

Sabina Nylund

Reverse Logistics and Green Logistics

A comparison between Wärtsilä and IKEA

International Business
2012

ABSTRAKT

Författare	Sabina Nylund
Lärdomsprovets titel	Reverse logistics and green logistics
År	2012
Språk	engelska
Sidantal	78 + 1 Bilaga
Handledare	Rosmeriany Nahan-Suomela

Logistik har en betydlig del utav företagets verksamhet. Detta är på grund av att det kan vara kost samt och är påfrestande för miljön. I denna undersökning kommer retur och grön logistik att analyseras. Målet med denna undersökning är att kunna svara på frågan ”vad är retur och grön logistik och hur de blir använda i praktiken”. Bifrågor som också blir besvarade är , vad retur logistik är, vad definerar grön logistik, vad är likheterna mellan retur och grön logistik, hur hanterar Wärtsilä och IKEa deras retur och grön logistik och vad är skillnaderna och likheterna mellan wärtsilä och IKEA med retur och grön logistik.

Den första delen av detta lärdomsprov kommer att bearbeta vad retur och grön logistik är och vad deras definitioner är. Retur logistik är processen när ett företag tar tillbaka varan pga diverse orsaker, medans grön logistik är hur man får logistik kedjan att vara miljö vänlig, grön logistik anpassas till hela kedjan, transport, packning, material införskaffning osv. Efter detta kommer två företags retur och grön logistik att analyseras och jämföras för att se skillnader och likheter. För att uppnå detta så kommer en kvalitativ undersöknings metod att användas. Företagena som blivit intervjuade för denna undersökning är Wärtsilä Finland Oy, Services, och IKEA FI.

I undersökningen kunde man dra slutsatsen att företagen i fråga har mera skillnader än likheter. Detta kan bero på de olika typerna av företagen. Som exempel på en skillnad inom den gröna logistiken var att IKEA FI har satt upp en fyllnads kvot på transporter, medans Wärtsilä FI använder konsolidering av leveranser. Inom retur logistiken är ett exempel på likheter de metoder som används med de returnerade varorna, de går hellst tillbaka till inventarie/försäljning. I dett lärdomsprov kunde man kunde faställa vad retur och grön logistik innefattar och vilka metoder företagen använder i praktiken.

ABSTRACT

Author	Sabina Nylund
Title	Reverse logistics and green logistics
Year	2012
Language	English
Pages	78 + 1 Appendix
Name of Supervisor	Rosmeriany Nahan-Suomela

Logistics is a significant part of the company's operations. This is because logistics can be costly and harmful for the environment. In this thesis it reverse and green logistics will be analyzed. The objective of this study is to answer the question "what is returned and green logistics and how are they used in practice?" Also sub questions that will be answered are; what is reverse logistics, how is green logistics defined, what are the similarities between reverse and green logistics, how does Wärtsilä and IKEA handle their reverse and green logistics and what are the differences and similarities between Wärtsilä and IKEA within their reverse and green logistics?

The first part of the thesis will deal with what the reverse and green logistics are and what their definitions are. Reverse logistics can be explained as the process where the company takes back the goods for some reason, and green logistics is when the company tries to adapt environmental friendly ways to the logistics chain. After this, the two companies reverse and green logistics will be analyzed and compared to see the differences and similarities. To achieve this, the qualitative research method is used. The companies that have been interviewed for this thesis is Wärtsilä Finland Oy, services, and IKEA FI.

In this research it could be conducted that the companies in question have more differences than similarities. This may be due to the different types of companies in question. As an example of a difference, in the green logistics was that IKEA FI has set up a filling ratio of shipments, while Wärtsilä FI uses consolidation of shipments. In return logistics there is an example of similarities to the methods used by the returned goods, they go preferably back to the inventory /reselling. At the end of the study it was possible to answer the study question and its sub-questions and also how the companies handle reverse and green logistics in practice.

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1.0 Introduction

Logistics is a big part of companies' actions. More focus is put on logistics and methods that are practiced within logistics. This is because money can be saved and give a competitive advantage to the company. Another factor that is affecting logistics is the pressure that comes from governments and customers. Governments are putting pressure on companies to be green and choose green options within logistics through legislations and laws. Meanwhile customers are getting more and more aware of greenness. So the importance with logistics and the methods behind are getting more attention than before. Practices such as reverse logistics give companies a competitive advantage when used effectively, and it can also protect the company. It is also a method that is considered to be green and is a part of green logistics.

