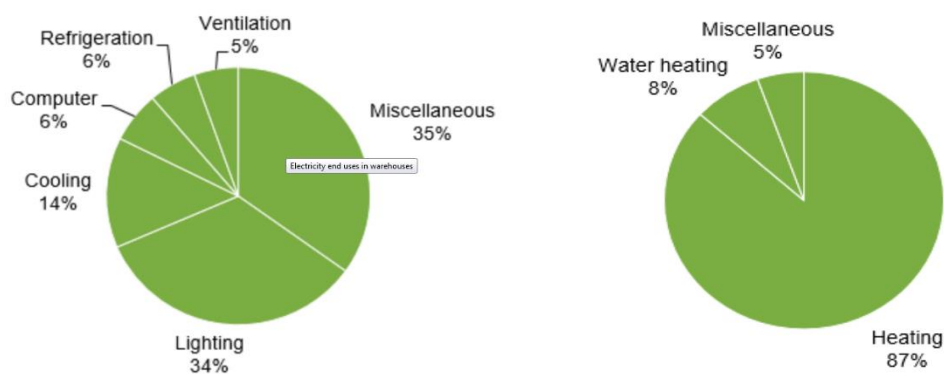


Figure 15. Electricity and natural gas usage in non-refrigerated-warehouses (Business Energy Advisor)

2.7.2.1.1 Lighting

On average energy amount needed to light the warehouse account for around 30% of total energy use. The implementation of sustainable lightning technologies is very important since the percentage of energy attributed to lighting in a facility is quite

high. The use of a daylighting technology will help make possible to save energy costs and decrease energy consumption in the long run. For example, setting solar panels on warehouse's roofs or use of wind energy can give positive results in saving energy. At the same time combination of artificial lighting with various sensors is a wise method, meaning that light can be tuned off in some parts of the warehouse that are not being used. (Napolitano, 2013)

Warehouses have a lot of roof space which enables them to be set up with solar panels to store energy during the day for lightning at night. Clear glass roofs are a good way to bring light into the building. Usage of transparent and translucent materials in roofing materials also will give a lot of light. Usage of energy efficient lightning like LEDs and the combination of passive solar lighting will lead to positive energy savings. (Napolitano, 2013)



Figure 16. Solar panels on the roof of IKEA's shop in Boston, USA (Greenguruguides, 2014)

The picture in Figure 16 shows how IKEA in Boston utilizes solar panels on the roof of its warehouse to decrease energy consumption. Annually, IKEA Boston can generate 1,078,200 kWh of clean electricity. (Greenguruguide, 2014)

2.7.2.1.2 Conversion of energy

One of the methods to regenerate power is by converting different forces from automated equipment to electricity, and recovering heat that is generated from cold storage systems. Other methods include switching to natural ventilation instead of electrically-run ventilation, and even adjusting the speed of conveyors and palletizers so that when left unused, this equipment can run at a slower pace or be turned off. (Furtado Efacec, 2015). At the same time undergrounds geothermal energy systems can be used to provide cost saving renewable energy for large structures.

2.7.2.1.3 Ventilation

Maintaining a fresh air level and minimize heat losses in the warehouse is a target of each manager. Well planned and designed ventilation system can help to achieve that goal.

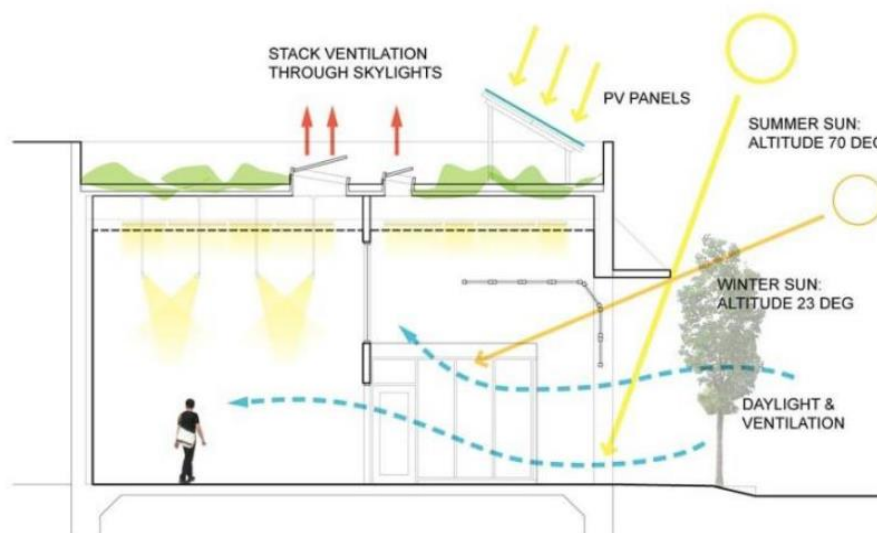


Figure 17. Smart ventilation system in Brooklyn Warehouse, New York (Minh Luu, 2016.)

From the Figure 17 can be seen an innovative approach that allows to maintain fresh air in the warehouse. The cold air (blue arrows) has greater air pressure, so it stays at the bottom of the building; warm air (red arrows) has less air pressure and thus it rises up. The difference between pressures creates an air flow through the building. (Minh Luu, 2016.)

Thus, more than 20% of cost savings can be achieved by implementing new efficient and eco-friendly technologies. Companies that are starting to practice green warehousing methods and technologies can then achieve good financial results and make their business environmentally sustainable. (Furtado Efacec. 2015).

2.7.2.2 Automated warehouses

A perfect solution to decrease energy consumptions could be automated warehouses. They can function in darkness and in non-heated environments. There is no need for supervision and man power. There are various automated techniques and methods including order picking technologies: bar-coding, radio frequency identification (RFID), and automated storage and retrieval systems (ASRS) to achieve a sustainable warehousing system (Furtado Efacec. 2015).

The use of Automated Storage and Retrieval System (AS/RS) can dramatically decrease such things as land use, energy consumption and waste production, including hazardous waste. Other advantages of AS/RS systems include: preventions of work accidents; automation of dangerous and hard work processes within a warehouse; comfort and convenient work environment; expansion of warehouse space; faster and more reliable operations of warehouse; easy and faster maintenance through modular and standard design; economy in investment and operation; protection of stored goods. (Kervola, 2015)

Switching to bar-coding and RFID technologies, and different picking technologies (pick-by-scanner, pick-by-light, pick-by-voice, pick-by-CMD, and pick-by-vision) will lead to a reduction in paper consumption thus approaching environmental sustainability. It will also give a better visibility and control over your inventory, processes and personnel. (Kervola, 2015)

Usage of AGVs and LGVs (see Figure 18) can also be a smart solution in order to be efficient and sustainable. This driverless machines can work 24/7 and increase safety, reduce warehouse and labor costs and provide more flexibility. In addition they don't need light in order to operate, thus less energy consumption.



Figure 18. Automated guided vehicles (System Logistics)

2.7.2.3 Designing and optimizing warehouse layout

One of the most important things in being green is a proper design of the warehouse layout. The storage space should be used in the most effective and efficient way in order to maximize the efficiency of energy use and decrease its consumption. Well-planned layout will allow to maximize workflow efficiency and remove unnecessary steps within the warehousing process. In addition it will give more space for more efficient material handling, order picking and storage processes. (Kervola 2015).

When planning and constructing the layout, companies need to take into account many things. One of the crucial ones that needs to be considered is product locating. An appropriate XYZ analysis as shown (see Figure 19) must be done in order to know the best place for product locating.

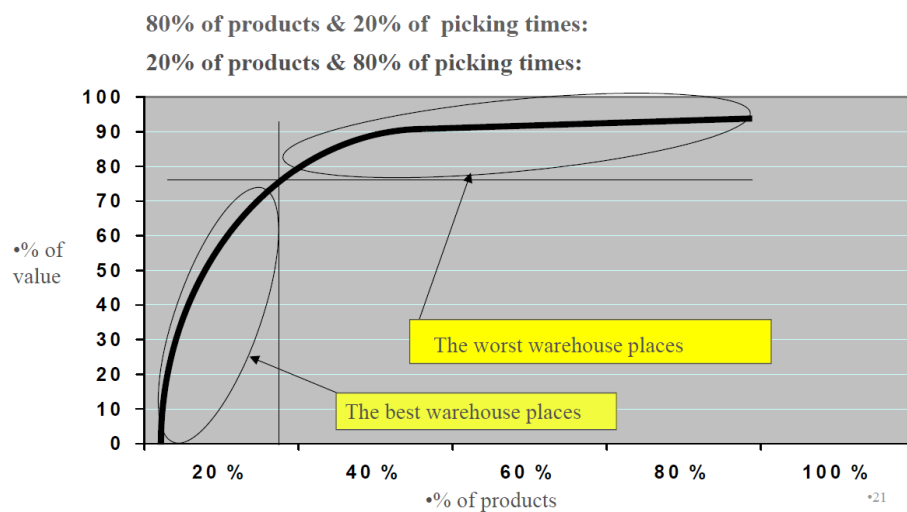


Figure 19. XYZ analysis in product locating (Kervola)

Normally, around 80% of goods (Y and Z items) embrace 20% of picking times and 20% of goods- 80% of the time. XYZ analysis are made by analyzing picking times because they tell which items cause most work and as a result more energy use. (Kervola 2015)

The movement of goods to, within, and from the warehouse needs to be efficient. An appropriate material flow method should be used to achieve energy efficiency and cost reductions. On the Figure 20 below is an example how products can be located according to their moving times. The products which stay long time in the warehouse must be located a bit more further from the inbound and outbound areas in order to reduce the number of unnecessary moves that require energy, time and cost.

