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# GREEN LOGISTICS IN LOGISTICS INDUSTRY IN FINLAND

Case: Inex Partners Oy and Suomen Kaukokiito Oy

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Kaukokiito Oy

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ABSTRACT

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This thesis deals with green logistics, especially about the environmental sustainability in the logistics industry in Finland. The main objective of this thesis is to analyze the main reasons for companies to practice green logistics and to give some constructive advice to promote the environmental sustainability of these companies' green logistics systems.

In the theoretical part, the different academic definitions of green logistics are introduced. Due to "green" being the core of green logistics, which represents sustainability, especially environmental sustainability, the definition of sustainability by the Brundtland Report is applied and the three pillars of sustainability, particularly the environmental sustainability, are described. In the meantime, the green logistics system, as the key theory of this thesis, which encompasses green transport; green warehousing; green packaging; green logistics data collection and management; waste management, is presented. Considering the environmental sustainability, each component of the green logistics system is examined in detail. In addition, the reasons for companies to develop green logistics are analyzed from the external and internal sides.

In the empirical part, data are collected by theme interviews via E-mail. The result was first presented from company to company. Then the authors concluded the common facts. The suggestions were given separately according to companies' situations.

The results of the thesis indicate that all the definitions of green logistics emphasize environmental sustainability. From the external sides comprising the marketing demand and environmental concerns and from the internal sides referring to the companies' long-term business goals, practicing green logistics is very important for Finnish logistics companies.

Key words: Green logistics, environmental sustainability, Finnish logistics industry, Inex Partners Oy, Suomen Kaukokiito Oy

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# 1 INTRODUCTION

## 1.1 Background

The word logistics' first appearance can date back to thousands of years ago when it started as simple as a way of providing time and place utility, according to L.D.H. Weld(Alan McKinnon, 2010). However, as the technology developed, logistics started to play an important role in the business world and organizations. Meanwhile, it has also started to play a vicious role in consuming non-renewable resources and in creating green gas emissions.

Governments and the public have started to pay attention to environmental problems since the 1950s. In the 1960s, articles about green logistics first started to show in logistics journals. Throughout the past 50 years, the pressure from public and governments encouraged companies to form the concept of green logistics.

The authors believe that green logistics is the expected outcome of modern logistics development. The logistics industry is emerging as a modern industry that relies on the specialization of socialized mass production and rapid economic development. It is closely connected to many current environmental friendly concepts such as green production, green marketing, green consumption and other green economic activities. Economic activities should not excessively consume resources just on the logistics section. In addition, green logistics is seen as a necessary way to reduce operating costs for companies. It is generally believed that from production to sales of a product, manufacturing accounted for only a small amount of the total time. The majority of the time is spent for warehousing, transportation, handling, packaging, distribution processing, information on processing and logistics processes. Therefore, the development of green logistics will definitely bring companies to a new eco-friendly operating structure.

## 1.2 Motivation of the Study

The first motivation of the study came from the authors' growing personal curiosity about the logistic field. Both of these authors came from China, where otaku (people who excessively rely on the internet, shop everything from the internet and spend most of their time alone at home) is a growing popular trend among young people.

These authors represent young people's lifestyle. In fact, this kind of lifestyle also forecasts the future business opportunities. After gaining many experiences with online shopping, these authors started to notice something about the delivery packages. Sometimes, the packages come in a very convenient form with recyclable materials, but there are also times when the products come in wrong sized carton-boxed packages with lots of unnecessary fillings. (see Figure 1)



FIGURE 1. Package comparison

Those always make these authors feel a bit bad about creating so much waste just by buying little things. And that was the first thing that encouraged these authors' study about green logistics.

The second motivation was more of a recent idea. After having logistics courses, these authors noticed that logistics has stepped into a wider area than these authors originally thought it would be. Topics about logistics methods are



discussed more than the logistics itself. Moreover, these authors also noticed that there is not yet an authoritative definition of green logistics. Although it is difficult for these authors to find information about the subject since it is still evolving, these authors still decided to study it, because of the unknown possibilities in the subject.

### 1.3 Objective and Research Questions

The objective of this thesis is to analyze the main reasons for companies to practice green logistics and to give some constructive advice to promote the environmental sustainability of these companies' green logistics system. By analyzing the research data, the authors will be able to summarize the current logistics trend and to help with improving companies' green logistics strategy.

The main research question will surround the concept of green logistics, followed by several sub questions.

#### **How is green logistics used in practice in the logistics industry in Finland?**

-what is green logistics?

-why do Finnish companies choose green logistics?

-how to improve green logistics in practice?

### 1.4 Limitations

As these authors' study is focused on Finnish companies' logistics departments, all the research and advice are made according to the situations in Finnish logistics industry. Roughly speaking, the first limitation is that the study might not be practical for other countries' logistics industry. To see it in a stricter way, the generalizability of the results might be limited because of the small number of research companies and the fact that they are Finnish

companies. The conclusions are based on their study within Finnish logistics industry and the case companies. Hence, the results are tailored for the Finnish case companies. It might not be practical to some other countries' logistics companies.

These authors take into consideration that many companies are operating internationally nowadays. However, green logistics is a special subject that is limited by many external factors, for example, climate, resources etc. Hence, the second limitation is that these authors will only carry out studies from companies' perspectives. As for companies that are operating internationally, these authors will only study the company's green logistics structure in Finland or study the company's green logistics concept in general.

## 1.5 Theoretical Framework

The theoretical part of this thesis consists of three main concepts: sustainability, especially the environmental sustainability, the framework of the green logistics system, and the external and internal factors that contribute to companies going green.

Because the word "green", which is the core of the phrase "green logistics" characterizes sustainability, the concept of sustainability and the three pillars of sustainability, economic, social and environment, will be discussed in Chapter 2.

The framework of the green logistics system is shown in Figure 2, which consists of the components: green transport; green warehousing; green packaging; green logistics data collection and management; waste management. (Marcus Thiell, 2011) The general feature of the green logistics system is employing advanced technology and equipment to minimize environmental damage and increase the utilization of the resources. (Rogers, 1998) In Chapter 2, the environmental sustainability will be applied to the framework of the green logistics system and each component of the green logistics system will deal with the environmental sustainability issues.

In Chapter 3, the main reasons why the companies go green and adapt to green logistics will be analyzed from the view of external and internal factors.

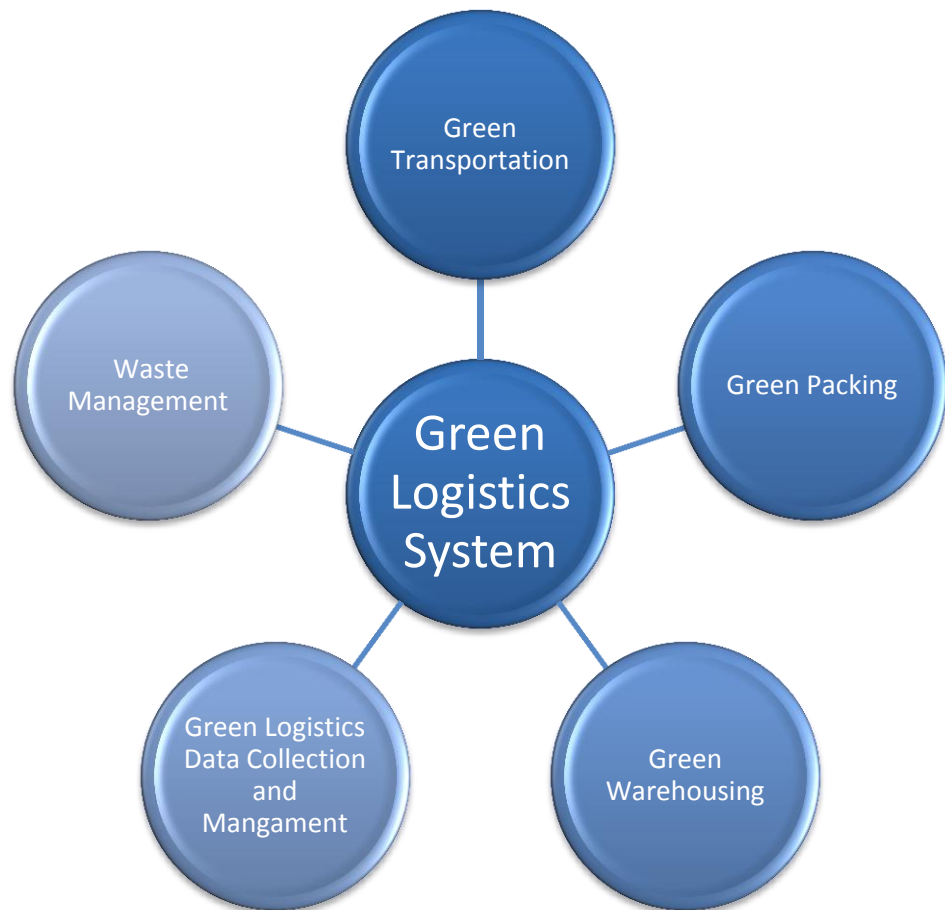


FIGURE 2. Framework of the green logistics system(Marcus Thiell, 2011)

## 1.6 Research Method

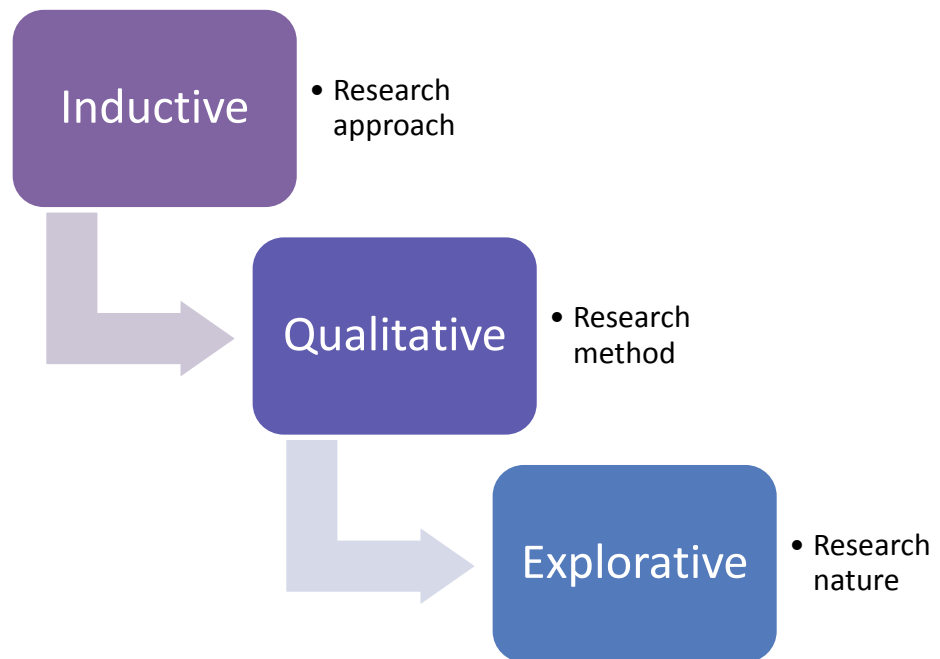


FIGURE 3. Research method

The authors started their thesis with gathering articles about green logistics. They first read an article about green logistics. Then, they started to look for more information on the aspects, which gave them a general idea about green logistics in modern society. An inductive approach is used during the process. The inductive approach helped these authors to condense a pile of raw data (data reduction), to link up the summary from the data with the research objectives.

These authors decided to use a qualitative research method in the beginning of the thesis (Chapter 1, 2, 3.) after having gathered condensed data. A qualitative research method is a method used to form theories based on multiple sources of context. Hence, these authors formed their theory and objectives of the thesis based on multiple secondary sources (literature, articles, internet).

Although a lot of theory concerning sustainability and green logistics exists, there is not that much research on the practical decisions of the companies. So the nature of this thesis is explorative and descriptive. In the case company research chapter, data is going to be collected by the means of interviews and

meetings with the companies, detailed company presentations and literature. Both primary and secondary research is going to be engaged in the process.

## 1.7 Thesis Structure

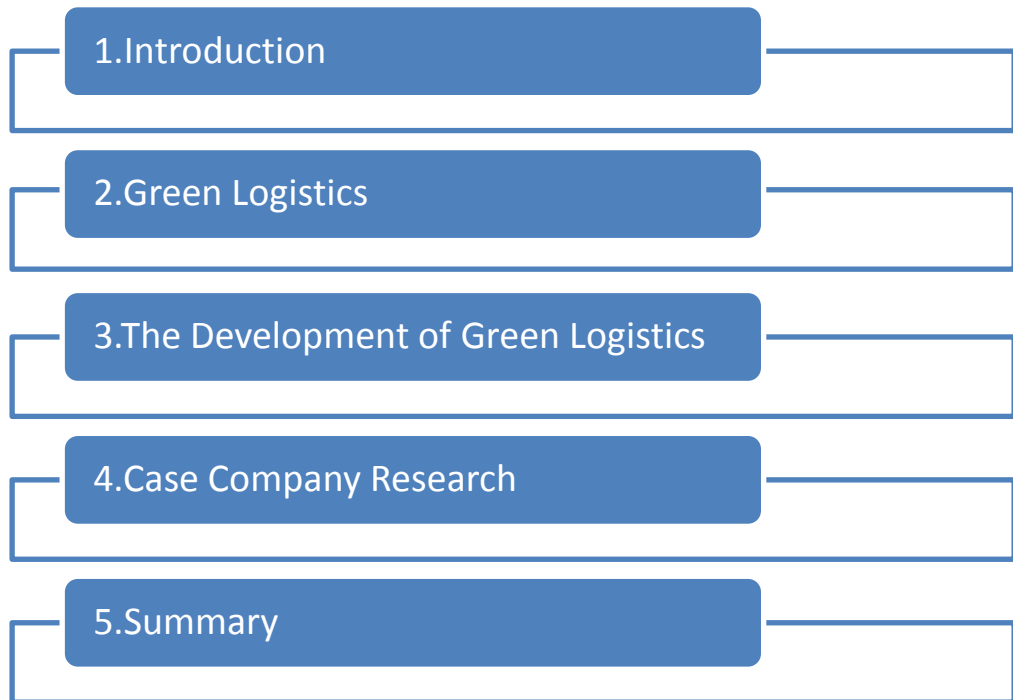


FIGURE 4. Thesis structure

The thesis structure is shown in Figure 4 above.