According to Waters (2007, 2) logistics can be defined as a “function responsible for all movements of materials through the supply chain”. A definition for supply chain management from Waters (2007, 2) is “A supply chain is the series of activities and organizations that materials both tangible and intangible- move through on their journeys from initial suppliers to final customers. Some say that the difference between supply chain management and logistics is that supply chain management considers the whole chain.”

The chartered institute of Logistics and transport (1998) separates logistics and supply chain management in these definitions: “Logistics is the time related positioning of resources or the strategic management of the total supply chain.” Meanwhile “the Supply chain is a sequence of events intended to satisfy a customer. It can include procurement, manufacture, distribution and waste disposal, together with associated transport, storage and information technology.”

In every organization information processing, recycling, location decisions, order processing, procurement receiving, transport, inventory management,

warehousing, material handling, and distribution, exist to some extent. These functions logistics embraces. When the importance of logistics was discovered in 1996 it became critical for companies to improve their supply chain or planning. This Deloitte And Touche (Waters, 2007,3) discovered that 90 percent of the companies are trying to improve this within two years. Some of the changes and what was put pressure according to Deloitte and Touche was (Waters, Global logistics, 2007,4) :

- Recognition that logistics is an essential function that must be managed properly.
- Realization that decisions about the supply chain have a strategic impact on performance.
- Appreciation of the high cost of logistics and the opportunity for major savings.
- Growing emphasis on customer satisfaction and recognition that this depends on logistics.
- Increasing competition for both users and providers of logistics. Growing concern about environmental damage and changing attitudes towards pollution, waste, traffic congestion, road building etc. (Waters, Global logistics, 2007,4)

This thesis deals with the topics of reverse logistics and its benefits from different perspectives. Green logistics will also be dealt with. The purpose with these two subjects is to see what differentiate them from each other and what they are. When these subjects have been defined and it has been examined how they work together there will be a comparison between two companies. This is to examine the differences and similarities they have in their reverse and green logistics.

Reverse Logistics and green logistics are subjects that are getting more important in the business world. With reverse logistics it is getting clearer how the companies can save money and build a more stable relationship with the customers. And as Pishvaei, Kianfar and Karimi (2009) concludes “Planning and implementing a suitable reverse logistics network could bring more profit, customer satisfaction and a nice social picture for the companies”. As a result a

good reverse logistics model in the company gives the company a good competitive advantage and also helps the company to save money and make a better profit. Even though reverse logistics has an important part of the supply chain management, many companies still use outdated processes that contributes to the supply chain inefficiencies and excessive inventory and costs. Also Pishvaei, and more (2009) states that “most of the logistics networks are not equipped to handle the return products in reverse channels.” An increasing trend is also outsourcing the reverse logistics, since companies themselves do not have the expertise in the subject themselves.

Green logistics is becoming very important in the corporate world, since the demands on companies are getting stricter and the green logistics have to be considered throughout the process in the business. In the late 1980s and in the early 1990s greenness became a catchword in the transportation industry. Since the world commission on Environment and Development set an establishment of environmental sustainability as a mission for international action, it gave the green issue a remarkable push in the economical and political fields. Logistics that was then a developing subject was seen by many as an opportunity to adopt a more green and environmental face. (Dr. Jean Paul Rodrigue, Dr Brian Slack & Dr Claude Comtois, 2009)

1.1 Purpose of the study

The purpose of the study is to examine reverse logistics and the green logistics. This is to define the different subjects and compare two companies in how they deal with reverse and green logistics. By comparing the two companies we get a view of what differences and similarities they have and also how they are using reverse and green logistics in practice.

The research question started to take shape after the researcher started to study and read about logistics. The researcher stumbled upon an article that dealt with reverse logistics. This was a subject that seemed interesting and new. When the researcher continued to read about the subjects she started to think about the green

perspective, which later after reading shaped into green logistics. The following research question took shape:

“What are Reverse logistics and green logistics and how are they being used in practice?”

Sub questions that also will be covered in this thesis to back up the research question are:

1. What is reverse logistics?
2. What defines green logistics?
3. What are the similarities and differences between Reverse and Green logistics?
4. How are Wärtsilä and IKEA handling reverse and green logistics?
5. What are the differences and similarities between Wärtsilä and IKEA within reverse logistics and green logistics?