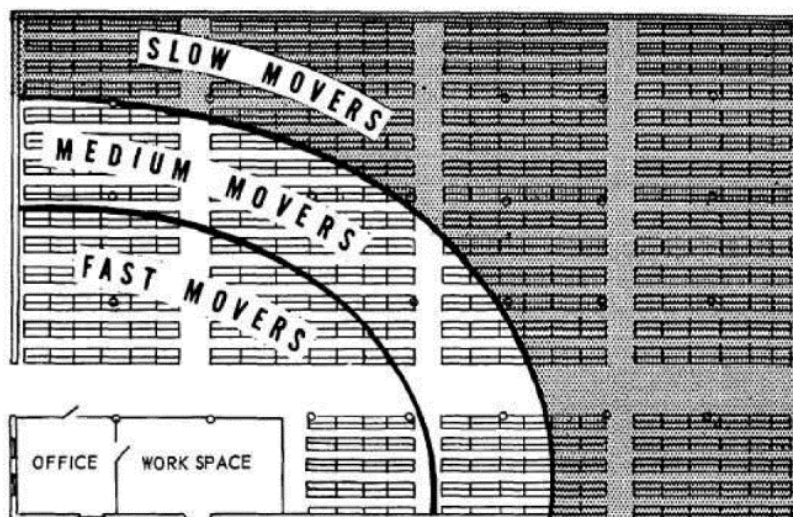


Figure 20. Product locating (Kervola)

Inventory should be accessible and retrievable as and when required. It should be stored with the minimum amount of energy and effort. The inventory level required and stored is determined by the demand forecast and the reliability of the supply lead time. Improving the accuracy of supply lead time and the demand forecasts will help to minimize inventory and therefore the storage space, energy need, costs and waste. (Emmett, Stuart, and Vivek Sood 2010, 137)

2.7.2.4 Location of the warehouse

A very important role in energy use of a warehouse plays its location. The transportation companies that transport goods to and from that building spend a lot of energy.

Therefore distribution centers must be located somewhere in the middle of transportation network, that could dramatically save energy resources and decrease environmental footprint. (Napolitano. 2013)

Moving the distribution facilities closer to inbound ports, big cities or closer to customers is a good way to minimize transportation energy usage and therefore reduce environmental emissions. Companies should locate warehouses in an optimized, more energy-efficient distribution network. To make an even bigger costs savings and less harmful effects on nature, some authors propose to optimize truck capacity and develop more efficient transportation routes. (Napolitano. 2013)

2.7.3 Green packaging

Packaging is very important part of every product. At the same time it is considered to be the most visible part of green supply chain, since most customers see the packaging before the product itself. What is green packaging? It is also known as sustainable packaging, and refers to the wrapping that is made out of recyclable materials and requires minimum energy and resources for its manufacturing. (Merton, 2016)

Some of the firms are still tend to use over packaging to attract customers. However, many people are now aware that overuse of resources in packaging result in waste accumulation, excessive cost, resource overuse and environmental degradation. (Emmett, Stuart, and Vivek Sood 2010, 139)

Packaging waste considered to be one of the biggest sources of environmental pollution. Green practices lead to decrease waste generation and improve environmental sustainability. According to Emmett and others (2010, 140) there are 4 key features of green packaging (see Figure 21).

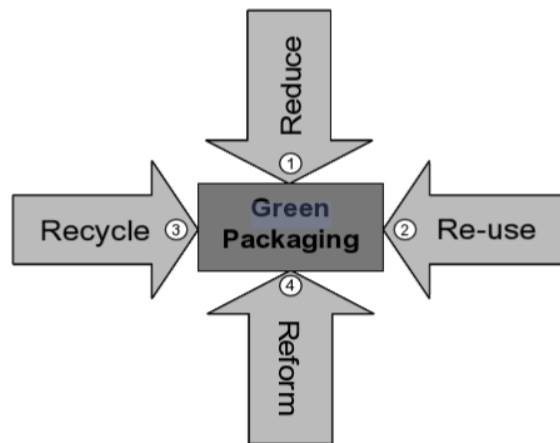


Figure 21. Green packaging characteristics (Emmett and others 2010, 140)

Firstly, reduction of packaging means that the company must ensure the minimum material usage in printing. Additionally, packaging should be resized to fit the goods, since many packages a bigger than the dimensions of the product.

Secondly, reuse of packaging means that organization must take full responsibility for taking the packaging from the consumer and putting it back in reuse. Government should make it as a law in order to guarantee that all companies follow this methodology.

Thirdly, recycling. Here it is important to ensure that the packaging can be recycled after its usage. Such materials as biodegradable plastics, plant-based plastics, post-consumer recycled polyethylene bags and special additives in order to make the packaging degradable must be used. This will decrease the contamination of water, wind and soil.

(Amber Merton, 2016)

Lastly, reforming of packaging tries to maintain the core function of packaging without any environmental impact. The commonly used materials must be changed to more environmentally friendly, the method of product delivery can also be changed (for example e-books and online manuals). (Emmett, Stuart, and Vivek Sood 2010, 142)

Thus green packaging must be adopted by many companies. It is not only reducing environmental effects but also minimize costs and enhance the companies' environmental image and customer's perception.

2.7.4 Green data collection

Data collection is an important element of the efficient workflow of the system. A proper data collection can help to detect the bottlenecks in the processes and decrease the usage of resources and mitigate the environmental impacts. On a table below, author have pictured some of main key indicators that should be monitored in order to improve environmental sustainability.

Table 2. Indicators that should be monitored

Transportation	Warehousing	Waste
CO2 emissions	Emissions	Amount recycled
Distance travelled	Energy usage	Amount reused
Tonnes distributed	Types of products	Amount sent to landfills
Vehicles fill rate	Amount of goods	Energy generated from waste
Fuel consumption	Pick-up time	
Travel time	Returned goods	
Tracking and tracing		

One of the most crucial things are tracking and tracing. It is very important to control and monitor the product flows in order to promote the greening of the whole chain. Appropriate data collection and management will help to optimize the usage of resources, predict and handle returns efficiently. For example switching to bar-coding and RFID technologies will lead to a reduction in paper consumption thus approaching environmental sustainability. It will also give a better visibility and control over your inventory, processes and personnel. Moreover, it will allow to avoid product losses and improve control over the flow of goods. (Zongwei 2011, 342)

2.7.5 Waste management

Nowadays there is a big concern about saving resources on our planet. Every day a lot of waste is produced and thrown into the environment. Despite the fact that some waste is recycled and reused waste management remain a crucial part of every company. Waste management is the process related with minimizing, managing, monitoring, and transportation and recycling of waste. From the environmental point of view - it is everything that harms the environment.

As it has been said in the previous chapter, packaging waste considered to be one of the biggest pollutants of the environment. According to Eurostat (2017), in 2015, 166.1 kg of packaging waste was generated per inhabitant in the EU-28. In addition, Figure 22 shows the development of the volume of all packaging waste per inhabitant generated, recovered and recycled.

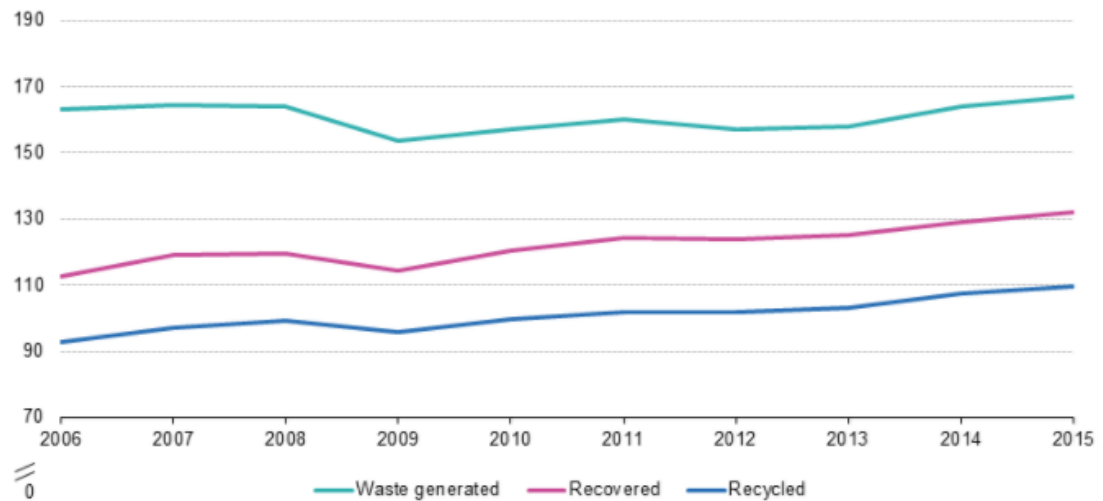


Figure 22. Development of all packaging waste generate, recovered and recycled in EU 27, kg per inhabitant (Eurostat, 2017)

Recovery of packaging waste includes recycling and energy recovery – generation of energy from waste at special incineration plants. Organizations should try to recycle and reuse the waste within their facilities or use outsource waste management services. For example, waste from one company can serve as a raw material for another firm, thus reducing the impact on the environment. A proper waste managing system is a key for a sustainable development. (Eurostat, 2014)

2.8 Benefits of green logistics

Green logistics brings various benefits to environment, society and economy. One of the most important one is the reduced impact on the Earth's ecosystem and humans. Green practices improve quality of life by mitigating air and noise pollution. In addition, reduce amount of waste and increase recycling and recovery of it. Green activities increase usage of renewable and alternative energy sources, thus reducing greenhouse emissions and saving energy.