In Chapter 2, the authors will define green logistics and answer the question about what is green logistics, and in the end of the Chapter 2, the core thesis theory will be introduced.

In Chapter 3, these authors focus on providing general background information about green logistics and its formation in chronological order. Detailed information about the current green logistics situation in Finland will also be given.

In Chapter 4, these authors will conduct their case company research. Data will be presented and analyzed separately according to company. Within this chapter, the authors answer the research questions about how green logistics is used in practice and how to improve green logistics in practice.

In Chapter 5, there will be a brief summary of the thesis. The final conclusion will be given by answering the research questions of this thesis and two recommendations for further research are provided.

## 2 GREEN LOGISTICS

In the beginning of this thesis, the authors discussed what green logistics is. In the discussion, these authors thought that the key to find the correct definition of green logistics is to understand the word “green” of the phrase “green logistics”. Based on some research and study, these authors find that “green” symbolizes sustainability; furthermore, it emphasizes environmental responsibility.

### 2.1 Definitions of Green Logistics

Before explaining the details of the findings, it is better to have a look at the various definitions of green logistics. Green logistics is a concept put forward in the mid-80s(Beaman, 1999).

➤ Rodrigue, Slack and Comtois(Rodrigue, 2001) :

Rodrigue, Slack and Comtois defined green logistics by dividing the words, explaining them separately and putting them together: “Logistics is at the heart of modern transport systems. As has been demonstrated, the term implies a degree of organization and control over freight movements that only modern technology could have brought into being. It has become one of the most important developments in the transportation industry. Greenness has become a code word for a range of environmental concerns, and is usually considered positively. It is employed to suggest compatibility with the environment, and thus like logistics, is something that is beneficial. Then put together the words suggest an environmentally friendly and efficient transport and distribution system.”

➤ Sbihi and Eglese (A. Sbihi, 2007):

Green logistics is concerned with producing and distributing goods in a sustainable way, taking account of environmental and social factors.

➤ Larsen (Larsen-Skjott;ym., 2007):

Green logistics is defined as “efforts to measure and minimize the environmental impact of logistics activities, these activities include a proactive design for disassembly”.

The common perception of these definitions of green logistics emphasizes environmental sustainability. Therefore, in the following sections, the concept of sustainability, particularly environmental sustainability will be focused on.

### 2.1.1 The Brundtland Report Defined Sustainability

The word “sustainability” is derived from the Latin *sustinere*: tenere, to hold; sus, up. In many dictionaries, there are plenty of meanings of “sustain”, mainly including “maintain”, “support”, or “endure”.

In 1987, “sustainability” was defined in a report published by the United Nations. This report is called *Our Common Future (1987)*, which is better known as the Brundtland Report. It was preceded by some publications about the social responsibility of businesses and their impact on the environment. For instance, the report *Limits to Growth*, published by the Club of Rome in 1972, promoted the idea that economic and population growth, as it developed at the time, could not be sustained indefinitely by the planet because it depleted natural resources. (Peattie, 1995)

Since the Brundtland Report, which has been used more in the sense of human sustainability around the world, defined sustainability, as people understand it today, the definition of sustainability and sustainable development has been the



most widely quoted. The direct quotation from the report of the definition for sustainable development is: “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” In this definition, needs and limitations are the key concepts. If the present generation continues to exceed the planet’s environmental capacity and borrows the essential resources from the future generations, without a doubt, the future generations will be limited to meet their own needs.

Following the publication of the Brundtland Report, the United Nations Conference on Environment and Development (UNCED) was organized in Rio de Janeiro in 1992. This conference is also known as the Earth Summit. In the summit, there were 108 heads of state or government and about 2400 representatives of non-governmental organizations (NGOs). The principal themes of the conference were on environment and sustainable development. Its aim was to help the governments to rethink economic development and to find suitable ways to halt the destruction of irreplaceable natural resources and the pollution of the planet. The resulting document of the summit was called the Agenda 21, which is a wide-ranging blueprint for action to achieve sustainable development worldwide (EU Conference, 1992).

Agenda 21 also influenced companies’ business activities. As a key business performance activity, logisticians and supply chain managers in companies could no longer ignore the importance of sustainability in logistics. (Hans, 2011)

### 2.1.2 The Three Pillars of Sustainability

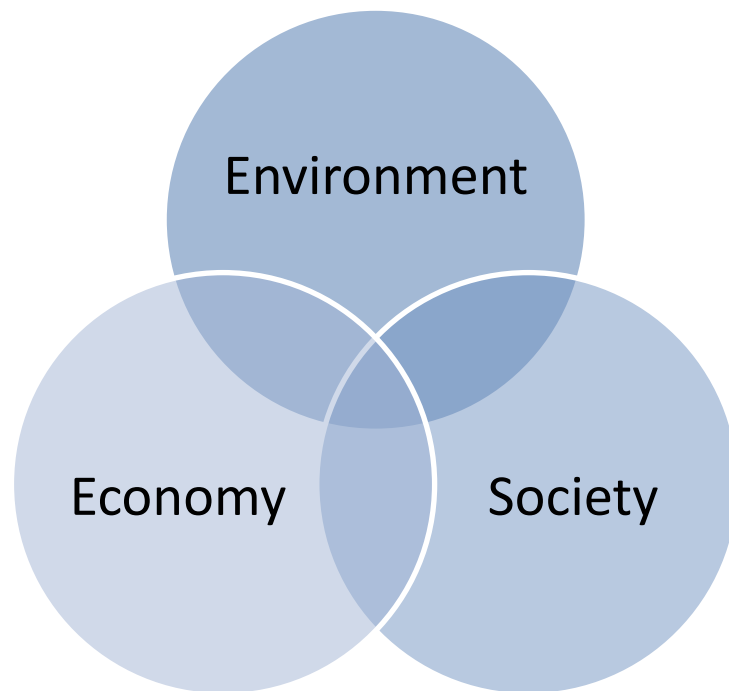


FIGURE 5. The three pillars of sustainability

The three pillars of sustainability consist of economy, society and environment. As it is presented in Figure 5, these three components are intertwined. They are not mutually exclusive and can be mutually reinforcing (“Sustainability”, 2010). The main objective of sustainability is developing and implementing the proper methods to balance the three pillars, that is to balance the consumption of resources with the impact of that consumption on the environment(Parsons). However, there are general factors restraining the achievement of sustainability such as cost, lack of awareness, coordination and communication, as well as resistance(Carter, 2000). Once these barriers which influence the impact of consumption on the environment are being overcome, the economic and social “value creation” (Table 1) can be provided.

TABLE 1 Contribution of green logistics to the creation of economic and social value (Kumar, 2006)

<b>Creation Value</b>	
<b>Economic</b>	<b>Social</b>
<b>Improved customer satisfaction</b>	Reduced environmental impact (e.g. CO <sub>2</sub> -emissions, noise levels)
<b>Good relations with stakeholders</b>	Better utilization of natural resources (e.g. fuel, packaging)
<b>Green image</b>	
<b>Higher delivery reliability through optimized route planning and less truck downtime</b>	Development in harmony with culture and available resources
<b>Higher productivity through higher motivation of the employees</b>	Reduced social cost (e.g. health problems in the communities)
<b>Reduced liability risk</b>	Access to clean water and clean energy
<b>Reduced taxes</b>	Creation of jobs
<b>Improved financial performance</b>	Enhanced quality of life

In these authors' opinion, Figure 5 is a little bit simplistic to visualize the relations of the three pillars of sustainability. Thinking deeply in terms of the three pillars of sustainability requires Figure 6 as follows.

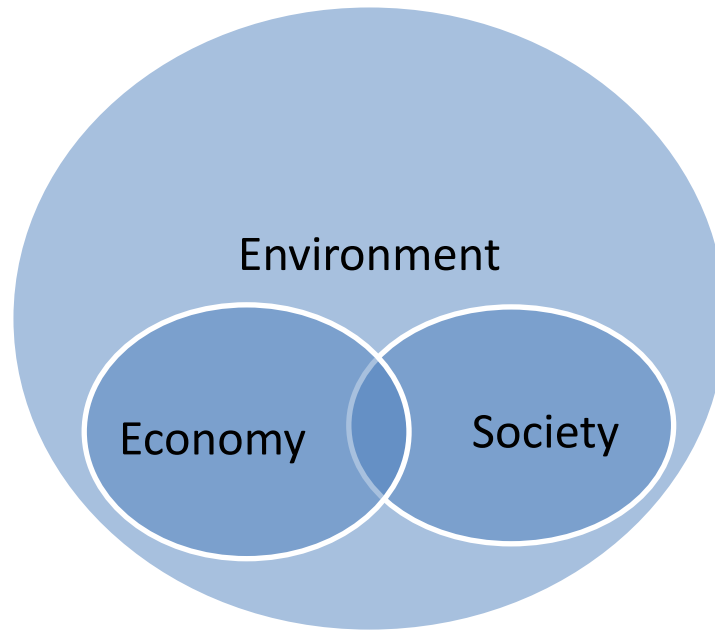


FIGURE 6. The three pillars of sustainability (Thwink org)

According to Figure 6, by systems thinking, these authors recognize that the largest system of them all is the environment. It contains the human system, which has two main systems: social and economic. When groups of people, from a tribe to a nation, agree to form a government, they form a social contract to increase their general welfare. This contract ties the social and economic systems of the group of individuals together. The people (the social subsystem) are working together under a central government to maximize their economic system's output. Due to the lower the carrying capacity of the environment, the lower the common good delivered by the social system and the less output the economic system can produce, the environmental sustainability must be given the highest priority. (Thwink)

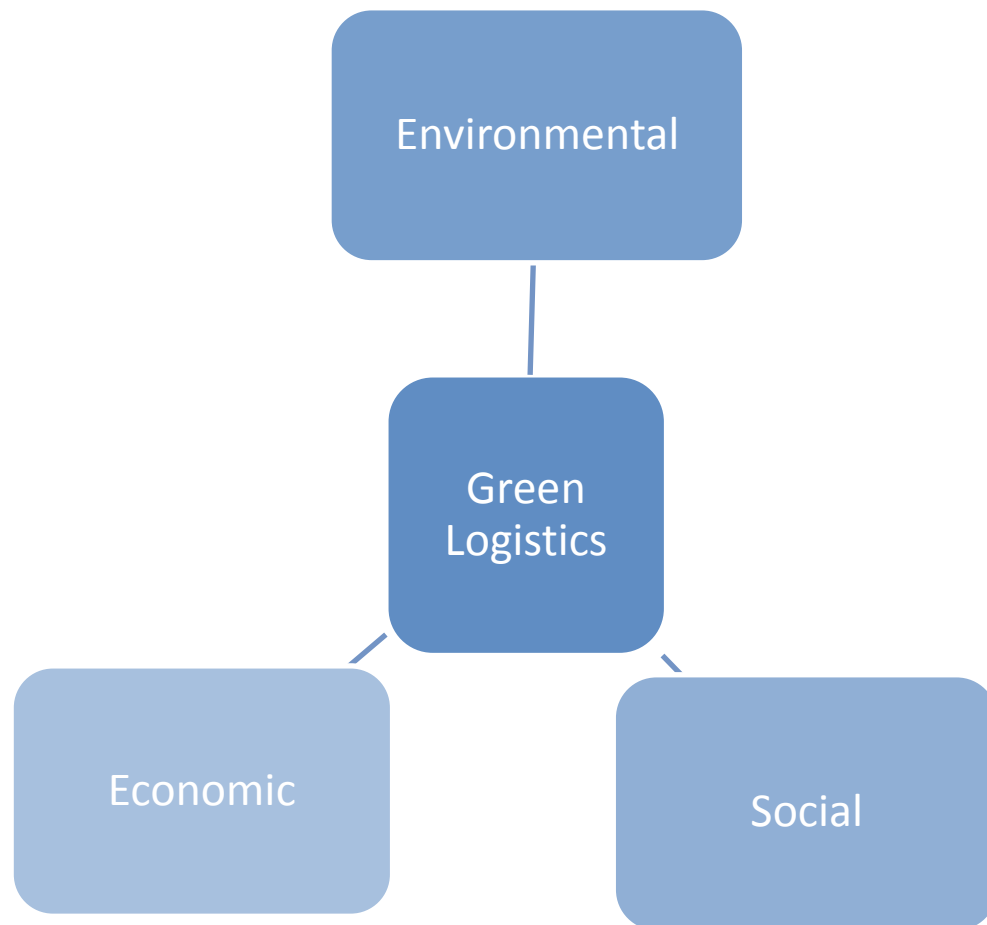


FIGURE 7. Green logistics framework

The three pillars of sustainability can be applied to green logistics (see Figure 7). As mentioned in the definitions of green logistics before, in the past, companies coordinated their logistics activities comprising freight transport, warehousing, packaging, materials handling and data collection and management to meet customer requirements at minimum cost which just refers to the monetary terms.

Now, the environment has been a concern. It is treated as a factor of the cost. Some companies have already taken external costs of logistics associated especially with the environmental issues such as climate change, pollution and noise into account. Green logistics is therefore defined as efforts to exam ways of reducing these externalities and achieving a more sustainable balance between environmental, economic and social objectives, see Figure 7. All the

efforts in the “green” logistics area are therefore focused on contributing towards, and ensuring, sustainability.(Hans, 2011)

### 2.1.3 Environmental Sustainability of Green Logistics

According to Poist’s argument, the history of logistics could be divided into three eras, see Figure 8. They are prelogistics, logistics and neologistics.

Each era was separately characterized by disparate approaches: the Modal Cost and Modal Rate approaches; the Total Cost, Total Profit and Total Channel approaches; the Total Enterprise approach in which companies began to consider the logistics systems as part of the overall corporate mission and objectives and the Total Responsibility approach.