2.0 Methodology

A qualitative research method will be used in the thesis. A qualitative research has the features such as the aim is a complete, detailed description. The difference between qualitative and quantitative is that in qualitative research the researcher might only know roughly in advance what they are looking for, whereas in quantitative the researcher knows clearly in advance what they are looking for. Also qualitative researches the design of the study takes shape as the study unfolds. Meanwhile in quantitative every aspect of the study are being carefully formed before any collection of data is conducted. In the data collection, in qualitative the researcher is the tool that is used for information gathering, but in quantitative it is used tools such as questionnaires or other equipments to collect numerical data. Qualitative is used to make it possible to go indeapth into issues of interest and to be able to explore nuances that are related to the research problem. Some collection methods that are used in qualitative research are focus groups, triads, in-depth interviews, and uninterrupted observations. Qualitative research is used to develop an initial understanding of an issue or problem, look for a range of ideas and feelings about an issue, to understand different perspectives between groups and categories of people. The reason why qualitative is more appropriate than quantitative is that in order to get a good answer to the research questions, observations and interviews are more suitable. A qualitative research method goes more in depth and answer to questions such as “Why is it like that” can be answered. There is not a big target group of which the research will aim, since there are only two different companies involved in the research. When it comes to the companies they need to be analyzed through interviews and reading material that can be found and provided. In the interviews that will be done either personally or electronically the respondents will be asked the same questions in order to get a fair point of view from both companies. When enough material has been gathered then the analysis will begin, to see the differences and similarities between them. This is because companies have their own way of handling their reverse logistics and how they handle the green perspective. (Neil, 2007, Mora, 2010)

Restrictions will be adapted in the company analysis between Wärtsilä and IKEA. Within Reverse logistics the return flow will be examined and within green logistics will be dealt with issues such as packaging, transportation and warehouses. The whole supply chain could be examined but since the companies come from different product fields a comparison between materials would not be a fair comparison. But within the theoretical framework the whole chain will be considered so that there will be enough background information.

Within a research Joppe (2000) defined reliability as: The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable. Joppe (2000) also defined validity as it “determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow you to hit "the bull's eye" of your research object? Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research of others”

Regarding the reliability and validity it should be taken into consideration that this research is conducted by a student in their final studies, so the student might not have the necessary experience or knowledge that is required. Also it can be affected since the research was conducted only with three respondents. If more interviews would be conducted within the companies then the reliability and viability would be increased. Something that might also affect is the different fields that the companies are within, since IKEA is a retailing business and Wärtsilä the research is conducted within the Service part of the company.

3.0 Theoretical framework

Within this part of the thesis Reverse Logistics and Green logistics will be dealt with and discussed. In this part both reverse and green logistics will be defined and explained in depth. This will give enough theory so that the company analysis can be done and analyzed. First Reverse Logistics will be dealt with, topics that will be written about are the benefits and challenges, areas and the process, adapting a reverse logistics model and reverse logistics models, return types and outsourcing. In the end a conclusion will be done. The following topic will be green logistics. Within green logistics topics such as adaption of green logistics, green logistics system models and logistics systems, green logistics and supply chains and paradox issues will be dealt with. After these subjects within green logistics have been handled a summary will be concluded. Then after that the both subjects have been dealt with a summary of reverse and green logistics including their differences and similarities will be conducted. In this part also will be stated which theories that be used for the company analysis.

3.1 Reverse logistics

Reverse Logistics is a part of logistics. Usually when logistics is mentioned only one way is thought of. That is when the goods leave the company and is transported to the customer. Reverse Logistics handles issues such as remanufacturing, refurbishing, recycling or disposal to use resources effectively. Dowlatshahi (2000, 143) defined reverse logistics as follows: “Reverse logistics is a process in which a manufacturer systematically accepts preciously shipped products or parts from the point for consumption for possible recycling, remanufacturing or disposal.” Another definition by Hawks (2006) is that reverse logistics is “the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal.” She then continues to explain it as reverse logistics is the process of moving goods from their typical final

destination for the purpose of capturing value, or proper disposal. A third definition of reverse logistics by Larsen, Schary Mikkola and Philip (2007, 292) is that reverse logistics encompasses a broad range of activities within, and outside of, logistics including: product returns, source reduction, recycling, material distribution, reuse of material, waste disposal and refurbishing, repair and remanufacturing.