Furthermore it enhances safety at working conditions resulting in better health and higher efficiency. From economical point, it reduces costs by optimizing traveling routes, better vehicle utilization and load planning, proper usage of resources and workforce. Moreover, green logistics improves customers perception and loyalty, resulting in strengthening of company's brand. (Emmettet al. 2010, 126)

In the table below author has summerised all the benefits of green logists. As it can be seen green logistcs brings many benefits to various parties, thus it should be practiced and evolved as a concept.

Table 3. Benefits of green logistics

Environment	Economical	Social
Reduce waste	Reduce costs	Improves quality of life
Reduse greenhouse gasses emissions	Strengthen brand image	Increase safety at work
	Benefits from the government	Improves working conditions
Reduce energy usage	Competitive advantage	Health benefits
Increases efficiency	Increase profit	

3 Reverse logistics

Many companies has started to focus on reverse logistics because of the environmental issues. There are many triggeres that effected the firms to take reverse distribution more seriously. For example increasing of landfill costs, desposition bans, new environmental regulations, laws and restrictions. In this chapter the author introduced how the reverse logistics activities can effect the environment and improve the environmental sustainability.

3.1 Definition

According to Rogers and Tibben-Lembke (1998) reverse logistics is the process of organisation, implementing, monitoring and controlling the efficient and cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of re-capturing value or proper disposal.

Reverse logistics basically deals with goods which are returned or unsold. In addition, such terms as recycling, reuse, remanufacturing and refurbishment also can be related to the definition of reverse distribution.

3.2 Reverse logistics activities

Typical reverse logistics activities include collection, sorting/separation, recycling, re-processing, reuse, redistribution and disposal of used, damaged, unwanted or out-dated goods; also packaging and shipping materials from end user. Figure 23 shows a common reverse flow. As it can be seen from the picture above all these actions are directed to decrease the amount of waste and improve the state of environment.

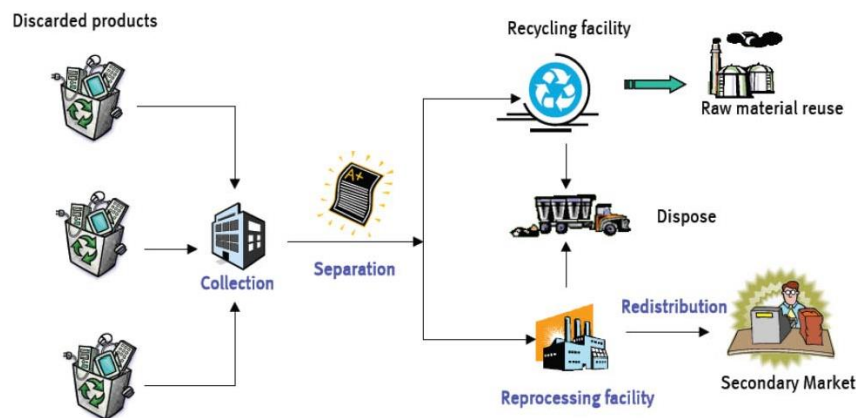


Figure 23. Reverse flow (Bajor, 2014.)

The reverse flow consists of products and packaging returns. Customer returns represent the core share of product returns. From Table 4 it is clear that in every industry returns vary dramatically. It is a main target for every company to learn how to manage the reverse flow efficiently. (Rogers and Tibben-Lembke 1998, 6)

Table 4. Return percentages from different industries (Rogers and Tibben-Lembke 1998, 6)

Industry	Percent
Magazine Publishing	50%
Book Publishers	20-30%
Book Distributors	10-20%
Greeting Cards	20-30%
Catalog Retailers	18-35%
Electronic Distributors	10-12%
Computer Manufacturers	10-20%
CD-ROMs	18-25%
Printers	4-8%
Mail Order Computer Manufacturers	2-5%
Mass Merchandisers	4-15%
Auto Industry (Parts)	4-6%
Consumer Electronics	4-5%
Household Chemicals	2-3%

Different disposition possibilities are represented in the Table 5. However, in order to decide what to do with the returned items a right decision must be taken. The process of checking the goods at entry point is called gatekeeping. At that point a person decides how to dispose the product. It is considered to be the first crucial step in making the entire reverse flow manageable and profitable. (Rogers and Tibben-Lembke 1998, 10)

The main goal of every company must be to reduce the amount of items going to landfills. It is very important because gases emitted from landfills considered to be very toxic and harmful for the environment.

Table 5. Product and packaging disposition (Rogers and Tibben-Lembke 1998, 10)

Products	Return to Supplier Resell Sell via Outlet Salvage Recondition Refurbish Remanufacture Reclaim Materials Recycle Landfill
Packaging	Reuse Refurbish Reclaim Materials Recycle Salvage

3.3 Landfills

According to Eurostat statistics (2014), landfilled waste represents an enormous 195 million tonnes of waste (see Table 6). It is a huge loss of resources in the form of both materials and energy and thus it should be limited as far as possible. Effects of landfills are terrifying: groundwater contamination from leaches, air pollution from emitted toxic gases, soil and land pollution due to toxic chemicals, landfill fires and health effects. (Eurostat, 2014)

Table 6. Domestical waste organization excluding major mineral wastes, imports and exports of waste in the EU-28, 2014, 1 000 tonnes (Eurostat)

Treatment category	Treatment in the EU (WStatR)
Recycling (RCV_O)	393 550
Backfilling (RCV_B)	12 910
Energy recovery (RCV_E)	106 130
Incineration (INC)	34 110
Landfilling (DSP_D)	195 720
Other disposal (DSP_O)	3 190
Total treatment	745 610

Some of the solutions for reducing amount of waste going to landfills are: reduce, recycle and reuse of waste; implementation of the WEEE and RoHS directives; creation

of landfills bans for: different batteries, motor oil, tires, liquid waste, computers etc. Companies should put the reverse logistics as core competency inside their supply chains in order to be sustainable and efficient.

3.4 Reusable transport packaging

In many cases different handling units and packaging such as roll cages, pallets, carton boxes, totes are in rotation between companies, suppliers and shops. When the pallets or roll cages are damaged they can be refurbished or fixed and returned into use. When the end of life cycle comes these packaging can be disposed by the company or by outsourced services. However, every useful materials that can be further used are distracted from goods which are going for waste. (Rogers and Tibben-Lembke 1998, 11)

Transport packaging has a great impact on natural resource shortage, ozone layer depletion, global warming and increasing amount of waste. In order to be more environmentally friendly and reduce operational costs companies started to use reusable transport packaging. Returnable packaging can be used to achieve different companies' targets: marketing, environmental, economic. It protects the product, and preserves the environment. The main idea of returnable/reusable packaging is presented on the Figure 24. The manufacturer ships the packaging to the supplier, who in its turn ships the packaging with goods to the customers. Then customers return the packaging for recycling/reuse to supplier, who in its turn return it to the manufacturer. Thus a closed circle of transportation of packaging can be observed.

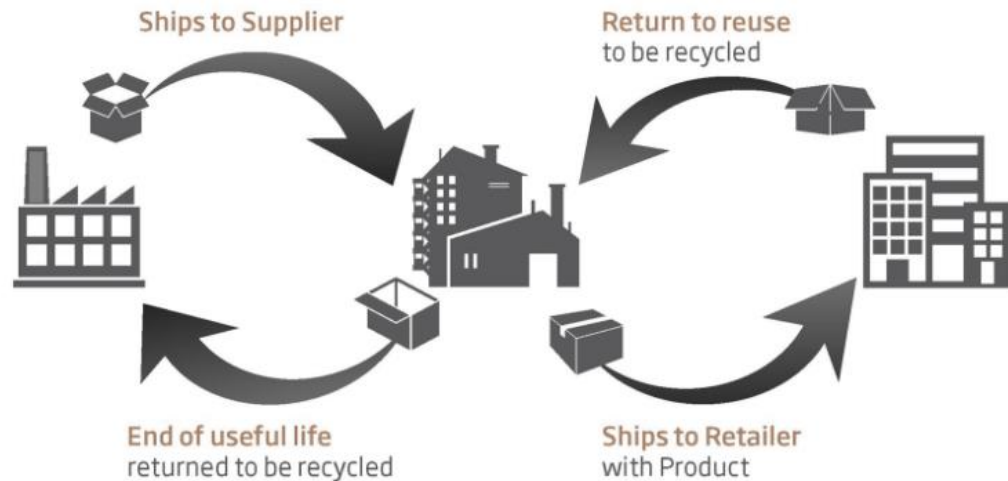


Figure 24. Transportation of packaging in a circle (Bajor, 2014)

Returnable packaging can be: reusable pallets, racks, bulk containers, hand-held containers and totes. Various durable materials like plastic, metal or wood are used to withstand rough handling and different conditions during transportation. (Mpack)

Another great benefit except environmental and cost benefits is future flexibility. Transportation industry demand changing all the time and requirements for the goods transportation also changes. Reusable packaging can always be reconfigured by changing/modifying the dunnage- the material used inside the container to prevent damage during shipment- which is much cheaper than buying a new handling unit. Lastly, if the company cannot find any use for containers, they can be returned for the manufacturer for a reward. At the end of lifecycle mostly all of the containers are recycled, since they are made from the recyclable materials. (Rogers and Tibben-Lembke 1998, 126)

Furthermore, reusable packaging require some maintenance. When the units are returned they are inspected, cleaned and tested. Also the damaged containers are detected they are repaired or recycled. If the reusables cannot be fixed, a new one has to be purchased. Therefore, well planned and organized reverse logistics leads to the strong corporate identity, cost savings and reduction of consumption of natural resources and pollution to the environment.