Furthermore, the primary emphases of the three eras were totally different. The first era prelogistics emphasized the design of efficient transport systems while the second era logistics stressed the design of logistics systems rather than simply transport systems. The third era neologistics consists of two phases: phase one focused on logistical contributions to a company’s economic welfare and phase two emphasized the corporate and societal implications of logistical decisions. Poist also insisted that logistics is especially well positioned to contribute to environmental and ecological control. (Murphy, 1996)

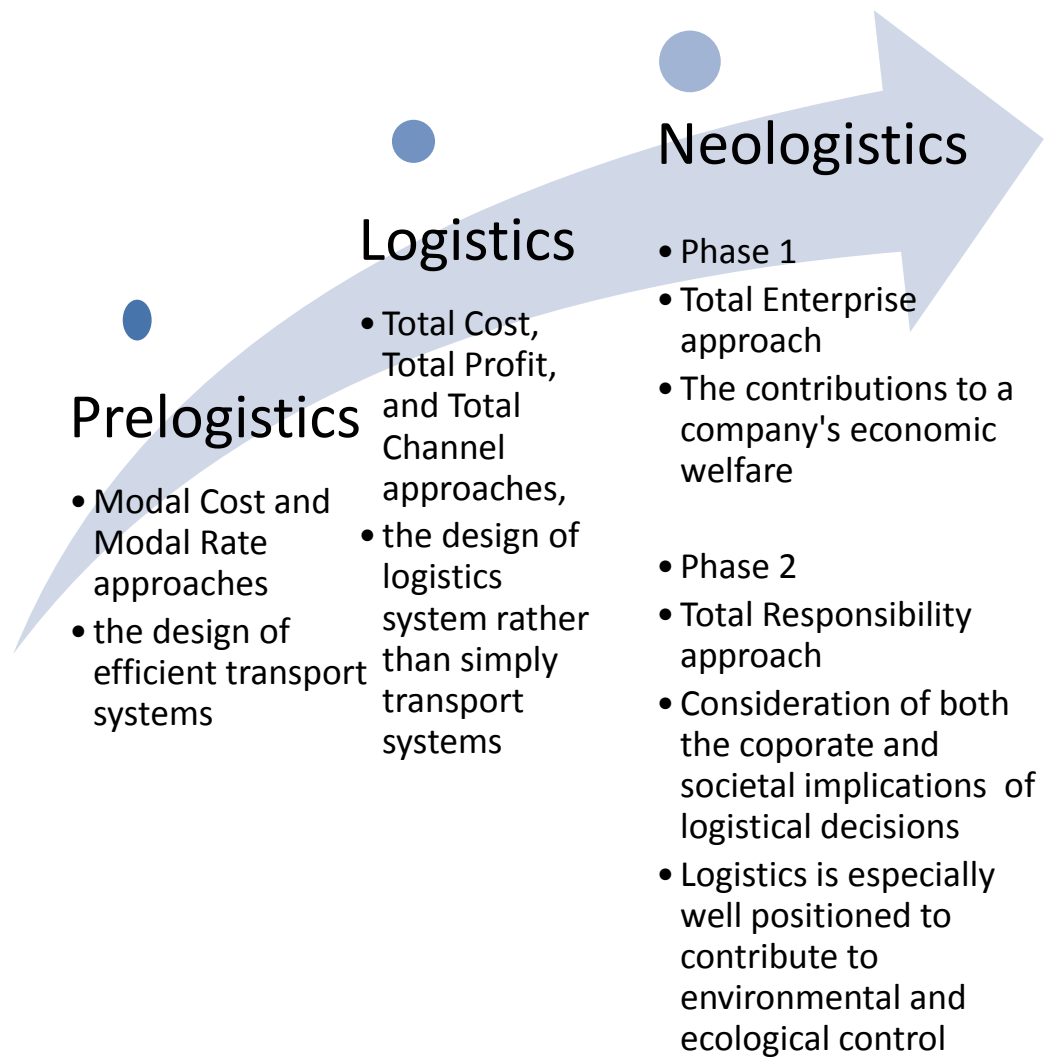


FIGURE 8. Green logistics: comparative views of environmental progressives, moderates, and conservatives(Murphy, 1996)

Poist concluded that environmental issues affect numerous logistical decisions since the public concern about negative impact on the natural or physical environment has increased and environmentalism has been characterized as the most significant force shaping the economy, as well as the most important issue facing business during the 1990s. Indeed, some corporate executives have referred to the 1990s as the “decade of the environment” (Murphy, 1996). Because the environmental issues were more noticeable and frequently more threatening than other social problems and the environmental cost of logistics went up quickly, many company executives considering the long-term interest, made their logistics decisions more environmentally friendly. For instance,

some companies implemented the environmental certification to achieve their goals improving the company reputation and generating a competitive advantage.

#### 2.1.4 Environmental Certification

What is environmental certification? Environmental certification is a form of environmental regulation and development where a company can voluntarily choose to comply with predefined processes or objectives set forth by the certification service(Nebel. G, 2005). The feature of the environmental certification is addressing companies' various environmental managements which are in accordance with their objectives to minimize the harmful impacts to the environment.

##### ◇ ISO 14001:2004 and ISO 14004:2004

The first two supplier certifications in quality management standards, ISO 14001:2004 and ISO 14004:2004, deal with environmental management systems (EMS). An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency (Environment Management).

ISO 14001:2004 provides the requirements for an EMS and ISO 14004:2004 gives general EMS guidelines. Other standards and guidelines in the family address specific environmental aspects including labeling, performance evaluation, life cycle analysis, communication and auditing.(Dunn, 1995) (see Table 2) Companies compile a set of environmental practices depending on these environmental standards not only in their logistics but also in their entire business.



TABLE 2. Environmental certifications

<b>The environmental certifications</b>	<b>ISO 14001:2004</b>	<b>ISO 14004:2004</b>	<b>Other standards and guidelines: labeling, performance evaluation, life cycle analysis, communication and auditing</b>
<b>Issues the environmental certifications deal with</b>	deal with environmental management systems (EMS)	gives general EMS guidelines	address specific environmental aspects

Except for providing the supplier environmental certifications, the International Organization of Standardization also gives the environmental assessments to evaluate the vendors' qualification. The environmental assessment ISO 14000 series, as a registration process for vendors, targets environmental processes all around the world. The evaluation process is made of the organization evaluation and the product processes assessment. The environmental organization evaluation includes management systems, environmental performance, and environmental auditing. The product process assessment looks at life-cycle assessment, labeling, and product standards. The object of setting the environmental assessment ISO 14000 is to gain a worldwide standard for environmental processes. (Cascia, 1994)

#### ✧ Breeam

Breeam is the world's leading design and assessment method and rating system for sustainable buildings. Since Breeam was first launched in 1990, there are

already 250,000 buildings certified by Breeam assessment ratings and more than a million constructions were registered for assessment. Nowadays, it has become one of the most comprehensive and widely recognized measures of a building's environmental performance. (Breeam)

The Breeam assessment consists of the measures of performance which evaluate the buildings' specification, design, construction and use. These measures involve a wide range of categories and criteria from energy to ecology. Those criteria refer to water, pollution, transport, materials and waste.(Breeam)

#### ✧ European emission standards

European emission standards define the acceptable limits for exhaust emissions of new vehicles sold in European Union member countries. The emission standards are defined in a series of European Union directives staging the progressive introduction of increasingly strict standards (Standards).

Currently, the various vehicle emissions: nitrogen oxides (NO<sub>x</sub>), hydrocarbons (HC), carbon monoxide (CO) and particulate matter (PM) are regulated. Those regulations of the vehicle emissions are used for most vehicle types such as cars, trucks, trains, tractors and similar machinery, barges, but not including seagoing vessels and aircraft(Standards).

For each vehicle type, different standards apply. The European standard is to be implemented jointly by the Economic Commission for Europe (ECE) vehicle emission regulations and the European Union (EU) vehicle emissions directive. The vehicle emissions regulations can be recognized by the ECE participating countries voluntarily; however, the EU vehicle emissions directive was enforced by the EUE or EU members(Standards).

European standards with Arabic numerals: Euro 1, Euro 2, Euro 3, Euro 4 and Euro 5 are for Light Duty Vehicle standards, whereas, the standards with Roman numbers are for Heavy Duty Vehicles. In Europe, those standards are generally updated every four years. For example, Euro I to Euro V for HD

Diesel Engines, were separately implemented in 1992, in 1996, in 1999, in 2005 and in 2008, (Standards). (See Table 3)

TABLE 3. European emission standards for HD Diesel Engines

<b>European Emission Standards for HD Diesel Engines</b>	<b>Date</b>
<b>Euro I</b>	1992
<b>Euro II</b>	1996
<b>Euro III</b>	1999
<b>Euro IV</b>	2005
<b>Euro V</b>	2008

In comparison with the vehicle emission standards in the United States and Japan, the European standard is more extensive in the testing requirements. Therefore, most of the developing countries introduce the European standard as their own vehicle emission system.

## 2.2 Green Logistics System

In this section, the framework of the green logistics system will be presented. Furthermore, the environmental sustainability will be applied to the framework of the green logistics system by green logistics practices.

As mentioned in the definition of the green logistics, the word “green” which is the fundament of the phrase “green logistics” characterizes environmental sustainability. As well as green logistics, the concepts of reverse logistics and closed-loop supply chain also address the environmental sustainability.

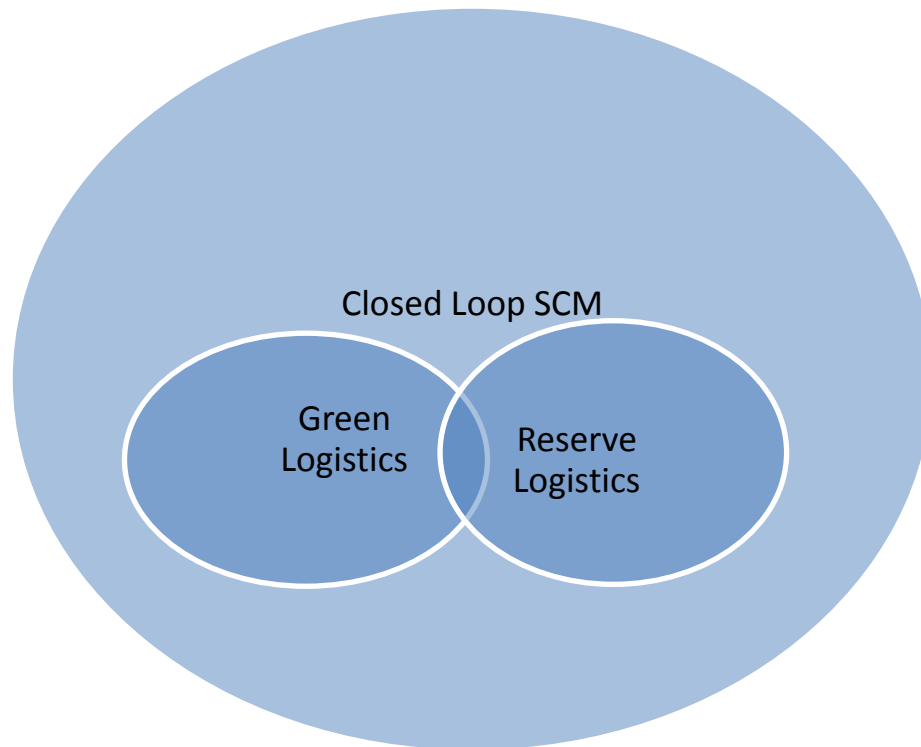


FIGURE 9. Closed-loop supply chain management & green logistics & reserve logistics (Marcus Thiell, 2011)

The closed-loop supply chain management, including reserve logistics and green logistics, is the widest scope of environmental concepts affecting logistics systems (as in Figure 9 above).

Reserve logistics is not only covering transportation, warehousing, and value added services in the context of redistribution of end-of life products and residuals but also their collection, product inspection, dismantling and separation, reprocessing of secondary materials and products, and distribution into productive processes.(Voigt, 2004)

The framework of the green logistics system consists of these components: green transport; green warehousing; green packaging; green logistics data collection and management; waste management. (Marcus Thiell, 2011) (see Figure 10) The general character of the green logistics system is employing advanced technology and equipment to minimize environmental damage and increase the utilization of the resources. (Rogers, 1998)



FIGURE 10. The framework of the green logistics system(Marcus Thiell, 2011)

Now, based on Figure 10 the framework of the green logistics system, the authors begin to explain each component of the green logistics system dealing with the environmental sustainability issues separately.

### 2.2.1 Green Transport

Transportation, which is a major logistics activity has a significant influence on the environment. For that reason, green transportation is one of the main components of green logistics.

There are mainly three sources that have impact on the environment from transportation. These are construction of transport networks, operation of

transport vehicles and disposal of transportation vehicles and parts. (see Figure 11)(Dunn, 1995)

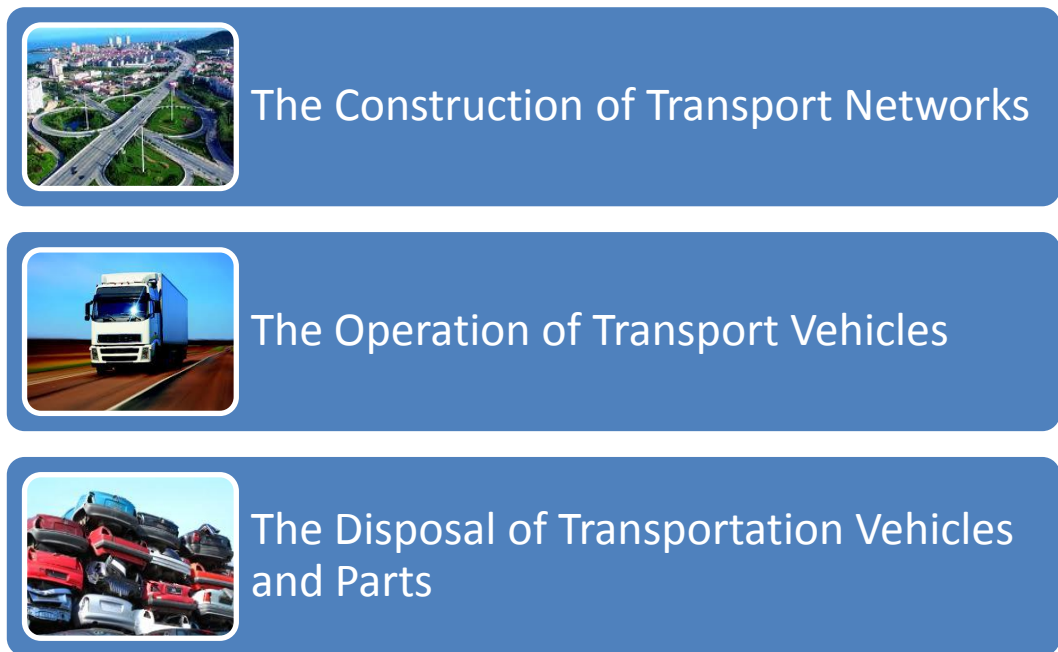


FIGURE 11. The three main sources that have environmental impact from transportation(Dunn, 1995)

Recently, more and more environmental problems arise from the three main sources. For example, using fossil fuel leads to the emission of many toxic chemicals such as CO<sub>2</sub>. Furthermore, the roads, airports, harbors and rails are often filled up and many landfills are polluted with dismantled vehicles and parts. In order to make transportation efficient to prevent these problems and protect the environment, many companies, considering the three main sources, did the green transportation practices within the four general strategies, to use less, to substitute, to clean up the outputs, and to turn outputs into inputs. (Marcus Thiell, 2011)

TABLE 4. The green transportation practices within the four general strategies(Marcus Thiell, 2011)

<b>Three Main Sources from Transportation</b>	<b>Green Transportation Practices</b>	<b>to use less</b>	<b>to substitute</b>	<b>to clean up the outputs</b>	<b>to turn outputs into inputs</b>
<b>The Construction of Transport Networks</b>					
<b>The Operation of Transport Vehicles</b>	Modal Choice	Yes		Yes	
	Freight Consolidation	Yes	Yes		
<b>The Disposal of Transportation Vehicles and Parts</b>	Clean Vehicles/Fuel Efficiency	Yes	Yes	Yes	
	Reuse of Pallets and Containers	Yes			Yes
	Standardization of Trucks Sizes	Yes	Yes		

In Table 4, the authors classified the companies' green transportation practices within the three main sources from transportation and the four general strategies by subject. Because of the government's central role in the

construction of transport networks, there is no company green transportation activities listed within this source. Now, these authors give details of green transportation practices as the following:

#### ✧ Modal Choice

Nowadays, it is common that companies prefer to use multimodal transport to deliver the products. Usually, companies transfer goods from trucks to trains if there are convenient railways. In this way, companies are not only decreasing the transportation cost but also reducing CO<sub>2</sub> emission. According to a report by the American Trucking Association, the environmental efficiency of transport by railways is greater than that of transport by trucks. Every year, transportation by truck, which is nearly 70% of all U.S. freight uses at least three times as much energy per ton carried as transport by train. (Marcus Thiell, 2011)

#### ✧ Freight Consolidation

It is a key for companies working with suppliers to provide products configured within the companies' facility. The creation of distribution centers (DC) is the best practice for companies to integrate operations with their suppliers. Companies transport products for a group of sales points to the DC instead of providing each store by each supplier. In the DC, all the products will be classified and organized. At last, these goods will be distributed to the various stores. As a result, first of all, the companies reduce the number of delivery trips. Secondly, the companies achieve maximum efficiency in a minimum amount of time. Ultimately, the companies make a contribution to protect the environment as the delivery trips are reduced and a smaller number of trucks delivering goods to the stores is required.



#### ❖ Clean Vehicles/Fuel Efficiency

The concept of clean vehicles for companies emphasizes the methods to ensure that the vehicles do not leak out fluids such as oil and gas. The proper maintenance programs are important to help to maintain the vehicles in a safe and efficient working condition and to control and reduce the contamination emanating. In other words, the vehicle life will be prolonged and the accident rates accordingly will be reduced. What's more, the companies will save the operating costs and cut the amount of environmental damage.

In order to help a lot of fleet managers to make appropriate decisions when it comes to the fuel consumption and minimizing waste from the vehicle maintenance, the North Carolina Division of Pollution Prevention and Environmental Assistance (DPPEA) has examined some new technologies that address aspects including usage of alternative fuels, by-pass filters, recycled wash water and discharge into sanitary sewer systems.(Marcus Thiell, 2011)

#### ❖ Reuse of Pallets and Containers

Discarding the pallets and containers produces massive amounts of waste and has a very bad effect on the environment. On the contrary, reusing the pallets and containers can reduce waste and protect the natural resources. By using plastic instead of wood pallets and introducing a systematic program of evaluation and reconditioning of pallets and containers, the contamination is obviously reduced.

#### ❖ Standardization of Truck Size

The benefit of the standardization of truck size is to assist the companies to plan and optimize freight transport. In developed countries, standardization is used intensively, while in emerging markets, it is still a challenge for many companies. As has been known, in such business circumstances, most companies make use of outsource transportation services which are mainly

provided by independent truck operators. In addition, the operating life of these trucks is variable. Some of them work for over 40 years. Although, it is a requirement for multimodal transportation to standardize the truck size, under such business environments, it is very difficult for the companies to do this with their entire fleet easily and quickly.

Except for the mentioned green transportation practices within the three main sources which have an impact on the environment from transportation, there are other solutions companies can consider. For instance, companies commonly choose nowadays to outsource transportation to a sustainable carrier. What is a sustainable carrier? The simplest answer is a carrier providing an environmental friendly service with sustainability criteria in its evaluation and operating processes.

By using green transport practices, companies can not only generate cost reductions but also protect the environment by reducing pollution and traffic congestion. However, as legal persons whose objective is gaining profit, companies taking green transportation activities mainly aim to reduce the operating costs.

### 2.2.2 Green Warehousing

Cross-docking has been a trend in warehousing. It means that manufacturers or distributors, based on the information from stores, directly transport goods to wholesalers and retailers without storing the products in their warehouses. Through cross-docking, companies can cut their costs and achieve maximum efficiency with careful planning and shared information on sales. Many mass merchandisers and grocery chains such as Wal-Mart reportedly have used cross-docking. For those companies, they believe this type of operation is environmentally responsible because both the amount of land occupied by warehouses and the movement within the warehouses is reduced.(Dunn, 1995)

However, in fact, for most companies, warehousing is still one of their compulsory sections of logistics. Good warehouse layouts and warehouse management can save on operating costs and reduce environmental costs.

Good warehouse layouts include two aspects:

✧ Construction

One aspect is the construction of warehouses with eco-friendly features such as solar walls, natural lighting, adequate floors, on-site recycling and heat-reducing power plants. Those building designs are important and directly affect the level of energy needed for the operation of the warehouse. For instance, refrigerated storage is extremely special. Hence, several aspects of the designs must be taken into account in order to make them environmental friendly such as thicker floors, walls and roof; the use of inbound and outbound conveyors with lock gates for pallets instead of doors; the selection of the right compressor and cooler; appropriate choice of components for the refrigeration process; the application of speed control for compressors; advanced lighting methods; adequate pipe dimension and insulation; defrosting using hot gas and computerized control systems all help to achieve this goal (Duiven, 2002).

✧ Capacity

The other one is the capacity of the warehouse which was utilized efficiently through scientific operations: receives inventory professionally and stores it scientifically until it is required by the market.

Good warehouse management takes full advantage of specialized tools and technologies, for example, clean material handling equipment, process optimization, automatic warehousing systems, inventory minimization programs and just-in-time systems, product disposition and on-site recycling. Considering the general four strategies, the practices of good warehouse management were explained. (see Table 5)

TABLE 5. The practices of good warehouse management within the general four strategies(Marcus Thiell, 2011)

<b>The practice of the good warehouse management</b>	<b>to use less</b>	<b>to substitute</b>	<b>to clean up the outputs</b>	<b>to turn outputs into inputs</b>
<b>Clean material handling equipment</b>	Yes	Yes		
<b>Process optimization</b>	Yes			
<b>Automatic warehousing systems</b>		Yes		
<b>Inventory minimization programs and Just-in-time system</b>	Yes			
<b>Product disposition</b>				Yes
<b>On-site recycling</b>			Yes	Yes

✧ Clean material handling equipment/fuel

In a warehouse, forklifts are common vehicles. The main function of the forklift is to handle stock. The types of fuel it uses are various from gasoline to diesel or electric power. Using electric-powered vehicles in a warehouse is helpful to reduce noise and emissions.

✧ Process optimization

There is a very practicable way to reduce the impact of warehousing activities on the environment. It is avoiding reprocessing, errors and waste by improving

the equipment's utilization and performance to minimize its process steps and emissions. Some advanced technologies are introduced to develop the flow of operations. For instance, the radio frequency picking system which is a reliable and hardware-independent solution makes a contribution to minimize the steps of process needed to prepare orders.

✧ Automatic warehousing systems (AWS)

The advantage of utilizing the automatic warehousing system in the warehousing management is to optimize organization, timing and flow. Additionally, it can contribute to the reduction of energy consumption. For instance, Cofares group is a large distributor that supplies products to 13,000 pharmacies in Spain from nearly 30 distribution centers. Because the company delivers orders from one to 20 items to each pharmacy three or four times a day, an automatic warehousing system was created to receive orders and to prepare for shipment. By this way, the workers in the warehousing do their job quickly and accurately.(Cofares)

✧ Inventory minimization programs and just-in-time system

The maintenance of the inventories, as the essence of warehousing, should be improved by efficient operation. The principle of reducing the inventories is being close to the companies' minimum required level. In the meantime, the reduction corresponds to their operations.

A good example for minimizing the inventories is Toyota's just-in-time system (JIT). With the exception of minimizing the number of products in Toyota's inventory, this system also reduces its errors and wastes.(Marcus Thiell, 2011) However, there is an obvious shortage of this modern inventory management technique. It requires frequent deliveries of materials and products, that is, it involves additional transport.

For companies, inventory carrying costs and transport costs are the primary factors when they evaluate the trade-offs in the inventory management. If the reduction in inventories is less than the increase of the transport cost, definitely, companies prefer the just-in-time system. Considering the environmental issues in inventory management, a JIT system which is characterized by frequent deliveries may not be favorable since it adds the traffic pressures and creates demands for new roads. Therefore, when companies make the inventory decision whether to adopt a JIT system or not, according to Rao(Rao. K., 1991) , they must think about the congestion issues with short and long-term perspectives. In the short run, companies need to utilize their off-peak capacity, select less congested routes, redesign delivery trucks, and consolidate shipments to improve efficiency. In the long run, companies need to re-evaluate location, partnerships, technologies and channel structure that affect the operation of JIT systems.

#### ✧ On-site recycling

The concept of on-site recycling is to promote recycling of materials, products and packaging in the warehouse, even the entire company. The key to do this activity successfully is to train the workers and managers to promote environmental awareness and take actions to protect the environment.

#### ✧ Product disposition

It is certain that some materials and products which are outdated are retained in the warehouse for a long time. For these stocks which are no longer useful for their original purpose, companies should think about alternative uses such as reusing the materials for other types of operations, selling in second hand markets, repairing and refurbishing. This is good for the companies to minimize their required inventory level and energy consumption.

The obstacles for companies to implement good warehouse management are their elevated market costs. However, these activities of good warehouse

management are not all costly. In emerging markets, the less costly practices of good warehouse management are more prevalent. (Marcus Thiell, 2011)

### 2.2.3 Green Packaging

In modern business, packaging is an important process of all products before they enter the market. According to Kotler (Kotler, 1984), there are typically three kinds of packaging: primary packaging, secondary packaging, and shipping packaging. (see Figure 12) Primary packaging contains the product itself and is the immediate and required container. Secondary packaging is the material that protects the primary package and is discarded when the product is about to be used. Shipping packaging refers to packaging necessary for storage, identification, and transport. It is discarded when the product reaches its destination.



FIGURE 12. The three kinds of packaging

Usually, the packaging is made in factories. The elements of the packaging which have an impact on warehouse and transport costs are size, shape and

materials. The better packaging of products, along with rearranged pallet patterns, makes companies realize the substantial savings by reducing materials usage, increasing space utilization in the warehouse and in the trailer and reducing the amount of handling required. The outcome is less packaging waste and fewer vehicles required. This efficiency directly translates into less environmental impact. (Wu, 1995) On the contrary, the inadequate packaging can lead to the damage of products during transport. Dealing with the inadequate packaging issues, innovative packaging technologies and environmental certifications can be introduced. They will help companies to minimize the product's losses in transportation and improve their product's packaging.

#### 2.2.4 Green Logistics Data Collection and Management

The scientific methods of data collection and management which are paramount in the logistics management can not only optimize the management of the resources, but also reduce fuel consumption and increase profit.

##### ✧ Radio frequency identification (RFID)

According to the information collected, companies can recognize the date of the product's validity. Then, they can take actions to prevent returns or manage returns efficiently. The widely used technology in the information collecting today is called Radio Frequency Identification (RFID). It is a unique tool to identify and track products without direct visual contact. Through the instant traceability of RFID regarding the status of different products, companies can retain resources and track damages and losses easily.

##### ✧ Fuel consumption monitoring

Due to the rise in fuel prices, companies spend more and more money on fuel. Furthermore, for companies, it is fairly difficult to change the increasing trend



of the fuel price. Therefore, the wisest choice for them is to reduce the cost of fuel by using a fuel monitoring system.

Generally, the fuel monitoring system is made up of three main components: fuel level sensors, special devices for storing data from fuel level sensors and personal computers with special fuel monitoring software for storing all the data and analyzing it. In this way, companies acquire full control over the use of fuel and can see the real detailed pictures of the vehicle activity.(Guardmagic)

#### 2.2.5 Waste Management

Every day, lots of waste is produced in logistics. For example, warehouses generate large numbers of packaging waste as mentioned before. When the products expire in the warehouse, they become waste. In this condition, it is necessary to take appropriate measures in waste management.

##### ✧ Waste contractor

Companies employ various waste contractors who provide a wide range of services including the collection and management of residual waste, recycle paper, glass, chemicals and hazardous waste. The main reason that companies choose different contractors to collect different waste types is to get the most competitively priced contracts which meet all of their requirements.(Sarah Maynard, 2010)

##### ✧ Trade waste recycling

Companies should look at ways to increase trade waste recycling. The wastes should be processed via new technologies such as Mechanical Biological Treatment(Defra, 2007) when they are collected. By taking full advantage of

new technologies, it is possible for companies to turn the waste into valuable resources.

### 3 THE DEVELOPMENT OF GREEN LOGISTICS

In this section, the authors introduce the development of international green logistics by giving examples from the United States, Europe and Japan. Then the processing of the green logistics research will be briefly presented. Next, from the view of external factors, the main reasons for why the companies go green and adapt the green logistics will be analyzed. At last, by doing the literature research, these authors find the key drives for greening logistics and supply chains from the perspective of internal factors.