4 Case study

4.1 Background

In the practical part of the study two companies: Kesko and S Group were contacted. These companies were chosen because they operate in the same field of business and considered to be competitors. Their green and reverse logistics activities and its impact on the environment were investigated. In addition, the usage of green practices of both companies were analyzed and compared and appropriate conclusions were made. Based on the found information, the researcher made some possible suggestions, in order to improve the environmental sustainability of those companies. Figure 25 represents the practical framework of the study.

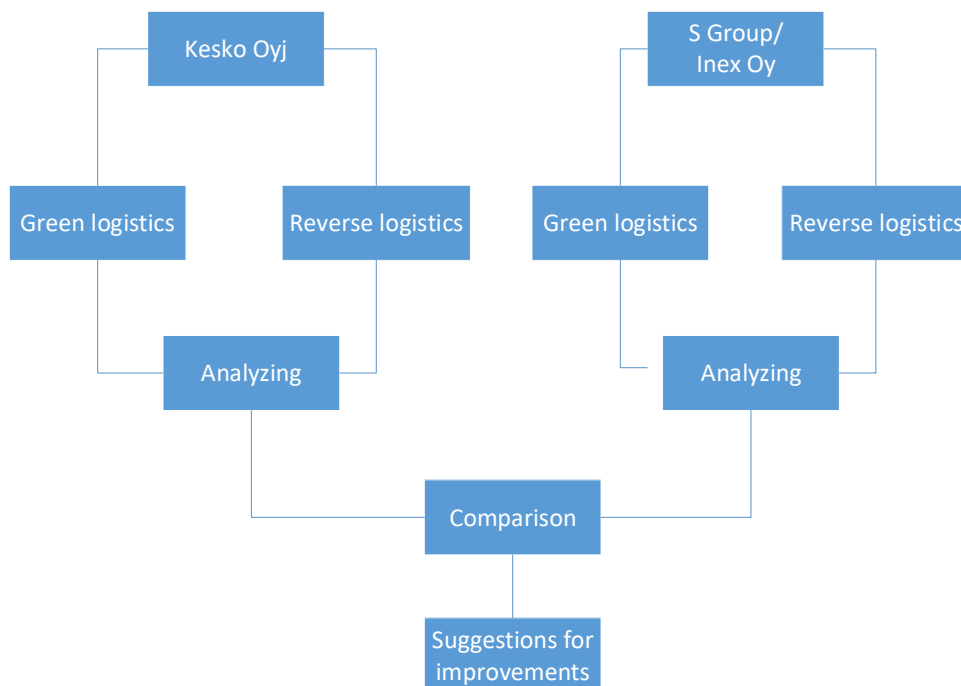


Figure 25. Practical framework

The data for the practical part was collected mainly through email interviews, company's websites and annual reports. The interviews questions can be found from Appendix 1. The answers from both companies will be represented further in this chapter. From Kesko Oyj the Environmental Specialist was interviewed and the answers were for Kesko Logistics, operating logistics in Finland for K grocery stores and HoReCa customers. For S Group the Environmental expert from Inex Oy- the company that does logistics for S Group grocery and consumer stores was interviewed.

4.2 Kesko Oyj

Kesko corporation (Kesko Oyj) is a Finnish retailing conglomerate with its head office in Katajanokka, Helsinki. They operate in the grocery trade, the building and technical trade and the car trade. It also has branches in Sweden, Norway, Estonia, Latvia, Lithuania, Russia, and Belarus. In this part the green and reverse logistics operations for Kesko's grocery stores in Finland will be discussed. The main environmental goal of Kesko is to mitigate climate change together. It strives to encourage customers and suppliers to contribute to the sustainable use of natural resources. (Kesko)

4.2.1 Green logistics

4.2.1.1 Energy consumption

Kesko is paying a big attention to the production of renewable energy. Since 2017 Kesko has purchased only renewable electricity in Finland. Starting from summer 2017 there are 16 solar energy companies which are doing their businesses in close cooperation with K-food stores. Therefore K-Group is considered to be the biggest producer and user of solar power in Finland. The installment of new technology on the K-food store roofs cover around 10-15% of the store's annual electricity consumption. For example when the daytime is long during summer day, solar panels can accumulate so much energy that it can cover around 60% of the food store's consumption. One of the biggest solar power plants is located at K-city market Tamisto, where 1600 panels can cover 50% of the energy consumption in the store. The life cycle of a solar power plant is as long as 35 years. Thus in the era of innovations modern technology can enable solar power production even in overcast weather and during wintertime. (Kesko)

Another share of energy consumptions falls on lightning. For it LED lamps, adjustable and directional lights are used. They bring up to 60% of energy consumption savings compared to traditional technology. In addition freezers considered to consume many energy. Thus Kesko is installing lids and doors on such equipment. This can result in up to 40% electricity savings. Moreover Finnish retailer is using recovered heat of condensation from all of its cooling equipment. Therefore there is a need for additional heating only during very low temperatures. (Kesko)

One more method to save energy is to use remote monitoring and building automation in order to optimize energy usage. In February 2017, the remote energy operating center took responsibility for the building automation of 214 Kesko facilities. The operational hours of properties and equipment can be changed remotely, which is very important in case of unpredictable situations. Setting the correct running times and set points guarantees the correct operation of assets as well as energy efficiency. In addition, distant adjustment of refrigeration equipment for optimum temperatures and defrosting cycles is possible. Thus deviations can be avoided and work efficiency improved. In addition to remote energy control there are 45 property managers working for this company. They are responsible for efficient usage of energy in various food stores. (Kesko)

The table below represents the changes of heat and electricity usage during 2016-2017. Since 2016 there has been an increase of 0.7% of the total electricity consumption, whereas the non-normalized consumption of heat increased by 4.7%. (Kesko)

Table 7. Environmental effect of the heat and electricity usage of the properties owned and used by Kesko in Finland, 2016 – 2017 (Enegia)

Energy	Unit	2016			2017			Change 2016-2017		
		Electricity	Heat	Total	Electricity	Heat	Total	Electricity	Heat	Total
Purchases	GWh	794.3	308.9	1 103.2	799.9	323.5	1 123.4	0.7 %	4.7 %	1.8 %
Primary energy	PJ	7.71	1.00	8.71	4.20	1.05	5.25	-45.5 %	5.1 %	-39.7 %
Fossil	PJ	1.00	0.68	1.68	0.88	0.72	1.60	-11.7 %	6.1 %	-4.5 %
Renewable	PJ	0.11	0.32	0.43	1.91	0.33	2.24	1632.0 %	3.1 %	416.7 %
Nuclear	PJ	6.60	-	6.60	1.41	-	1.41	-78.7 %		-78.7 %
Environmental effects										
Climate change	tonnes CO2-eqv	96 592	54 746	151 337	85 274	57 709	142 983	-11.7 %	5.4 %	-5.5 %
Nitrous oxides	tonnes NOX	133.6	132.8	266.4	117.9	139.1	257.0	-11.7 %	4.7 %	-3.5 %
Sulfur oxides	tonnes SO2	107.4	117.4	224.8	94.8	122.9	217.7	-11.7 %	4.7 %	-3.1 %
Used nuclear fuel	tonnes	1.63	-	1.63	0.36	-	0.36	-77.6 %		-77.6 %

In 2016 there has been 11.7% less emissions coming from electricity usage comparing to the previous year. This can be explained that since from 2017 Kesko used only electricity produced with renewable energy. Also in 2017 Kesko's greenhouse gas emissions roughly accounted for 0.2% of total Finnish emissions. (Kesko)

4.2.1.2 Transportation

Kesko has three warehouses, one for K-stores, and one for HoReCa (Hotel/Restaurant/Cafe) customers and one for frozen food. All are situated in Vantaa, Helsinki region and have good road connections to other parts of Finland, where they have regional terminals for deliveries to local customers. Such location enable company to

have an easy access to port and the biggest airport in the country, thus providing a great cooperation with foreign branches and business partners. (Saari, 2018)

The main mode of transportation is road. Trailer combinations are used for long-distance between warehouses and terminals and biggest K-stores. Delivery trucks and small vans are used for stores and HoReCa deliveries from regional terminals. This shipping method is used since the area of the country is rather small and using trucks allows to be more flexible and save cost. However, from the environmental point of view rail transport should be in priority. (Saari, 2018)

One of the most crucial things is that the transportation of goods for Kesko's grocery trade in Finland is managed by Kesko Logistics and includes its own fleet. It means that Kesko has a direct control over its logistics operation providing a better visibility of its operations and setting environmental goals. Moreover, the majority of Kesko's logistics operations in Finland use certified ISO 14001 environmental systems. In order to save costs and have less environmental impact all the deliveries are optimized by the size of the shipment and the distance and timetable to the customer to get the maximum payload and minimum emissions. Deliveries from suppliers come in containers or trailers depending on the goods and where they come from. Routes are optimized and drivers have been trained to drive efficiently. In addition, deliveries are always consolidated when possible. Even ambient and frozen food are delivered with same truck that has two compartments with different temperature. The transportation inside the warehouses is done by electric forklifts or with a hand forklifts. However there are no automated vehicles there. (Saari, 2018)

Table below represents the CO₂e emissions from logistics operations in Finland. There has been a tiny increase in numbers since 2015, however Kesko works hard to reduce emissions. The increase in numbers is caused by the acquisition of Suomen Lähikauppa.