#### 3.1 The Evolution of International Green Logistics

Green logistics originated in the United States(Yutong, 2012). Then, it was rapidly developed all over the world.

##### 3.1.1 United States

The United States is one of the earliest countries that developed the logistics industry in the world. Due to the US free economy policy, the economy and with it the logistics business developed quickly. As a consequence, the green logistics was firstly paid a lot of attention to in the US. For instance, the US government established the strategic objective which is developing the social economy based on the development of modern logistics within the guidance of the US government's macroeconomic policies.

According to the United States 2025 "National Transportation Science and Technology Strategy", the main goal of the US transportation industry is to achieve a transportation system that is fast, safe, efficient, accessible and convenient(Council, 1999 s. 6). In order to achieve this goal, many US companies already use some advanced technologies such as electronic data exchange (EDI), just-in-time production (JIT), distribution planning, green packaging in their actual logistic activities, for example, transportation,

distribution and packaging(Yutong, 2012). These important technologies provide a strong technical support for the green logistics.

### 3.1.2 Japan

Since 1956, by introducing the concept of modern logistics management from the United States, Japan has carried out its own logistics modernization vigorously(Yutong, 2012). What's more important, because of the logistics industry was treated as the lifeline of the national economy in Japan, the importance of green logistics could not be ignored at the beginning.

The Japanese government makes many efforts to increase its supervision and control of preventing traffic pollution and accidents and restricting the noise and vibration along the road. In 1989, Japan made three green logistics targets which include decreasing the discharge standards of the nitrogen-containing compounds by three percent to six percent, reducing the particle matter more than six percent and cutting down the sulfur content in gasoline by ten percent. In 1992, the Japanese government announced restrictions on car nitrogen dioxide. In the next year, Japan asked the enterprises to update the old vehicles to meet environmental standards(Yutong, 2012).

In 2001, "Implementation of the new integrated logistics outlook" came into being. This framework emphasized the reduction of air pollution emissions, strengthening the protection of the global environment, recycling the available resources to achieve the virtuous cycle of resources and establishing a new logistics to meet the environmental requirements(Yutong, 2012).

### 3.1.3 Europe

Europe is one of the earliest regions that introduced the concept of logistics. It is also one of the earliest areas which applied the modern technology for logistics management and improvement.

In the 1980s, Europe began to explore a new kind of a cooperative logistics system(Yutong, 2012). Several years later, an integrated logistics and supply chain management was created. The main purpose of the integrated logistics and supply chain management is to achieve the integration of logistics and information flowing between the final consumer and initial supplier, that is, to change the enterprises' dispersed logistics management and strengthen the cooperation between the enterprises involved in the process of the commodity circulation to improve the logistics efficiency and reduce the negative affect of disorderly logistics on the environment.

In addition, the Freight Forwarding Organizations in Europe (FFE) attached great importance to the development of green logistics. Firstly, it formulated appropriate green standards for transportation, handling and management processes. Secondly, it encouraged the enterprises to use a new concept of green logistics which is focused on the planning and construction of logistics facilities which should be combined with environmental protection to operate their logistics activities. Thirdly, it supported the research and application of new technologies in green logistics.

#### 3.1.4 Green Logistics in Finland

Finland is situated in Northern Europe. The seasons vary from hot summer to cold winter. Although the weather conditions are harsh in Finland, Finland still pays a lot of attention to the protection of the environment.

There are three major Finnish institutions, Sitra, Tekes and VTT providing innovative solutions for environmental sustainability in Finland.

##### ◇ Sitra

Sitra as a Finnish innovation fund, stimulates new business models that aim for sustainable well-being and promotes the stable and balanced development in

Finland, the growth of its economy, and its international competitiveness and cooperation. Sitra reports directly to the Finnish parliament.(Sitra)

✧ Tekes

Tekes is the main public funding expert organization for financing research, development and innovation in Finland. It promotes wide-ranging innovation activities in research communities, industry and service sectors. With those innovations, Tekes emphasizes not only funding technological breakthroughs, but also the significance of service-related, design, business, and social innovations. Tekes works with the top innovative companies and research units in Finland. Every year, Tekes finances some 1,500 business research and development projects, and almost 600 public research projects at universities, research institutes and polytechnics.(Tekes)

✧ VTT

VTT Technical Research Centre of Finland which is the biggest multitechnological applied research organisation in Northern Europe has a global network. It actively develops high-end technology solutions and innovation services in Finland and internationally. As a part of the Finnish innovation system under the field of the Ministry of Employment and the Economy, VTT is a non-profit organization. Because VTT has a wide-ranging knowledge base, it can combine various technologies and create new innovations professionally.(VTT)

Transport systems and logistics is one of VTT's research and technology focus areas. According to its logistics solution using the new Information and Communication Technologies (ICT) such as the introduction of RFID in unit and package identification and applications in innovative intermodal solutions, it is obvious to find that Finland makes efforts to develop the environmentally friendly logistics systems both nationally and at the European level.

In addition, VTT published a research article, *Transport in Finland: towards sustainable logistics* (Transport in Finland, 2012) in June 2012. By analyzing the vehicle models and fuel consumption in Finland in 2011, it suggested to use electric, hybrid and FC vehicles and increase the biofuel production in Finland. In this research, it also pointed out that many transport research programs focusing on energy efficiency and renewable energy are supported by a number of companies and organizations in Finland.

In the 21<sup>st</sup> century, in the logistics industry, the priority of development is to efficiently use the resources and maintain the earth's environment simultaneously (Yutong, 2012). Thereby, a new green logistics system is established which is characterized by the whole process from production to waste efficiency.

Currently, countries such as Finland are trying to promote green logistics as the focus of the development of the logistics industry. For instance, Finland actively carries out special green logistics technology research to promote a wide range of applications and introduces green logistics policies and regulations to lay the foundation for a green and sustainable development of logistics.

### 3.2 Green Logistics Research

It would be interesting to know when the first article about green logistics was published. One possible starting point would be the publication of the first paper on an environmental theme in a mainstream logistical journal (Alan McKinnon, 2010 p. 5). However, there was a large amount of earlier research on the environmental effects of freight transport undertaken before logistics was recognized as a discipline.

In the 1950s, the concerns about the damaging effects of freight transport were expressed. And most of the substantive research on the subject was done in the 1960s (Alan McKinnon, 2010).

According to Murphy and Poist (1996), “prior to the 1960s, there was relatively little concern regarding environmental degradation. For the most part, the environment’s ability to absorb wastes and to replace resources was perceived as being infinite”.

As time went on, the focus of research moved to matters of public concern that can have a negative impact on the natural or physical environment. Hence, there was an increase in the number of logistics-related environmental articles published in popular trade magazines such as *Distribution*, *Traffic Management*, and *Transportation and Distribution* while there were only few articles in more scholar publications. Even though many articles were appearing in famous magazines, as Murphy and Poist found that, a review of articles published in the *Logistics and Transportation Review*, the *Journal of Business Logistics*, and the *Transportation Journal* since 1990 reveals only three dealing with logistics-related environmental issues. Nonetheless, scholarly interest in environmental issues in logistics appears to be growing (Alan McKinnon, 2010).

### 3.3 The Necessity of Green Logistics

In this part, the authors clarify the main external factors which lead to companies going green and adapting green logistics.

#### ➤ Marketing demand

One reason for being green is for the companies’ business, it can cause an increasing market demand as growing environmental awareness on the part of consumers in many countries can give a company a competitive advantage. During the 1980s, several companies were interested in the concept soared with increased consumer concerns about how products were manufactured and delivered in the early 21st century(Luo, 2011). Now, these companies already found the answer. They observed that customers prefer the green products and packaging friendly to the environment. According to the conclusion of



Shrivastava (P, 1996) consumers are willing to pay higher prices for environmentally sound products, are seeking more information about contents, and care for the disposal and recyclability of products..

➤ Environmental concerns

Another reason the concept of green and green logistics attracts more and more companies' attention is that some serious environmental problems have arisen from the world economic growth which occurred in the past few decades, for instance, the depletion of the ozone layer, the rapid disappearance of rain forests, the pollution of air and water, and the scarcity of landfills. These environmental problems pose threats to the global quality of life.(Dunn, 以及其他, 1995) In accordance with the US National Academy of Sciences and the Royal Society of London, after nearly four decades of unprecedented expansion, "if current predictions of population growth prove accurate and patterns of human activity on the planet remain unchanged, science and technology may not be able to prevent either irreversible degradation of the environment or continued poverty for much of the world" (Brown, 1994).

Additionally, as Thiell, Zuluga, Montanez and Hoof (Marcus Thiell, 2011) conclude, transportation as part of the logistics operation has a significant impact on the environment. This impact is diverse, in terms of the range of externalities and the distances over which their adverse effects are experienced. The distribution of goods impairs local air quality, generates noise and vibration and causes accidents. Furthermore, the CO<sub>2</sub> produced by the transportation vehicles is often considered one of the main causes of the global warming effect which is seriously threatening the world today. According to the study of Kahn Ribeiro and Kobayashi (Suzana Kahn Ribeiro, 2007), it is estimated that freight transport accounts for about eight percent of energy-related CO<sub>2</sub> emissions worldwide. In the road transport sector, the amount of energy used to move freight is increasing at a faster rate than the energy consumed by cars and buses and, in the European Union, may overtake it by the early 2020s (Commission, 2003).

Due to the threat of increasing environmental problems, governments and international organizations make efforts to protect the environment. There are numerous severe pollution regulations set forth by governments and international organizations. According to Wu Haw-Jan and Steven C Dunn(Dunn, 1995), in preserving the environment, the role of governments is as a regulator, facilitator and buyer. Governments set standards such as vehicle emission standards and recycling requirements on the federal, state and local level. They also set standards in noise control. In addition, governments create some environmental barriers which are gradual instead of numerous traditional tariff and non-tariff barriers in import and export trade. In Europe, there has also been set stringent standards on source reduction, material reuse and waste recycling.

The benefits from governments' measures are, on one hand, the support for research and the providing of investment and regulatory incentives for businesses to develop new environmental technologies. For instance, they support the development of transport infrastructure and regulations including high-speed rails and alternative fuels. On the other hand, with the governments' standards and regulations, companies can handle environmental issues in a proper manner. This could help to avoid legal and financial consequences of environmental mismanagement, coupled with bad publicity(Dunn, 1995).

There is no doubt that companies, in order to achieve their business objectives and maximize their profitability, must respond to increasing consumers' demand for green products, comply with ever tightening environmental regulations, and implement environmentally responsible plans as a good corporate citizen. (Dunn, 1995)

### 3.4 The Key Drivers for the Greening of Logistics

In this part, the key drivers, as the internal factors for companies to go green and utilize green logistics are examined.

TABLE 6. Key drivers for the greening of logistics and supply chains (Alan McKinnon, 2010)

<b>Eye for Transport (2007)</b>		<b>Aberdeen Group (2008)</b>		<b>Insight (2008)</b>	
'Key Drivers for Instigating Green Transport/Logistics'		'Top Five Pressures Driving the Green Supply Chain'		'Main Drivers for Green Logistics'	
Improving public relations	<b>70%</b>	Desire to be thought leader in sustainability	<b>51%</b>	Optimizing logistics flow	<b>18%</b>
Improving customer relations	<b>70%</b>	Rising cost of energy/fuel	<b>49%</b>	Improving corporate image	<b>16%</b>
Part of their corporate responsibility agenda	<b>60%</b>	Gaining competitive advantage/differentiation	<b>48%</b>	Reducing logistics costs	<b>15%</b>
Financial return on investment	<b>60%</b>	Compliance with current/expected regulation	<b>31%</b>	Achieving regulatory compliance	<b>15%</b>
Government compliance	<b>60%</b>	Rising cost of transportation	<b>24%</b>	Satisfying customer requirements	<b>15%</b>
Decreasing fuel bills	<b>60%</b>			Differentiation from competitors	<b>11%</b>
Increasing supply chain efficiency	<b>55%</b>			Developing alternative networks	<b>10%</b>
Decreasing risk	<b>50%</b>				

Based on several surveys, the key drivers behind company initiatives to green their logistical systems and supply chains (Table 6) are concluded. In Table 6, it shows that improving public relation is the most important motivator which occupied 70% while developing alternative networks is the least factor which just owned 10%. Even though the methodologies, sample sizes and

composition and questionnaire formats of those surveys were totally different, the same conclusion, that the key drivers for corporations are improving their image, competitive differentiation, cost saving and compliance with government regulation, was made. However, none of these surveys examine the details of protecting the environment. (Alan McKinnon, 2010)

Therefore, the main purpose for companies to promote their green credentials through the management of logistics is just to enhance their public relations, not to help the environment. When companies take actions, they are typically taking the easy route of reputation and brand protection on green messaging.(Alan McKinnon, 2010).

In fact, on the one hand, “the corporate support for Green is as much for the potential to sell new products and technologies as it is about saving the planet” Gilmore stated. On the other hand, in business terms, the most fundamental of all green objectives should be to maintain a physical environment that can support a high level of economic activity in the longer term (Alan McKinnon, 2010).

## 4 CASE COMPANY RESEARCH

In this section, Inex Oy's and Kaukokiito Oy's operations will be studied. First, these authors will discuss the theoretical framework of the empirical part, and then these authors will discuss the criteria based on which the companies were chosen and how the data was collected. Then the data is going to be presented from company to company. These authors will not compare the two companies' situations concerning that they are in different industries and they have potentially different prerequisites that led them to make certain logistics decisions. However, these authors will point out the common measures that were taken by both companies. In the end of this chapter, these authors will give constructive suggestions separately for each company to help them in improving their logistics operations.

### 4.1 Data Collection

The authors have gathered lots of information by desk research, constant E-mail surveys and mail activities. Although there are only two companies that were interviewed, the authors have tried to contact many logistics companies. The authors took information mostly from the website (Port of Helsinki). The following table shows the companies that we have contacted.

TABLE 7. Potential case companies

<b>Company name</b>	<b>Contact time</b>
<b>UPS</b>	17 January 2013
<b>DSV Air &amp; Sea Oy</b>	17 January 2013
<b>Suomen Kaukokiito Oy</b>	17 January 2013
<b>Itella Oy</b>	20 January 2013
<b>SA-TU Logistics Oy</b>	22 January 2013
<b>Moonway Oy</b>	24 January 2013
<b>Deutsche Bahn AG</b>	25 January 2013
<b>Tschudi Group</b>	25 January 2013
<b>Inex Partners Oy</b>	13 February 2013

The initial idea was to choose logistics companies that operate in different fields, so that these authors could see from different perspectives and gain a better overview about the green logistics in practice. However, in the process of contacting companies, these authors made their choice of company mostly based on the companies' willingness to participate.

The interviewees' backgrounds are shown as in Table 8 below. Two of the interviewees work in the environmental field in the companies, while one is an expert in the logistics field. Both of the interviewee companies are in the field of logistics. Kaukokiito Oy operates only in Finland and provides logistics services to various customers. Inex Partners Oy operates both in Finland and internationally and is mainly focused on providing logistic services for S group's groceries and supplies only.

TABLE 8. Backgrounds of the interviewees

<b>Interviewee</b>	<b>Country</b>	<b>Company</b>	<b>Position</b>
<b>Marjo Viitalo</b>	Finland	Kaukokiito Oy	Quality Manager
<b>Hong Tran</b>	Finland	Inex Oy	Logistics Designer
<b>Iina Kari</b>	Finland	Inex Oy	Environmental Expert

During the interview process, these authors have contacted many companies. Most of them did not cooperate with the thesis. Table 6 above only showed the companies that accepted the interview request.

The data was collected by the means of E-mails, mails and secondary research. All of the interviews were done through E-mails. In addition, Marjo Viitalo has sent these authors detailed Suomen Kaukokiito Oy's information by mail.

The data was collected by means of theme interviews. These authors agree that this is the best way to help us gain information because it gives freedom for different interviewees to answer from their particular business perspectives

while it also provides uniformity by having the same theme (green logistics in the case).

Due to the convenience of E-mail interview, these authors made two interviews for each company in order to capture the specialties of the companies. The first interview was based on the thesis theme and the second was more customized for the companies. They received answers from Marjo Viitalo on the following day with the possibility to have a further interview. Hence, they made the second one for Suomen Kaukokiito Oy based on the company situation. They also received answers from Hong Tran three weeks after they sent out their initial interview. After that, they sent out their second customized interview to Iina Kari in the Inex Partners Oy, and the result was received two weeks after the interview was sent out.

The following figure shows the initial theme interview structure:

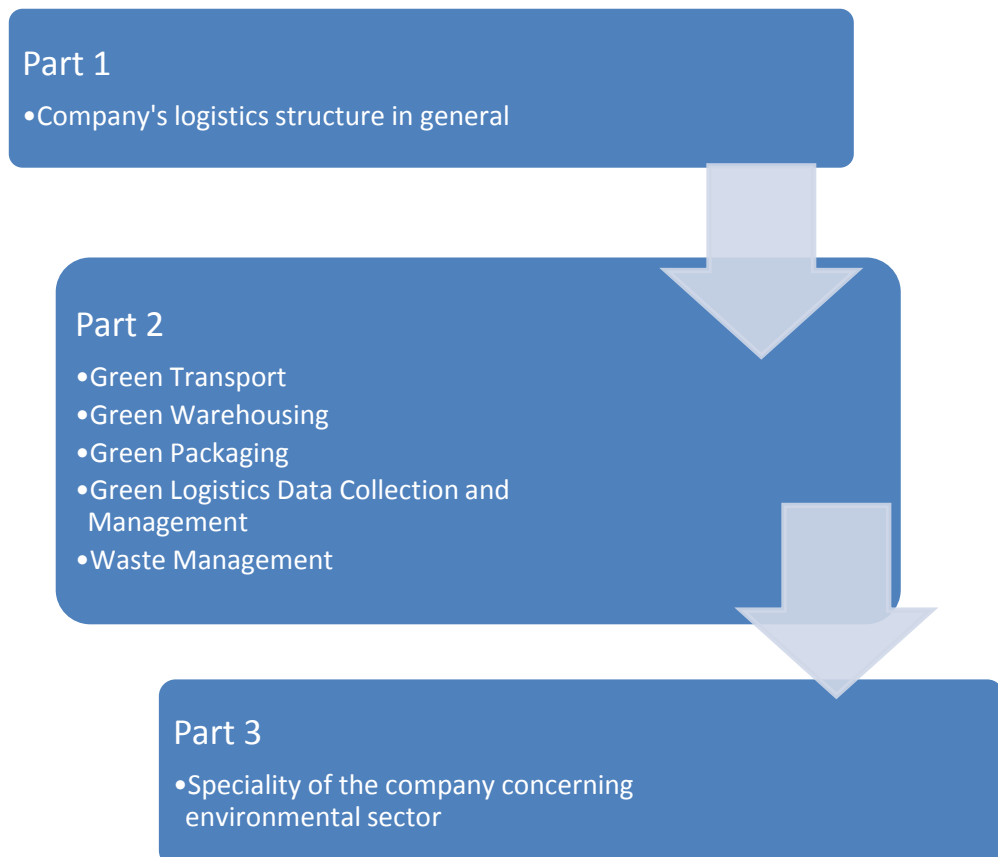


FIGURE 13. Concept of the theme interview

The initial interview was mostly based on the thesis theme. The focus was on the core theory part which they believe should be presented by their case companies. The complete interview questions can be seen in Appendix 1. These authors will not publish the answers due to the fact that these authors have covered most of them in the following chapter.

#### 4.2 Inex Partners Oy

Inex Partners Oy is a subsidiary of SOK which provides logistics and distribution services to S Group customers. It owns half of Finnfrost Oy, which is a company that does purchasing and logistics of frozen food products. The other half of the company belongs to Tuko Logistics Oy, which provides logistics service for a variety of products (The company's structure is shown as in Figure 14 below). Inex Partners Oy's reached a turnover of EUR 1,981.5 million in 2008 and it has nearly 2,300 employees at the moment.

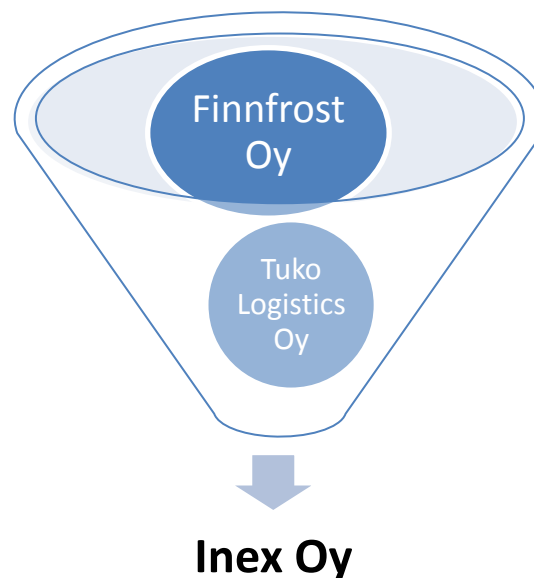


FIGURE 14. Inex Partners Oy's company structure

Inex Partners Oy pays great attention to the environmental effects it causes during its operation and monitors its business with sustainable development



measures. At the same time, it has different kinds of environmental labels. Inex Partners also works closely with its suppliers which also fulfill the environmental friendly criteria.

#### 4.2.1 Inex Partners Oy's Logistics

Inex Partners Oy has divided its warehouse operation into two larger separate segments: daily grocery and consumer/speciality goods. Inex Partners Oy also has terminal operations around Finland, some of which are Inex Partners Oy's own terminals and some are subcontracted from transport companies.

##### ➤ Daily Grocery in Kilo and Hakkilankaari

Inex Partners Oy has two separate logistic centers where most of its storage and transport operations take place. Kilo is the main logistic center but because of the growing number of warehouse products and the lack of free space in Kilo they needed to have a temporary warehouse (Hakkilankaari) solution. This problem should be resolved when the new logistic center in Sipo start operating (the estimated time is by the year 2019).

Hakkilankaari logistic operation has just been launched. Hakkilankaari's difference compared to Kilo is that they do not handle fresh groceries and non-food products as Kilo does.

##### ➤ Consumer/specialty goods in Sipoo and Hakkila

Inex Partners Oy's new logistic center is also located in Sipo (the new daily grocery logistic center is built next to this). There, the company's consumer and specialty goods are handled and delivered to S Group stores. Hakkila is the old logistic center whose operation will end in this year.

➤ Frozen products in Finnfrost logistic center

Inex Partners Oy's frozen products, for example ice cream, are stored in Finnfrost logistic center where they are also handled for Inex Partners Oy's deliveries.

#### 4.2.2 Green Logistics of Inex Partners Oy

Inex Partners Oy is committed to improving energy efficiency. An energy survey has been made within Inex, and it sets one of the goals as energy savings. Inex Partners Oy has also joined an energy efficiency agreement made by the Federation of Finnish Commerce, within which Inex Partners Oy aims at increasing energy efficiency by nine percent by 2016.

Within Inex Partners Oy, their daily work on several areas is reviewed by internal audits. Inex Partners Oy is continually taking different kinds of measurements about how to make their operations more environmentally friendly. Normal "old" practices are improved continuously; return logistics are developed so that their trucks do not need to travel with an empty load; waste management and chemical safety are also carefully taken into account.

Due to the external factors such as the Finnish demanding environmental conditions and long distances between towns, Inex Partners Oy chooses to use truck transport within Finland only. However, from Inex Partners Oy's point of view, an important part of energy efficiency is the CO<sub>2</sub>-emission calculation, which are made yearly by Inex Partners Oy's transporting companies. These surveys have been carried out since 2008.

➤ Green Logistics Data Collection and Management

A lot of attention is paid to energy efficiency in several perspectives of Inex Partners Oy's operation: in connection with new acquisitions, maintenance and so on. Energy efficiency has also been taken carefully into account in the

matters of heating and cooling systems and air-conditioning. The consumption and the costs of energy are monitored on an annual basis. Moreover, Inex Partners Oy reports the results to SOK Cooperation. All of Inex Partners Oy's responsibility information is reported to SOK Cooperation which provides a yearly responsibility survey and publishes it on S Corporation's website.

➤ Green warehousing

Inex Partners Oy's current distribution center for groceries in Espoo has joined the energy efficiency agreement. As described above, it aims to increase energy efficiency by nine percent by 2016.

The new distribution center for customer goods in Sipoo is warmed with geo energy and pellets and the electricity is produced with wind power. Planning of a new distribution center for groceries has started and the building is going to be BREEAM (as explained in Chapter 2.1.4) certified.

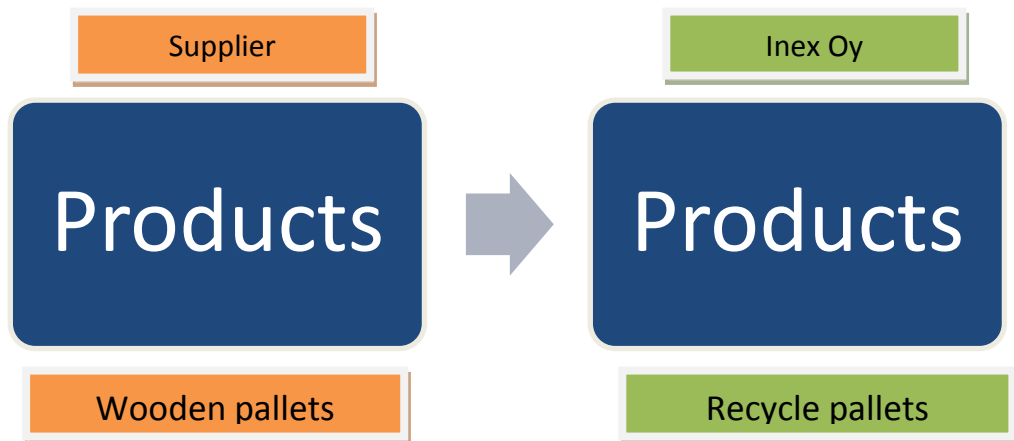


FIGURE 15. Inex Partners Oy's green warehousing process

In the case of warehouse products, suppliers usually deliver products on wooden pallets to Inex Partners Oy. Then Inex Partners Oy puts products on recyclable pallets which mean that they do not own the pallets (the process is shown as in Figure 15 above). In this way, Inex Partners Oy achieves the goal of being environmentally friendly and economically efficient at the same time. One pallet is piled up full with sales units. The sales unit can be cardboard, foil,

plastic or combination of cardboard and foil. Everything depends on how the manufacturer has packed their products and what materials they are using.

➤ Green Transport

Being responsible for S Group's grocery and customer goods logistics, Inex Partners Oy has optimized transportation of the goods, e.g., by paying attention to filling rates and routes. They have developed their transports as efficiently as possible, so they can avoid unnecessary traffic. This means to calculate optimal transport routes and times so deliveries can avoid unnecessary congestions. Optimization is an on-going process, where every chance for better performance is evaluated. Inex Partners Oy gathers information from its logistics operations for CO<sub>2</sub>-emission calculation yearly.

Inex Partners Oy does not own transportation itself. Audits on their subcontracting transport companies are made yearly. One of the four main areas of the audit questions are environmental issues. The other areas include questions from quality, safety and practical operation. Most of Inex Partners Oy's subcontracting transport companies have Euro classes 4 or 5 (as explained in Chapter 2.14) in their vehicles, which are designed to reduce emissions such as nitrogen oxides and hydrocarbons. The drivers in their subcontracting transport companies are educated towards economical driving according to Finnish transport law.

➤ Waste management

Table 9 below shows the materials used and environmental effects caused by Inex Partners Oy's operation. It is a principle for Inex Partners Oy to follow the legislation regulated for the environment (waste management included). The corner stone of Inex Partners Oy's waste management is to decrease the amount of waste, and to recycle as much as possible. Inex Partners Oy's

bio-waste is used to make biogas. Their main goal is to keep the amount of landfill waste to minimum.