Table 8. CO₂e emissions from Kesko's logistics in Finland, tonnes (Kesko)

Tonnes CO ₂ e	2015	2016	2017
Kesko's logistics	34,117	35,079	35,801

Kesko is using centralized distribution system. It means that all the deliveries from suppliers are shipped to the main warehouses in Vantaa area and afterwards are re-located to other individual branches. This type of distribution system gives numerous benefits in better visibility and control of its operation, flexibility, cost and time savings.

Also in 2017 Kesko has purchased eleven two-tier trailers and one extra-long HCT (high capacity transport) 'eco truck' for the long-distance transportation between main warehouses; in 2018 two new HCT-trailers will be added. It can be claimed that larger loads improve efficiency and benefit the environment. (Kesko)

4.2.2 Reverse logistics

Kesko is having its own reverse logistics. All returns of goods must be agreed with a person responsible for complaints. The most common reasons for products returns are damaged goods during transportation or in warehouse. A special person is responsible for assessing returned goods and their further movement. The company require to return only reusable handling units and crates from its customers. (Saari, 2018)

Another problem is related to the food waste. The goal is to minimize bio waste along the entire food supply chain starting from agriculture and ending with end-customers. Minimizing waste that comes from food products reduces related emissions to production, transportation and sales and decrease the impact on biodiversity. Picture below represents K Group food waste hierarchy. (Kesko)

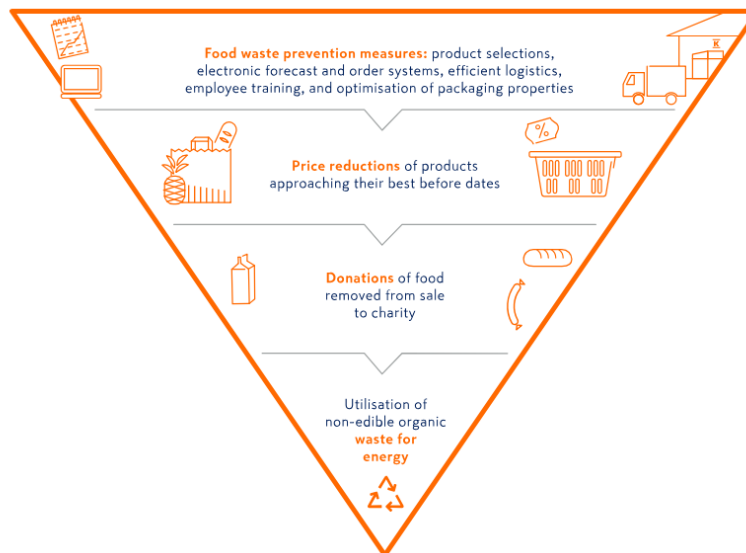


Figure 26. Waste hierarchy (Kesko)

K Group's goal is to reduce food waste relative to sales by 10% by 2020. Also they try to utilize organic waste in a proper way. For example Kesko cooperate with Gasum, Myllyn Paras and Wursti to produce biogas from biodegradable food waste collected from K-food stores. The biogas produced is used as energy in the production of Kesko products. (Kesko)





Kesko is reducing waste in K-food stores with the help of electronic forecasting and order systems, efficient transport and logistics, employee training, reduction of the prices for products before their expiration dates and optimizing packaging. In addition around 90% of K-food stores work together with local charities. (Kesko)

Another target is to decrease consumption of plastic bags to 40 bags per capita by 2025. Packaging material containing dangerous compounds in Kesko's own brands' products are replaced with an alternative material. Kesko's target is that by 2025, 100% of plastic waste is collected for reuse in all divisions. (Kesko)

Kesko is using in its warehouses and stores as carrying units mainly returnable roll cages and also wooden pallets. Plastic film is used for wrapping the handling units during transportation. The company reuse carrier trays, pallets and roll cages, plastic and cardboard is recycled. Almost every Kesko's own package have special codes on it that contains information about proper recycling. (Saari, 2018)

There were 399 eco take-back point in December 2017 that collected consumers' packages (fibre, glass, and metal) for recycling (Table 9). Plastic was collected at 173 eco take-back points. In addition, such items as beverage containers, batteries and accumulators, WEEE, impregnated timber and discarded clothing can be returned for recycling. (Kesko Annual report 2016)

Table 9. Different items gathered by Kesko's reverse logistics for disposition (Kesko Annual report 2016)

1,000 pcs		2016	2015	2014
	Aluminium cans	82,169	96,479	93,107
	PET bottles	54,648	61,403	54,296
	Recyclable glass bottles ¹	11,292	9,462	9,667
	Reusable crates	17,893	17,294	16,501

Since January 2017 K-stores use Pirkka ESSI circular economy bags. The bags are made of over 90% recycled materials. Also in 2017 wood fibre-based EcoFishBox was introduced. The new fish box will significantly reduce the use of plastics in grocery stores. (Kesko Annual report 2016)

According to the Table 10 the recovery rate of Kesko's waste in Finland was nearly 100%. However this number mainly cover warehousing operations. The recovery rate includes all waste except waste to landfill. (Kesko)

Table 10. Waste recovery (Kesko Annual report 2016)

Tonnes	Finland		
	2017	2016	2015
Non-hazardous waste	17,469	18,366	10,737
Recycling/recovery	17,467	18,204	10,621
Landfill	2	162	116
Hazardous waste	354	273	1,125
Recycling/recovery	258	183	160
Hazardous waste treatment	96	90	965
Total	17,823	18,639	11,862
Recovery rate %	99.99	99	99

4.3 S Group

The S Group is a Finnish retailing organization. The full formal name is abbreviated as SOK. It consists of 22 regional cooperatives all around Finland in the markets for groceries, consumer durables, service station, hotel and restaurant services, agricultural supplies, and car sales (Kari, 2018). The group operates in Finland, Estonia, and Russia. In this part green and reverse logistics of S Group's grocery and consumer trade will be reviewed. Additionally general information about the S Group environmental impact is going to be discussed as well. The environmental goal of the company is to prevent any adverse effects of their operations and to implement best practices with minimum impact on the surrounding.

4.3.1 Green logistics

4.3.1.1 Energy consumption

S Group promotes renewable energy through wind power. The company has been increasing its share of this source of energy every year. In 2016 almost 35 per cent of the entire year's consumption was produced with own wind power. The share of wind power in the electricity used was increased to approximately 50 per cent in 2017. The number of wind turbines in operation in 2017 was 131. Moreover, S Group has been monitoring the profitability of solar power. Dozen outlets are already converting solar energy into electricity. For example, since 2015 a solar power station

with 400 panels on the roof of S-Market Hennala in Lahti is in use. (S Group Responsibility report 2016)

S Group continuously tries to save and improve its energy efficiency. Most energy in S Group is consumed by cold storage equipment and store lighting. Table below represents S Group's energy consumption in 2014-2016. There has been a small grow of electricity consumption in 2016, since S Group has provided extended working hours for some of the shops. (S Group Responsibility report 2016)

Table 11. Energy consumption of S Group (S Group Responsibility report 2016)

Energy consumption	2016	2015	2014
Electricity consumption, GWh	1,138	1,111	1,140
Heat consumption, GWh	445	419	418
Water consumption, million m ³	2.1	2.1	2.0
Area, million gross m ²	5.1	5.1	4.9

4.3.1.2 Emissions

The prevention of the emissions going into air, soil and water are a part of S Group environmental responsibility. Operations of the organization generate greenhouse gas emissions and volatile organic compounds, which harm the environment. Also fuel delivery can lead to leaks. Table 12 depicts the emissions produced by S Group.

Table 12. CO₂e emissions of S Group 2014-2016, tonnes (S Group Responsibility report 2016)

S Group's carbon dioxide emissions	2016	2015	2014
Direct – Scope 1			
Own heating production	4,900	6,000	8,000
Refrigerant leaks in stores	66,000	–	–
Indirect – Scope 2			
Purchased electricity	154,000	192,000	252,000
Purchased district heat and cooling	70,000	71,000	56,000
Other indirect – Scope 3			
Product transport and delivery	77,000	64,000	68,000
Commuting and business travel	2,000	1,900	2,100
Packages	52,000	53,000	55,000
Total	425,900	387,900	441,000

Most of the energy used by S Group is purchased, thus it cannot fully influence the emissions. However as it has been said they invest in the own renewable energy production, such as wind and solar energy. In addition in some buildings old oil heating systems have been replaced by district heating and geothermal heating systems. (S Group Responsibility report 2016)

4.3.1.3 *Inex Oy*

Inex Partners Oy is a fully-owned subsidiary of S Group whose main task is to provide warehousing and transportation services for the grocery and consumer goods chain. Inex's central warehouses are in Sipoo. Consumer goods located in Sipoo since 2013 and groceries are to be centralized in Sipoo in 2016-2018 from Inex's old logistics center in Kilo.