TABLE 9. Inex Partners Oy's Eco Balance 2009

<b>Inex Partners Oy's Eco- balance 2009</b>			
<b>Imported packing materials</b>	60242 tn	CO <sub>2</sub> emissions	Properties: 10500 tn (CO <sub>2</sub> ) Transportation: 36400 tn (CO <sub>2</sub> )
<b>Private label packing materials</b>	221 tn	Re-used packages	132 472 tn
<b>Electricity consumption</b>	32968 KW 46KWh/ Delivered Ton	Utilization of waste	8902 tn (82% Utilized)
<b>Heat consumption</b>	17 826 MW/h 25 KWh/ Delivered Ton	Landfill waste	1958tn
<b>Water consumption</b>	25 515 m <sup>3</sup> 36L/ Delivered Ton	<b>Hazardous waste</b>	<b>6.6 tn</b>

They constantly follow the legislation concerning Inex Partners Oy and take into consideration the necessary changes. In practice, Inex Partners Oy aims at decreasing the total amount of waste by recycling audits and educating their employees. All of Inex Partners Oy's new employees are trained to recycle. Inex Partners Oy's environmental expert is responsible for the waste management training. Inex Partner Oy also has a monthly follow-up for the amount and costs of waste. Inex Partners Oy works also in close cooperation with their waste management partners.

### 4.3 Suomen Kaukokiito Oy

Suomen Kaukokiito Oy is the only privately owned company that offers transport service in Finland. The company was first founded in 1953 with only a few people. With their premium strengths: willingness to serve, accessibility, knowledge and expertise, and ability to solve problems, now, Suomen Kaukokiito Oy has developed into a big company with 35 freight terminals that cover Finland. The terminals work as operational hubs for their transport and warehousing system. Suomen Kaukokiito Oy has about 2,500 employees at the moment. The company is engaged with a few transport companies (Y. Auramaa Oy, Ilmari Lehtonen Oy, Kantola& Koramo Oy, Taipale Oy, Tyvi Oy, Welin Oy) in Finland, which act as its owners/carriers and maintain the transport chain of Suomen Kaukokiito Oy (the company structure is shown in Figure 16 below). There are three main business lines of the company: terminals, storage and online services.

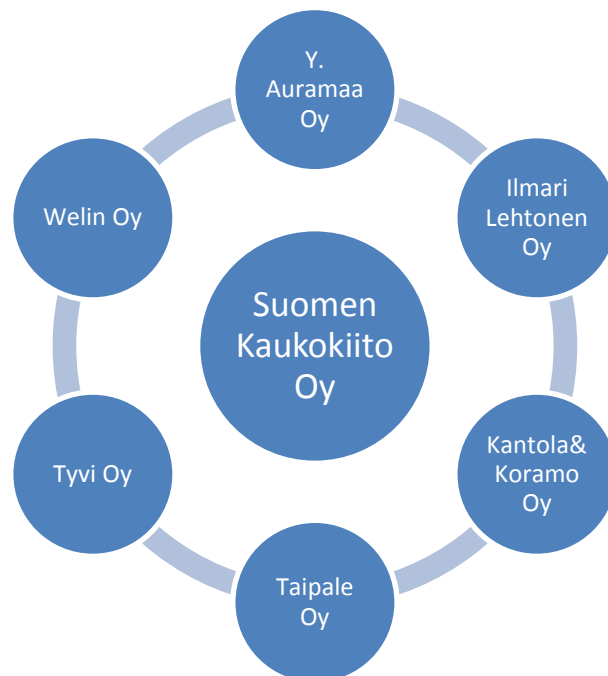


FIGURE 16. Suomen Kaukokiito Oy's company structure

Suomen Kaukokiito Oy is known as a transport chain with high quality. According to the latest analysis, people see it as a leading transport chain in Finland.

Suomen Kaukokiito Oy is certificated with ISO 9002 standard, which includes all of Suomen Kaukokiito's services, from regular route traffic to product specific warehousing directives. Moreover, Suomen Kaukokiito Oy also evaluates its environmental effects a lot. It is expanding its ISO 14 001 compliant environmental management system currently.

#### 4.3.1 Suomen Kaukokiito Oy's logistics

Suomen Kaukokiito Oy provides comprehensive logistic services to customers. Suomen Kaukokiito is very flexible. Customers get to decide what kind of service they want.

##### ➤ Transport services

Suomen Kaukokiito Oy provides customers with freedom about contracting on the forms of transport services, and it emphasizes timing when it comes to transport. Just in time (JIT) is the core concept of Suomen Kaukokiito Oy's transport operation. The following services are the main ones that are provided by Suomen Kaukokiito Oy:

##### ✧ Fixed- route service

Overnight transports between the terminals: freight leaving tonight will reach its destination by morning. Suomen Kaukokiito offers rush transports on specific routes. Same-day transports are shipped within one working day. Local transports are based on customer contracts, which specify either same day or overnight shipments.

##### ✧ Express transport service

Every day, there are customers making contracts with Suomen Kaukokiito Oy about express transport. Express transport service means that shipments reach their destinations within one working day. Regular same-day routes are:

- Turku-Helsinki-Turku
- Turku-Tampere-Turku
- Turku-Rauma-Turku

Same-day service transport shipments (arriving on the morning ferry from Scandinavia) reach their destinations on the day of arrival. Compared to normal overnight transports, same-day shipments are considerably faster.

✧ Special transports

The special transports are made based on customers' will. There are no certain sample types of it. Customers can contract with Suomen Kaukokiito freely.

➤ Warehousing

Suomen Kaukiito Oy owns warehouses throughout Finland. All of the warehouses are close to its terminals. There are two kinds of warehousing services:

The first one is that Suomen Kaukokiito Oy rents only the warehouse and the customer works there by himself with his own staff. The second one is that Suomen Kaukokiito Oy rents the space and the handling of the goods meaning that their staff does the handling. They offer book-keeping for the customers. Within the second kind of warehousing service, all of the included services are as follows:

✧ Freight handling

Order receiving and processing, shipment classification, packing and palletizing

✧ Inventory accounting



## Bill of loading and dispatch traffic, dispatch functions, transports

### ➤ Terminal Services

At the terminals, Suomen Kaukokiito Oy provides services of clearance accounting, advising and reporting customs terminal operations, customs clearance. Suomen Kaukokiito also provides customers with loading, unloading or transfer of goods for transports arriving in or departing from Finland at the terminals.

### 4.3.2 Green Logistics of Suomen Kaukokiito Oy

Suomen Kaukokiito Oy sees that their biggest achievement in the environmental aspect is that they have built new terminals all over Finland. Old terminals have been mainly inside cities and have been outdated. New terminals have been built away from the population centers, so the large trucks do not need to drive inside the urban area. That causes less pollution of all kinds (exhaust CO<sub>2</sub>, noise, etc.). For the past ten years they have built mainly one new terminal per year. The newest was taken into production just a few weeks ago – Pori terminal got ready and was taken in use on March 1st 2013. Besides the terminals, Suomen Kaukokiito Oy's owners (transporters) invest in vehicles which are mainly quite modern and new (approximately less than four years old).

### ➤ Green transport

Suome Kaukokiito Oy reduces CO<sub>2</sub> emissions from transporting, delivery, terminal and warehousing processes in general, within which, Suomen Kaukokiito Oy focuses on trying to reduce CO<sub>2</sub> emissions with new vehicles approximately less than four years old, new terminals, rationalized and well-planned delivery and transporting in particular. Suomen Kaukokiito Oy

plans routes carefully and cuts back unnecessary driving. Moreover, it has its own ERP-system to make its emission lighter and its Navistar's application program for track-and-trace. Suomen Kaukokiito Oy educates drivers according to the EU-directive for economical driving and anticipates driving which reduces use of fuel and CO<sub>2</sub> emission. They also monitor fuel consumption per driver.

➤ Environmental certification

Suomen Kaukokiito Oy's quality system meets the requirements of the standards ISO9001:2008 and ISO14001:2004 (explained in Chapter 2.1.4) which means that they have their documentation system consider the following processes: sales, customer services, invoicing, warehousing and production (=terminal services and transport)

Each process has been described by its actions and responsibilities. There is a quality group that consists of the quality manager and the terminal managers of each terminal within Kaukokiito Oy. The quality group members meet on a regular basis and handle the possible failure situations, claims and also suggest developments and improvements to the highest management.

➤ Waste management

Suomen Kaukokiito Oy recycles according to their environmental system. Almost everything is recycled: paper, carton, and plastic, glass, metal and wood. Only 3-15 % of their waste goes to dump. They do not create a lot of waste since they neither do manufacturing nor packaging in their business. They mainly transport packed goods on pallets or cartons.

➤ Sustainable logistics chain of Suomen Kaukokiito Oy

Suomen Kaukokiito Oy has 29 terminals and the transports between those terminals are handled every night – both ways. For example:

They have a truck/trucks going to each terminal of theirs every night from Tampere. Trucks leave from Tampere between approximately 18:00 – 02:00, so that if the goods are picked up today they will be at the destination terminal early in the morning (tomorrow). The goods will be mostly delivered the day after pick-up. They have a timetable for places that are very far from the terminal and thus cannot receive deliveries every day. Mainly deliveries are handled overnight though and the same goes for the incoming loads. There is a truck/trucks coming to Tampere from every other terminal of theirs each night and the goods are delivered to Tampere the next morning / day.

Pick-ups and the deliveries are handled by Suomen Kaukokiito Oy's subcontractors who have smaller delivery trucks (app. 700 pcs). The line transport is handled by their owner transporters (the six companies that keep up Suomen Kaukokiito Oy's operation) with large trucks, trailers, semi-trucks and so on. Full loads and part loads (>2500 kg) are mainly picked up and delivered with the same truck and the goods are not unloaded to the terminal between pick-up and delivery. Therefore, loading bays are required for the deliveries as large trucks can not be unloaded without a loading bay because they do not have tailboards.

#### 4.4 Further Suggestions for the Case Companies

After all the interviews and research were done, the background and green logistics operations for each case company were presented as above. Although the case companies are specializing in different logistics services, the authors did find them working on similar subjects in terms of green logistics. The following Table 10 presents the common aspects that the two case companies have been working on in terms of green logistics operation.

TABLE 10. The common facts about the case companies' green logistics operation

<b>Common green logistics measures</b>		
<b>Company name</b>	<b>Green transport</b>	<b>Waste management</b>
<b>Inex Partners Oy</b>	<ul style="list-style-type: none"> <li>▪ Planning the optimal transportation route.</li> <li>▪ Vehicles that reduce emissions.</li> <li>▪ Educating drivers for driving economically.</li> <li>▪ Monitoring emission/ fuel consumption</li> </ul>	<ul style="list-style-type: none"> <li>▪ Focusing on recycling</li> </ul>
<b>Suomen Kaukokiito Oy</b>		

As seen in Table 10 above, the measures that were taken to build up green transport are similar between Inex Partners Oy and Suomen Kaukokiito Oy. Besides that, both companies have put effort in waste management operations. They both focus on recycling a lot. These common measures show a great new trend among logistics companies in Finland.

However, considering that the two companies provide different core logistics services for different purposes, these authors would still like to give separate suggestions based on each company's own situation.

The following paragraphs will first present information about how green logistics are used in practice (within the case companies) and then these authors will combine the information that they gathered and their core thesis theory to give advice on how to improve their green logistics operations.

#### 4.4.1 Suggestions for Inex Partners Oy

##### ➤ Green transport

From the authors' point of view, Inex Partners Oy has done a fairly nice job in terms of Green transport operations. In order to give a better view of the operations, these authors imported the main sections from Table 4 and took

them as criteria here to evaluate what Inex Partners Oy has done and what can be improved further.

TABLE 11. Evaluation of Inex Partners Oy's green transport operation

<b>Main Sources from Transportation</b>	<b>Green Transportation Practices</b>	<b>Inex Partners Oy</b>
<b>The Operation of Transport Vehicles</b>	Modal Choice	-
	Freight Consolidation	Yes
<b>The Disposal of Transportation Vehicles and Parts</b>	Clean Vehicles/Fuel Efficiency	Yes (can be improved)
	Reuse of Pallets and Containers	Yes
	Standardization of Trucks Sizes	Yes

As seen in Table 11 above, Inex Partners Oy has covered almost all the aspects in terms of green transport during its operation. It has several distribution centers built at optimal locations for the company. It uses recyclable pallets to take products. All of its subcontracting transport companies have Euro classes 4 or 5 in their vehicles. These authors did not grade Inex Partners Oy in terms of modal transport since Inex Partners Oy has chosen truck transport in Finland due to external factors explained earlier in the chapter. It is deemed that truck

transport is the means of transportation that suits current Finnish environmental conditions the best.

However, there are still minor things that can be improved. Due to the limitations on the study material, these authors have only acquired the knowledge that Inex Partners Oy has been paying attention to the maintenance of its vehicles, they do not know what methods it uses. They have found out several useful techniques that could minimize fuel consumption and waste about the vehicle maintenance, for example: using alternative fuels, by-pass filters, recycled wash water and discharge into sanitary sewer systems. Those could be taken into account if Inex Partners Oy plans to improve its maintenance service.

➤ Green warehousing

As S group's supplier, these authors would not recommend Inex Partners Oy to use the cross-docking method, because S group is more in a position to do that. Warehousing is very necessary to Inex Partners Oy, and it has been running it well. However, in order to have an overview about the warehousing situation of Inex Partners Oy, they made the following table based on Table 5 from the green logistic system theory. Each section was evaluated based on performance.

TABLE 12. Evaluation of Inex Partners Oy's green warehousing operation

<b>The practice of good warehouse management</b>	<b>Inex Partners Oy</b>
<b>Clean material handling equipment</b>	-
<b>Process optimization</b>	Yes (can be improved)
<b>Automatic warehousing systems</b>	-

<b>Inventory minimization programs and just-in-time system</b>	-
<b>Product disposition</b>	-
<b>On-site recycling</b>	-

Due to the limited study material, the authors only have a general overview about Inex Partners Oy's green warehousing operation, but it also provides us with opportunities to give suggestions in a broad way.

First of all, as shown in Table 12, Inex Partners Oy has been continually working on process optimization within its logistics operations in general. It evaluates all the chances for a better performance.

Within its warehousing operations, the authors would still suggest that it could use, for example, a radio frequency picking system, which could help in minimizing the steps that are needed when preparing orders. In this way, they would gain in efficiency and utilization of the equipment in terms of warehousing operations. When it comes to the equipment in the warehouses, they would suggest Inex Partners Oy to use electric powered vehicles to handle stock in its warehouses, since electric powered vehicles are the most environmentally friendly ones that would reduce emissions. Besides that, these authors suggest that Inex Partners Oy could adopt an automatic warehousing system, which could significantly contribute to energy saving and would also increase efficiency.