Regarding energy consumption Sipoo logistics center is using geothermal heat and pellets for heating. There are 150 pieces 300 meters deep geothermal wells under the consumer goods logistics center, and these wells recover heat from the bedrock. Considerable emission reductions have been achieved by a customized power plant and by utilizing renewable energy sources. In the warehouse both fluorescent tubes and led tubes are used. They are replacing the old fluorescent tubes with led tubes as they break. Also company uses day lighting in open offices. Lighting is controlled with both motion and light sensors in the offices, lighting in the rest of the warehouse is pretty much lit all the time because of the production being run 24/7. Outdoor areas use light sensors too. (Kari, 2018)

For ventilation they have various control systems. Most of the ventilation is controlled by the return air CO₂-levels and are using recirculated air as much as possible, also the air supply units are equipped with efficient heat recovery ventilators for both heating and cooling. In addition, for reducing energy consumption they have own energy manager optimizing all of the HVAC-systems (heating, ventilation and air conditioning) to be as energy efficient as possible. (Kari, 2018)

Regarding waste management Inex's recycling rate is 100 %. Inex's objective is to use waste primarily as material, and when this is not sensible, the waste is channeled to energy production. Inex sorts all the waste coming from their logistics operations. Generated waste is channeled primarily to material recycling or secondly energy production through their waste management partners. (Kari, 2018)

The most common way of shipment is by trucks. This mode is effective, we can reach our customers easily than by trains. Environmental aspects are one criteria when choosing carriers. Inex consolidate goods as much as possible. It is more cost-effective and environmentally friendlier that way. Inex has 10 hubs with modern facilities

in Finland. Distribution channels are optimized for each product. The most common way to pick goods in warehouses is through automated processes. The warehouse in Sipoo is around 97% automated, so very few people are involved in handling and moving of goods. (Kari, 2018)

As for packaging Inex uses wooden pallets, rocos and plastic boxes as carrying units. Most common materials for packaging are carton, plastic, polyfoam, tapes. All of the handling units are reusable. They are returned from S Group's stores back to Inex. Plastic and cardboard are also returned from stores. (Kari, 2018)

4.3.2 Reverse logistics

Concerning return policies Inex customers (retail stores) may return products if they have a permit which is given by the claim service. Usually the stores have to place claim in very same day or 1 day after receiving the products and ask for return permit. If permit is allowed the store have to carry out return immediately. The sender attach a written (cover letter) form on product to be returned. The products goes through visual inspection and manually handling before returning to the stock. If products cannot be sold again, items then go to charity or waste. Returns from the market goes mostly back to the production plant or supplier. In the warehouse they have a special place for returned goods, both pallets, rocos, plastic boxes as well as returned goods from S-Group's stores. (Kari, 2018)

Waste management of S Group is taking an important role in the company. S Group striving to reduce its waste amounts and reuse/recycle it efficiently as much as possible. Also it target is to minimize percentage of waste going to landfill. Figure below represents a waste processing split to different categories. Amount of waste going to landfills was only 1% in 2016, however the company's goal is to reach 0%. (S Group)

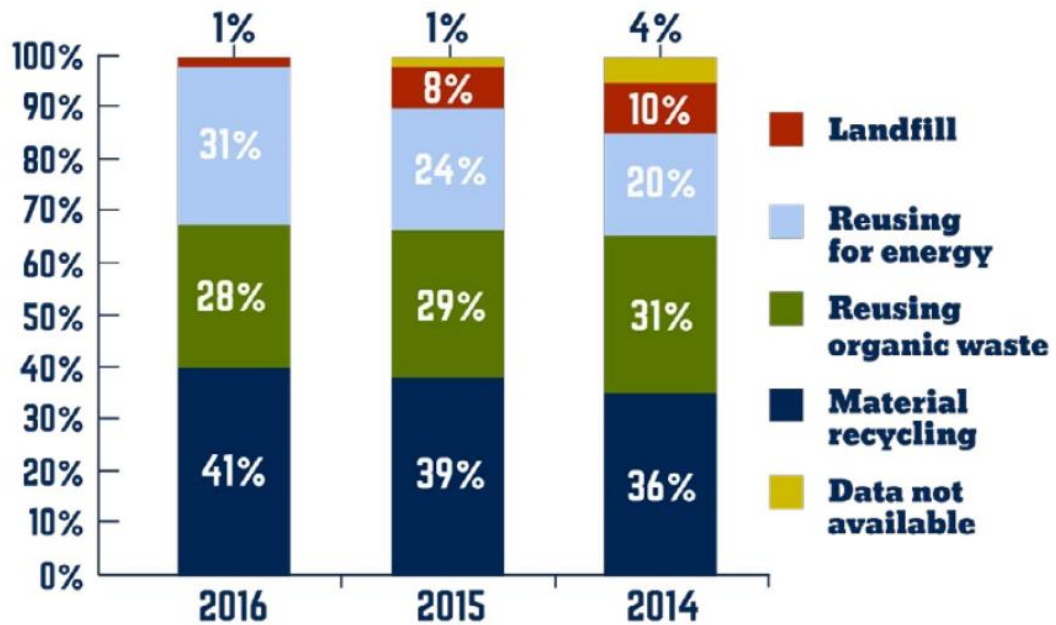


Figure 27. Waste processing in S Group (S Group)

Additionally grocery stores sort waste more effectively and they make a deal with waste management companies to increase reused waste share. Around 40% of waste is directed for recycling and 30% for energy recovery. Organic waste is used for production of bioethanol or directed to bio gasification. Grease waste is reused as energy as much as possible, and expiring food is increasingly directed to charity. (S Group)

Company has many recycling points at different shops. The recycling stations at S Group's outlets accept cartonboard, plastic, glass and metal containers and clothes (see Table 13). Also S Group's grocery stores that are larger than 1,000 m² accept decommissioned electrical devices and electronics for recycling. Moreover in all shops there are boxes for used portable accumulators and batteries. (S Group)

Table 13. Recycling of different waste (S Group Responsibility report 2016)

Recycling	2016	2015	2014
Recycling stations, total	423	332	263
Recycled plastic bottles, million pcs	169	153	153
Recycled glass bottles, million pcs	41	41	41
Recycled aluminium cans, million pcs	576	564	564
Clothes donated to UFF, tonnes	2,986	2,760	2,350
Recycled portable accumulators and batteries, tonnes	382	342	311

4.4 Comparison of companies

Author decided to compare both green and reverse logistics of two companies in order to understand what and how can be improved. The comparative method for analyzing data was chosen since Kesko and S Group are considered to be competitors and it is the best way to find the pros and cons in their operations in terms of environmental sustainability.

4.4.1 Green logistics

Table below represents the comparison of green logistics of Kesko and S Group. Further the data will be analyzed and explained.

Table 14. Green logistics comparison

Green Logistics		
	Kesko Oyj/ Kesko Logistics	S Group/ Inex Oy
Environmental goals	Mitigate climate change together and promote the sustainable use of natural resources	Prevent any adverse effects of their operations and to implement best practices with minimum impact on the surrounding
Energy consumption	Target is to purchase only renewable energy	Purchases different types of energy from others
Who is responsible for efficient energy usage?	Kesko has 45 property manager responsible for efficient energy usage	Inex Oy has own energy manager
Renewable energy production	Solar energy	Wind energy, solar energy (beginning), geothermal energy (Sipoo)
Transportation mode	Road	Road
Reason for transportation method	Flexibility, costs, speed	Flexibility, costs, speed
Green carriers	Has its own fleet, carriers are trained to drive in an eco-friendly way, has high capacity transport in its fleet	Paying attention to environmental aspects when choosing a carrier
Shipments optimization	Route optimization, goods consolidation, optimization of	Route optimization, goods consolidation

	goods by time, load and distances	
Location of the main warehouses	Vantaa	Sipoo
Energy saving methods in warehouses	Led lights, Heat of condensation from refrigeration equipment, lids and doors on refrigeration units, remote monitoring of properties and equipment	Using geothermal heat and pellets for heating, LED lights, day lightning, motion and light sensors in offices, lighting in the rest of the warehouse is lit because of automation
Picking methods in warehouse	Pick by voice	Automated
Automation in warehouses	Some processes are automated	Fully automated warehouses
Packaging materials in warehouses	Plastic film for wrapping the handling units during transportation	Mainly carton, plastic, polyfoam, tapes
Handling units in warehouses	Returnable roll cages and wooden pallets	Wooden pallets, rocos, plastic boxes. All of our handling units are reusable.
Recyclable packaging promotion	Recyclable bags made of 90% recyclable materials, new fish boxes with less plastics	Recyclable bags made of 60% recyclable materials

Both companies are well aware about the importance of mitigating climate changes and improving environmental sustainability. Their target is to improve operations efficiency and to lessen the emissions which they emit. Kesko is promoting renewable energy production by installing solar panels on its store's roofs. In addition they buy only the renewable energy. It means that they take responsibility also for the emissions of their energy suppliers, which is very impressive. S Group in its turn invest in wind energy production and monitors the profitability of solar energy. Moreover Inex Oy in its warehouses is using geothermal energy. However most of the energy used by SOK is bought, thus the company cannot effect the environmental impact of its energy suppliers fully. Inex Oy has a special energy manager who is responsible for

the energy efficiency in the warehouse, while in Kesko logistics has a property manager. However it is better to have a person who is in charge only for one facility, since he will have more time to solve problems in a certain area.

Considering transportation, two companies are preferring to choose road transportation. The reasons for that are: flexibility, costs and speed. The most crucial point here is that Kesko has its own logistics with fleet, while for S Group's Inex Oy is taking responsibility for transportation and choosing a proper carrier. Having its own logistics gives a better control over operations and their impacts on environment. One can monitor the state of the goods and vehicles and make some improvements. From another side, own logistics can distract management from the main goals of the company. Kesko has high capacity trucks that are very efficient and can move more goods in one time, while S Group sets environmental aspects as a criteria when choosing a carrier. Two organizations are trying to minimize transportation through route optimization, cargo consolidation and eco-driving. Shipments are optimized by capacity, distances and time. Kesko even transports ambient and frozen food with same truck that has two compartments with different temperatures.

Kesko logistics has its main warehouses in Vantaa and Inex Oy in Sipoo. Both locations nice in terms of easy access to port and biggest airport of the country. It guarantees a good connections with business partners and foreign branches. However it's a bit far from the northern part of the country. Talking about energy savings methods in warehouses both companies are using LED lights and remote monitoring of its processes and operations. In addition Kesko logistics is using heat of condensation from refrigeration equipment, lids and doors on refrigeration units since frozen goods are consuming energy the most. Inex Oy is using geothermal heat and pellets for heating, day lightning, motion and light sensors in offices; lighting in the rest of the warehouse is lit because of automation and production 24/7. Warehouses in Sipoo are almost fully automated, thus giving huge competitive advantage to Inex in terms of cost, time and environmental impact. Almost all the operations are done automatically and only few workers are needed to keep the operation pace. Meanwhile in Vantaa picking in warehouses is done mainly using pick-by-voice methods and electric forklifts for moving goods. Packaging materials used in warehouse are mostly carton, plastic, polyfoam, tapes. Handling units are reusable pallets, roll cages, plastic boxes and rocos. Both companies are promoting recyclable packaging at their shops, which proves their environmental consciousness.

Kesko and S Group have proved that their operations and processes are executed with the great attention to the environment. However there are some things that can be improved in both companies. Suggestions for the improvement will be proposed later on.

4.4.2 Reverse logistics

The following table shows the reverse logistics performed by researched companies. Next author will analyses and explain the data.

Table 15. Reverse logistics

	Kesko Oyj/ Kesko logistics	S Group/ Inex Oy
Own or outsourced reverse logistics?	Own	Own with outsourced transport
Most common reason for returns	Damaged goods during transportation or storage	Wrong orders from customers
Special place for returned goods in the warehouses?	Returned goods have a place where they are first inspected and then forwarded to picking, supplier, waste etc. depending on the condition of the goods	Have a special place for returned goods, both pallets, rocos, plastic boxes as well as returned goods from S-Group's stores
Are returned products inspected?	Yes, there is a specialized person who performs a visual inspection.	Yes, there is visual inspection
Where do returned products go?	Depending on the decision they could go to waste, recycling, energy recovery, charity	After visual inspection goods are mostly returned to the stock. If the goods are in bad condition they are sent to charity/waste
Reusable packaging/handling units?	Use returnable roll cages, pallets and plastic crates. They are inspected and then cleaned or repaired if needed	All handling units (trolley, pallets) are rotating between stores and warehouse
Are returned products marked somehow?	Labeled	Cover letter form is attached to the goods

Waste recovery rates	Around 100% in Finland	Around 100% in Finland
Collection points for waste at shops?	Yes	Yes

Regarding the reverse logistics two companies have a very good planned and organized reverse distribution. Kesko has its own reverse logistics system with fleet, Inex Oy in its turn is outsourcing vehicles for backwards flow. As it has been mentioned before own fleet can give a better organizations and collection of returned good, save time and costs. The most common reasons for returns for Kesko logistics are damage of goods during transportation and storage, meanwhile in Inex Oy- wrong customer's orders. Both organizations have a special place in the warehouses for returned goods. It allows them to manage their return goods in appropriate way without overlapping with forward logistics operations. Both companies have a specialized persons responsible for inspecting the goods after they are returned. Those employees also decide where the product will go next: waste, recycling, storage etc. Additionally, both companies are demanding suppliers and shops to return handling units: roll cages, pallets and plastic crates and trolley. One good thing to mention is that Kesko is cleaning and repairing handling units after they are returned from shops or suppliers. This leads to additional costs and time spent on maintenance, however it will pay back in a long run. All of the returned goods are either labeled like in Kesko or have an attached over letter like in Inex Oy. It guarantees that returned goods will be handled in a right way, since irrelevant information can cause goods appearing in a wrong location. Both companies have a recovery rates around 100% which is very impressive. Both competitors have many collections points at their shops premises or nearby for customers to return used bottles, glass, food crates, batteries, lamp bulbs and clothes.

Kesko and S Group have a great contribution to the environmental sustainability with their reverse logistics. They not only decrease usage of resource and recycling of waste but also try to keep handling units and packaging in rotation within the supply chain.

4.5 Suggestions for improvements

In this chapter author will propose his own ideas that could help to enhance and improve the efficiency of the companies' logistics operations and decrease their impact on the environment. It is believed that only with understanding of the importance of adopting environmentally friendly principles into the companies' structure can im-

prove the environmental sustainability. The firms must take into consideration economic, social and in the most environmental factors during its operations in order to be environmentally friendly and sustainable.

4.5.1 Kesko Oyj/ Kesko logistics

The Table 16 represents the changes that can be made and their impact on companies operations and environment. Next all the changes will be described in more detailed way.

Table 16. Possible changes for Kesko

Kesko Oyj/ Kesko Logistics			
Areas	Changes	How to achieve	Effects
Energy production	Increase renewable energy production	Install solar panels on every shop's/warehouse's roof, build wind turbines	Less emissions, better social image, cost savings in a long run
Efficient energy usage	Energy manager for every shop/warehouse, every employee contribution	Trainings regarding efficient energy consumption, benefits and rewards	Lower energy consumption, less costs, lower environmental impact
Energy savings methods in warehouses/shops	Use sensors for lightning control, use daylights, use control systems for ventilation and air conditioning.	Require investments, good planning to use daylights efficiently	Reduce energy consumption, save costs, less emissions
Transportation mode	Use combination of road and rail transport for long distances	Optimization of routes and loads in the most cost efficient and environmentally friendly way	Less CO2 emissions, more costs in some cases, longer delivery times
Automation in warehouses	Use automation systems or automated vehicles in the warehouse	Buy automated guided vehicles/ use automated storage and retrieval systems	Processes run 24/7, less energy consumption, reduce human errors

Reusable handling units and goods tracking	Use RFID to track inventories	Require some investments in equipment and a good IT system	Retain resources and track damages and losses easily
Recycling in the warehouse	Recycle the waste in the warehouse or nearby	Implement waste management plan	More recycled materials, less waste
Packaging materials	Use as little as possible materials, use only recyclable components	Optimization, design and planning of the packaging	Less raw materials in use, less waste
Fewer returned goods	Decrease number of returned goods due to unsafe transportation and bad handling in the warehouse	Increase safety of load, training of employees, appropriate package	Less costs and transportation, less waste and environmental impact

Kesko Oy is doing a good job in terms of greening its operations. However there are some things that could be done better or improved. First of all, considering energy production, the company should increase the amount of renewable energy that they produce. Solar panel should be installed not only on the big supermarkets, but on every shop and warehouse. In addition, in some areas wind energy or geothermal energy could be used. Moreover, the firm must use and buy only renewable energy also in the foreign branches of its business. According to Kesko they have around 45 property managers responsible for efficient energy usage. However, number of shops under Kesko's ownership is much bigger, therefore it is wiser to have energy managers for each shop. This will improve energy efficiency of different shops and allow to concentrate more on the future innovations. Regarding energy saving methods in the warehouse, Kesko logistics have very good approaches. Nevertheless, the use of lighting control sensors could decrease energy usage and save costs. Furthermore daylight should be used during day time, which also helps to minimize energy consumption.

Kesko logistics is using road transport as the main mode. In author's opinion, the company should start switching to rail transport. It is more environmentally friendly and can carry bigger amount of goods on the longer distances. Another solution can

be combination of road and rail transport. In terms of goods consolidating and routes optimization Kesko logistics are doing pretty well. From the interview with Kesko's environmental specialist, it has been revealed that most common reasons for return of goods are damaged items during transportation and warehouse handling. Author suggests that firm should concentrate on the safety of load, reliable packaging and employee's trainings. Additionally, people who handle goods in the warehouse should be aware of rules for carrying various specific goods. This will result in decrease of return goods, saving costs and less transportation leading to less emissions.

Talking about warehouse operations Kesko logistics should invest in automation. This will allow to run operations 24/7, work without lights and reduce errors. Radio Frequency Identification will enable to track inventories during transportation and in the warehouse, follow damages and losses. The company should also think about recycling possibilities in the warehouse. This implementation will require some new equipment and qualified personnel. In return it can reduce waste, increase recycling and allow to return some of the parts as raw materials back in production. Lastly, Kesko Oy should strive to use only recyclable packaging. The wrapping must be optimized for each product and have minimum raw materials in it. Adoption of this methodologies will save resources, costs and energy. In terms of waste management company is doing great job and does not require any changes.

4.5.2 S Group/Inex Oy

The table below depicts the possible improvements that can be adopted in order to increase efficiency and mitigate environmental impact.