During the interviews, these authors found out that Inex Partners Oy has problems with its main logistics center Kilo at the moment due to the growing number of warehouse products and a lack of free space. Hence, besides its temporary warehouse solution, they think a just-in-time system (JIT) and product disposition are all very good solutions for them. The just in time system would reduce errors and wastes, and since the Kilo warehouse center

handles daily groceries which means that it has frequent deliveries already, this would fulfill the requirements of JIT. Instead of using the Hakkilankaari (temporary warehouse) to handle non-fresh groceries, these authors think product disposition would be a better way to get rid of the non-useable items and regain some inventory space. Moreover, this is also a good way for companies to minimize their required inventory level and energy consumption.

Considering that Inex Partners Oy uses recyclable pallets to store inventories in the warehouses, the last suggestion here for Inex Partners Oy is to do on-site recycling, which would promote the recycling of materials, products and packaging in the warehouses.

➤ Green packaging

As in the green packaging definition, Inex Partners Oy's products' packages would fall into the third category, which refers to shipping packaging. As described in the previous paragraphs, Inex Partners Oy has done a really good job when it comes to the packaging already as it uses recyclable pallets to take the products. The authors think that they can not give more advice mainly due to the fact that Inex Partners Oy usually takes in products that are already packaged by the manufacturers.

➤ Green Logistics Data Collection and Management

During our interviews, the authors learned that Inex Partners Oy has a really clear organization structure. It monitors its consumption and energy on an annual basis, which is a really smart act. However, in order to optimize the management of the resources, they would suggest Inex Partners Oy to adopt Radio Frequency Identification (RFID) within its operation as well. RFID can help companies retain resources and track damages and losses easily.



➤ Waste Management

Inex Partners Oy has a complete waste management sector. It has its own quality experts and it also works closely with its waste management partners. The wastes are very much reused as explained in the previous paragraphs and it uses its bio-wastes to make biogas. The authors studied the technologies for waste treatment and they would recommend mechanical biological treatment just as a reference to Inex Partners Oy in case that it wants to improve its recycle loop.

#### 4.4.2 Suggestions for Suomen Kaukokiito Oy

➤ Green transport

As one of the leading companies in the logistics industry in Finland, Suomen Kaukokiito Oy has been putting lots of efforts in optimizing its logistics operations. Green transport is also an aspect that Suomen Kaukokiito Oy has been working on. The following table shows what Suomen Kaukokiito Oy has done and what can still be improved with the authors criteria.

TABLE 13. Evaluation of Suomen Kaukokiito Oy's green transport operation

<b>Main Sources from Transportation</b>	<b>Green Transportation Practices</b>	<b>Suomen Kaukokiito Oy</b>
<b>The Operation of Transport Vehicles</b>	Modal Choice	-
	Freight Consolidation	Yes
<b>The Disposal of Transportation Vehicles</b>	Clean Vehicles/Fuel Efficiency	Yes (can be improved)

<b>and Parts</b>	Reuse of Pallets and Containers	-
	Standardization of Trucks Sizes	Yes

As shown in Table 13 above, Suomen Kaukokiito Oy has done a fairly complete job in terms of green transport. The company has terminals all around Finland. It anticipates driving which reduces use of fuel and CO<sub>2</sub> emission. All of the company's vehicles are relatively new (less than 4 years old).

However, as shown in the table, there are still several aspects that Suomen Kaukokiito Oy can improve. It was mentioned in the earlier paragraphs that although Suomen Kaukokiito Oy does not do packaging, they do need pallets and cartons when they transport goods. Here, these authors would suggest Suomen Kaukokiito Oy to introduce plastic pallets instead of wood ones and a systematic program of evaluation and reconditioning of pallets and containers. In this way, the contamination and waste would be reduced significantly.

When these authors carried out their interviews with Suomen Kaukokiito Oy, they enquired about conditions of the vehicles themselves, however, they did not acquire information about the maintenance of the vehicles. Hence, they have a few technologies that they would like to suggest. Suomen Kaukokiito Oy can adopt new technologies that address aspects including using alternative fuels, by-pass filters, recycled wash water and discharge into sanitary sewer systems.

Besides these two points above, these authors think Suomen Kaukokiito Oy has done a great job in general. These authors will not give suggestions in terms of modal transport due to the nature of the company.

➤ Green warehousing

First of all, the authors would not recommend the cross docking method for Suomen Kaukokiito Oy since Suomen Kaukokiito Oy is a company that provides logistics service. Moreover, warehousing is one of the main business lines for Suomen Kaukokiito Oy. In order to have a better overview of Suomen Kaukokiito Oy, they made the following table with our criteria to evaluate Suomen Kaukokiito Oy's green warehousing operations.

TABLE 14. Evaluation of Suomen Kaukokiito Oy's green warehousing operation

<b>The practice of good warehouse management</b>	<b>Suomen Kaukokiito Oy</b>
<b>Clean material handling equipment</b>	-
<b>Process optimization</b>	-
<b>Automatic warehousing systems</b>	-
<b>Inventory minimization programs and just-in-time system</b>	Yes
<b>Product disposition</b>	-
<b>On-site recycling</b>	-

Due to the limitation of the interview materials, these authors only have learned that Suomen Kaukokiito Oy has been using a just-in-time system during its logistics operations. Hence, they are going to give advice on all other aspects.

First of all, they would suggest Suomen Kaukokiito Oy use electric powered forklifts in warehouses if it is still using gasoline or diesel powered ones.

Electric-powered vehicles in warehouses are helpful to reduce both noise and emissions. Besides the quality group meeting, they would suggest Suomen Kaukokiito Oy adopt some technologies to optimize the warehousing activities. For example, a radio frequency picking system, technologies that develop the flow of operations would help with avoiding reprocessing, errors and waste and it would also make a contribution in minimizing the steps needed to prepare orders. Also, they would recommend Suomen Kaukokiito Oy to build up a complete automatic warehousing system (AWS) if it does not have one yet. An automatic warehousing system also contributes to the optimization of warehousing processes, but only in a more comprehensive way compared to process optimization technologies. Additionally, it can contribute to the reduction of energy consumption which fits Suomen Kaukokiito Oy's concept about its warehousing. In addition to all the technologies, they would recommend Suomen Kaukokiito adopt the concept of on-site recycling which could help with promoting recycling of materials, products and packaging in the warehouse, even in the entire company.

Besides all the recommendations given above, these authors decided not to give recommendations about product disposition. They learned that Suomen Kaukokiito Oy only provides services and does not own any products. Hence, they think product disposition is not a useful criterion for evaluating Suomen Kaukokiito Oy's green warehousing operation.

➤ Green packaging

According to the theories the authors have developed, Suomen Kaukokiito Oy's deliveries only use shipping packages. However, it was noted earlier in this chapter that Suomen Kaukokiito Oy does not do any packaging. Hence, they decided not to give any advice on this matter.

➤ Green Logistics Data Collection and Management

From the authors' point of view, Suomen Kaukokiito Oy has done a lot in terms of green logistics data collection and management already. It has its own ERP-system and its Navistar application for track-and-trace and it also monitors fuel consumption.

Nevertheless, in order to optimize its green logistics data collection and management operations, they would still give some suggestions. First of all, on top of its own Navistar application, they would recommend RFID technologies as a reference. RFID technologies can trace without visual contact; therefore, the authors think they are convenient tools to use. Although these authors know that Suomen Kaukokiito Oy has been monitoring its fuel consumption, these authors do not know how it monitors. Hence these authors would recommend a complete fuel monitor system for Suomen Kaukokiito Oy if it does not have a complete one yet. A complete fuel monitor system consists of three main components: fuel level sensors, special devices for storing data from fuel level sensors and personal computers with special fuel monitoring software for storing all data and analyzing it. In this way, companies can have full control about the fuel consumption.

➤ Waste management

It is known that Suomen Kaukokiito Oy has its own environmental system. However, these authors still suggest that it could use some waste contractors. Waste contractors are usually experts in the field. Contracting with them would save lots of time and money for Suomen Kaukokiito Oy.

## 5 CONCLUSION

In conclusion, the authors will briefly answer the research questions about what is green logistics, why do Finnish companies choose green logistics and how to improve green logistics in practice.

### ✧ What is green logistics?

In fact, there are many definitions of green logistics. In this thesis, three authoritative definitions of green logistics were quoted. As seen Table 15 below, these authors find that the definitions based on these authors' study and from these authors' opinion are very similar. Furthermore, all of these definitions highlight the environmental sustainability.

TABLE 15. Definitions of green logistics

<b>Definitions based on the authors' study</b>	Rodrigue, Slack and Comtois (Rodrigue, 2001): Green logistics is defined by dividing the words, explaining them separately and putting them together. Putting the words together suggests an environmentally friendly and efficient transport and distribution system.
	Sbihi and Eglese (A. Sbihi, 2007):  Green logistics is concerned with producing and distributing goods in a sustainable way, taking account of environmental and social factors.
	Larsen (Larsen-Skjott;ym., 2007):  Green logistics is defined as "efforts to measure and minimize the environmental impact of logistics activities, these activities include a proactive design for disassembly".

<b>Definitions from the authors' opinion</b>	The authors thought that the key to find the correct definition of green logistics is to understand the word “green” of the phrase “green logistics”. Based on some research and study, these authors find that “green” means sustainability. Furthermore, it emphasizes environmentally friendliness.
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❖ Why do Finnish companies choose green logistics?

To answer another question, why do Finnish companies choose green logistics, the authors analyzed several research articles and studies. At last, the external and internal factors which are the main reasons why companies are going green and adapting green logistics described in Chapter 3 are concluded.

From the external sides, marketing demands and environmental concerns influence Finnish logistics companies to go green. Finnish consumers have a preference for environmentally sound products although they are more expensive. In addition, Finnish people have a high environmental awareness. Therefore, they have more concerns about serious environmental problems such as the pollution of air and water.

From the internal sides, over the past few years, sustainability has steadily been moving from the periphery to the heart of business, the environmental responsibility helps companies to achieve their business goals.(Zoetermeer, 2010)

During our interviews with our case companies, the companies show a neutral attitude towards green logistics operations. However, the companies do try to advertise their green logistics operations. These authors think that the benefit that green logistics could bring (cutting costs, brand image) would be the main motivation for companies to choose to use green logistics.

✧ How to improve green logistics in practice?

As it was explained in Chapter 4, different companies have their own ways of improving green logistics. In our case company analysis, the authors recommend Inex Partners Oy to focus on improving its green warehousing operations, while, Suomen Kaukokiito Oy could have more improvements on its green warehousing operations and waste management operations.



## 6 SUMMARY

The authors chose green logistics as their thesis topic for two reasons. Firstly, the subject is related to the authors' lifestyle and personal interests. Secondly, these authors noticed the lack of authority and unknown possibilities in the subject. The main objective of this thesis is to study the major reasons for companies to use green logistics and to give some constructive advice to promote the environmental sustainability of these companies' green logistics systems. The fundamental theory that is used during the thesis is the green logistics system which consists of five subsections. They are green transport, green warehousing, green packaging, green logistics data collection and management and waste management.

During the empirical part, the authors applied the theories into practice. The authors chose to have two Finnish logistics companies as their case companies in order to research the green logistics operations in Finland and give tailored suggestions. During the research, the authors learned about the good operations that our case companies have and also gave out constructive recommendations for further improvements.

### 6.1 Recommendations for Further Studies

As mentioned, there is a lack of research on how green logistics is used in practice in the logistics industry in Finland. The authors hope that this thesis can provide an insight into this issue and give some directions for future research.

The authors performed the only case study about companies' green logistics which emphasis on environmental sustainability. In the course of research for this thesis, these authors learned the concepts of reverse logistics and closed-loop supply chain and also addressed environmental sustainability. Therefore, studying the environmental sustainability of reverse logistics and closed-loop supply chain in practice will be helpful to understand green logistics better.

When the authors searched for the case company, they tried to contact with some Finish companies. However, only the two Finish companies: Inex Partners Oy and Suomen Kaukokiito Oy answered their interview questions. In the future, if more Finish companies will be interviewed, this topic of green logistics in Finland can be studied further.

In the empirical part, these authors' study is only about the Finnish companies' logistics department. Because that green logistics is developing rapidly around the world, it is also worth exploring green logistics in other developed markets such as Sweden and emerging economies like China.

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## **Interviews**

Hong Tran, 2013. Logistics Designer, Inex Oy. E-mail Interview 13 February, 2013



Iina Kari, 2013. Environmental expert, Inex Oy. E-mail Interview 7 March, 2013

Marjo Viitalo, 2013. Quality Manager, Kaukokiito Oy. E-mail Interview 17 January, 2013

## APPENDICES

### APPENDIX 1

Interview for case companies:

1. What kind of logistics organization structure do you have in your company?
2. What materials do you use for orders' packaging? (Wooden pallets? Veneer? Or paper cardboard pallets?)
3. What is the most common shipping method for your company to fulfill orders?
4. Do you care about your emissions during transportation? Have you tried anything/transportation method/ means that is more environmental friendly than conventional ones?
5. Do you have your own warehouse system? If you do, could you describe it to us? For how long can goods be stored in the warehouse?
6. Do you have a reverse logistics system or a return policy? If so, could you describe it to us?
7. Do you track your orders during transportation? How?
8. How many different means of transportation do you offer? Which has the least emissions or is the most environmental friendly in your opinion? Which means of transport is the most efficient one?

## APPENDIX 2

Detailed interview for Suomen Kaukokiito Oy:

1. How to reduce CO<sub>2</sub> emissions during logistics? Which services do you provide? (terminal services, transport, etc.)
2. What kind of quality system do you have inside your company?
3. How do you ensure economical driving?
4. How do you recycle?
5. Can you describe your sustainable logistics chain?
6. Anything worth mentioning when it comes to quality/ environmental efforts that your company has made?

### APPENDIX 3

Detailed interview for Inex Partners Oy:

1. What did you do to increase material efficiency and energy efficiency?
2. To be specific, what kind of self supervision support system you have?
3. How do you ensure economical driving?
4. What kind of equipment that you use fulfils current environmental requirements?
5. How do you manage waste and reduce the amount of waste?
6. What kind of waste management training for your employees do you have?
7. Anything worth mentioning when it comes to quality/ environmental efforts that your company has made?