Table 17. Possible changes for S Group/ Inex Oy

S Group/ Inex Oy			
Areas	Changes	How to achieve	Effects
Purchased energy	Buy only renewable energy	Assess and audit energy suppliers	Better social image, less emissions

Energy production	Increase renewable energy production	Consider solar energy not as a way of saving costs but as being environmentally friendly. Start to install solar panels on shops roofs and warehouses. Consider other renewable energy sources	Less emissions, better social image, cost savings in a long run
Energy savings methods in warehouses/shops	Install special management system that will allow to remotely monitor the properties and equipment	Hire a specialist who can plan and install a proper system	Reduce energy consumption, save costs, less emissions, possible to stop operation in emergency cases remotely
Transportation mode	Shift from road to rail transport. Combine road and rail transportation	Optimize shipments and routes. Choose rail for long distances and road for short ones	Decrease CO2 emissions, save time, possibility to transport more goods at once
Inex Oy fleet	Purchase own vehicles for transportation or before choosing carriers assess their environmental impact and monitor their emissions and fuel consumption.	Purchase high capacity long trucks. Close cooperation with carriers, special trainings for eco-driving.	Maximum payload and minimum emissions, saves costs
Minimize number of returned goods	Describe goods more precisely: online and in the shop; make return policies more strict; accept goods in a good condition; proper handling/ transportation of items	Good website, employees training	Less reverse transportation, save packaging materials
Reusable handling units and goods tracking	Use RFID to track items. Use CHEP's pooled handling units	Require some investments in equipment and a good IT system. Require some monthly expenses	Save resources, monitor the condition of returned goods and handling units
Recycling in the warehouse	Recycle the waste in the warehouse or nearby	Implement waste management plan	More recycled materials, less waste

Packaging materials	Use as little as possible materials, use only recyclable components	Optimization, design and planning of the packaging	Less raw materials in use, less waste
Recyclable bags/packaging promotion	Change all the plastic bags to paper or recyclable bags, designed own eco- packaging	Use only recyclable bags in shops, invest in own recyclable and efficient packaging	Less waste, better social image

First of all, S Group should set as a goal of its company to purchase renewable energy from suppliers. Since it can take some time to implement this idea, they should start with auditing and assessing of its energy suppliers. In addition there should be a tight cooperation and connection with them so that S Group could control and lessen the emissions from its distributors. Next the company must increase its renewable energy production at least in Finland, since they are considered to be one of the most energy consumers in that country. Renewable energy should not be considered as a way of saving money, but as a way of saving resources and improve environmental sustainability. Considering energy saving methods in warehouses Inex Oy has been doing a really good job. However, author believes that a possibility to monitor and control warehouse processes remotely will allow to increase efficiency, reduce energy consumption and avoid accidents.

Regarding transportation Inex Oy preferring road mode over others. They believe that it is more flexible, cheaper and faster. Nevertheless, authors think that logistics operator must consider a modal split in its operations, since rail transport is more efficient. One solution can be to use rail transport when shipping goods to/from Russia or other far countries or to the northern parts of Finland. Another option is to combine road and rail transport in order to move more goods at once and lower CO2 emissions. One of the most important changes that should be done in terms of transportation is to purchase its own fleet. From one point it is better to use an outsourced services from the companies that are professionals in that area. However, having own vehicles will allow to have a better control and monitoring of fuel consumption, emissions and vehicles conditions. For instance buy high capacity long trucks will allow to have a maximum payload and minimum emissions.

Talking about returned goods, the most common reasons for returns are wrong purchases and damages during handling. In this case the solution can be to describe goods more precisely online and in the shop, this will guarantee that customers buy what they want. Also return policies must be strict: only the goods with undamaged packaging should be accepted, the time during which returns are possible must be precise and possibility to exchange for a new item. This will exclude unnecessary return movements to the warehouse/ suppliers, changes of packaging, minimise waste and save energy. Inex Oy are using many pallets and handling units in their operations. Author suggests that they should track their handling units and goods in order to know about any damages and losses. Another great solution would be to outsource pallets, crates, boxes and other units from CHEP. This company providing recyclable, reusable and reliable handling units for a small fee. Also it takes care about cleaning, fixing and recycling of the equipment. Therefore Inex Oy will be sure about sustainability of its operations.

On-site recycling in the warehouse is a great idea to minimise waste and use resources efficiently. Some of the materials can be returned back to the production or used as energy. It will allow to avoid sending waste to landfills. Another proposal consider packaging materials. Inex Oy must use as little as possible materials and only recyclable components. The packaging must be designed and optimised for each specific product. In addition S Group should invent its own recyclable packaging in order to minimise waste. They also can substitute all the plastic bags and packaging in the shops for paper or recyclable ones. This will result in better customers perception, less waste and saving of resources.

4.6 Conclusion of the case

Both companies have a direct and indirect impacts on the environment. The most direct emissions come from generation of purchased electricity and by fuel consumption for producing own heat and electricity. Another big sources of direct emissions are transportation and waste coming from warehouses. Considering indirect emissions the greatest contributors are operations related to production, use, and disposal of goods and packaging.

However companies have proven that they are on the right way of mitigating environmental pollution. Some of their green logistics operations and processes are done with a high environmental awareness. Kesko and S Group should continuously improve their way of working and encourage others to put their contribution to the enhancing of environmental sustainability.

5 Summary

The main objective of this research was to answer the question: **How and in what way the companies can implement green and reverse logistics concepts in order to improve the environmental sustainability?** There are many methods and practices of adoption of the green logistics concept into the companies' structure. Using a rail instead of road transport, goods consolidation and optimization, routes planning, eco-driving and usage of bio-fuel can dramatically decrease CO₂ emissions. Various sensors for lightning, ventilation and air conditioning; usage of renewable energy; and reusable units tracking can lessen the energy consumption. The proper designed and optimized packaging from recyclable materials; reuse, recycling and correct disposal of returned goods tremendously decrease amount of waste.

Green and reverse logistics are sophisticated concepts that encompass a wide range of different activities and operations. Reverse logistics should have the same priority as the forward logistics. Companies must adopt green logistics principles in order to benefit the environment and themselves. The most common reasons of organizations for greening their supply chain are governmental regulations that brings such benefits as tax reduction and financial support; economic benefits meaning cost reduction and profit increase; competitive advantage resulting in new markets possibilities and product innovations; environmental standards, following which result in positive customer's perception. Even though there are many factors that trigger implementation of sustainable practices, firms must understand that our resources on Earth are limited and improvement of the state of environment is crucial and essential.

The most common barriers appearing on the road to green logistics implementation are lack of top management involvement, lack of costs, lack of proper IT system and

absence of governmental legislations and support. It is very strange that there exist barriers for reducing pollution and waste. Nowadays most of the companies still put high profit as the core goal. However in several decades resources will be exhausting and hard to get, so the companies must think in the future and start having environmental sustainability as a priority of its business.

On the example of Kesko and S Group author has convinced that big companies that operate in different countries are taking seriously the effects of its activities on the environment using different methodologies and techniques. They must continuously improve their operations and strive to perfection in order to be environmentally friendly and sustainable.

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Appendices

Appendix 1. Interview questiones

Green logistics

What is your name (not compulsory to mention) and what is your position in the company/where do you work?

What are the environmental goals of the company?

Warehousing

Do you have one warehouse or several smaller ones? How (it has different zones for storage sorting packaging etc.) and where the warehouse is located and what are the main reasons for that location? (Close to the big cities, good railway/road connection, located near the sea port etc.)

Do you use forklifts in the warehouse? If yes, are they electric, diesel or petrol powered?

Do you have automated guided vehicles in your warehouse?

What are the possibilities for recycling in warehouses? Can goods, packaging, waste be recycled in the warehouse itself, or does it need to be sent to a recycling plant?

What kind of lighting you have in the warehouse? (Normal lamps powered with electricity, LED lamps, solar panels, daylighting?)

For how long time the goods are usually stored in the warehouses? Do you have special place for the storage of returned goods?

What is the most common way to pick goods in the warehouse? (pick-by-scanner, pick-by-light, pick-by-voice, pick-by-CMD, or pick-by-vision, other?)

Are there any control systems for ventilation, lighting, heating?

How do you reduce energy consumption in the warehouse/outlet?

Transportation

What is the most common transportation mode you use to ship goods to the customers/ from suppliers? (trucks, train, small vans or combination) Why is this mode used?

When choosing carriers do you take into consideration if they are eco-friendly or not (amount of Co2 emissions produced etc.)?

Do you consolidate goods or the goods with same destination are sent separately?

Are the distances between warehouse and customers/retailers/suppliers long?

What is the most important indicator in transportation in your company time or cost?

Packaging

What kind of handling units do you use for carrying orders? (Wooden pallets, paper/ cardboard containers?)

What kind of packaging material is/are used? (Carton, plastic, polyfoam, plastic film or tapes)

Why are these materials used? (Cheapest, practical, more durable, easy to recycle etc.)

What are the purposes of the packing material? (protect goods, maintain needed conditions of the goods, protect from moisture etc.?)

Is the packaging material being reused? (Return of packaging materials, return of pallets, containers?)

Any data management systems?

Reverse logistics

What are the return policy in the company (E.g. goods can be return within 14 days, guaranty for goods etc.?)

Does your company has its own reverse logistics or outsourcing it?

What are the main reasons for products returns? (damaged during transportation, customer changed his mind, does not work properly) Is it measured somehow?

How is the product inspected after it is returned? Do you assess its value after the return in order to decide what to do with the product?

Where does the returned product go depending on its reason of return? (Warehouses, production plant/ supplier, recycling facilities, secondary market?)

How do you mark which problems the returned product has and what should be done with it? (Label it, mark with barcode or RFID tag?)

Do you use any reusable packaging materials? If yes, what kind of? (pallets, containers) What do you do with it after it is used and returned? (inspect, clean or repair?)

Do you require from customers to return packaging?

Are there any models or methods used to improve Reverse logistics?

Anything other related to the topic that can be added?