3.2 Reverse logistics benefits

As stated earlier “customer service related to a fast and flexible claim and return process and a short claim-to-pay-back period is important and can create both customer loyalty and competitive advantage” (Larsen, and more 2007, 295). The value can be regained through reparation or refurbishment when returned to the market place, components from product returns can be reused as refurbished components or as spare parts. In Larsen, and more (2007, 295) they identify five ways that proactive reverse logistics can have a positive impact on profitability:

1. Increased revenues realized from secondary sales
2. Offering new products in place of unsold or slow selling stock
3. Shareholder goodwill from acting with social and environmental responsibility
4. Reduced operating costs from reuse of recovered products and components
5. Higher asset turnover due to better management of returns inventory

3.3 Reverse logistics challenges

Within the reverse logistics there are challenges that differ from the forward flow of materials and products. These are challenges according to Larsen, and more (2007, 295-297)

1. Large variations in timing, quality and quantity of product returns
2. Lack of formal product returns procedures
3. Delayed product returns reducing their market value
4. Lack of local competence in inspection, evaluation and disposition of returns
5. Risk of cannibalizing new product markets
6. Lack of performance measurement for return process efficiency

Issues that make it difficult to forecast and allocate resources to return systems in reverse logistics are factors such as timing, quality and the quantity of product returns. There are only a few companies that have formalized information system and standard operating procedures for the management of returns. An ongoing issue is that the product returns that are returned by end-users is that they are usually unpacked, unlabeled or missing other relevant product identifications. So because of this it is very time consuming to identify the product returns and reliable the returns with barcodes.

Preponement is a strategy to reverse logistics responsive by reducing time delays, sorting, disposition, promote early collection and disassembly rather than late process and product differentiation.

Another problem for companies that are taking back used products or new products that are returned from the end customer to be returned to the market is Cannibalization. With this means that some of the products might be repacked and returned to the primary market at the same price, meanwhile some products might be sold in secondary markets. These can be electric auctions such as internet sites as amazon.com and e-bay.com. (Larsen, Schary Mikkola and Philip,2007)

3.4 Reverse logistics areas

According to Steele and Rodrigues (2008) there are five different key areas for reverse logistics

1. Returns prevention and warranty/repair policies
2. Logistics

3. Repair operations
4. Recycling and reuse
5. Product design for environment and service.

The first of these areas that will be discussed is “returns prevention and warranty /repair policies”. Return prevention and the setting of customer policies would according to Reverse logistics professionals belong to sales and customer service. Reverse logistics professionals would claim that sales and customer service often disregard ideas and improvements that might come from reverse logistics departments. These might be ideas such as possibilities to reduce NTF (No Trouble Found) returns and return policies. But since NTF returns are getting more likely to occur because of complex products and services. All recommendations that can reduce returns should become more valuable. It also gets more essential to face the problems from a more cross-functional perspective.

In this area the opportunity for reverse logistics is to “highlight options available to improve service and reduce cost in light of supporting green initiatives” (Steele & Rodrigues 2008, 28). If there are follow ups or customer consideration involved in return policies it is possible to reduce NTF returns. If business customers want to reduce their carbon footprint they need to be able to realize the need to remove wasteful activity. But when sales and customer service organizations are changing then they again need to have an understanding of the impact that these possible returns might have on the company’s own carbon footprint and costs.

Information in reverse logistics that needs to be share with senior management and with the organization that is responsible for developing corporate policies is the full impact of now days wasteful or also unnecessary activities and calculations of potential benefits of improved efforts. What needs to be understood is that any reductions in wasteful activities benefits reverse logistics, and this affects the whole company. Some of the benefits for companies that apply a more stringent control are savings from reduced handling, better product availability and reductions in the accounting activity.

The following topic is logistics. Since reverse supply chains needs to be reexamined because of trade-offs within labor costs and transportation costs are changing remarkably. When evaluating potential outsource partners these factors and changes in warehouse locations, repair operations locations must be considered. Reverse logistics needs to be calculated and compared to look at the positive and negative sides if returns and repairs are supported with one regional and centralized location. Since the shipments most likely have to travel long distances which has a negative impact because of fuel consumption and carbon emissions. Which is better then, a centralized or localized handling and repair facility.

Something else that needs to be considered is when an immediate response or a product solution is needed for a customer; the most common solution is to ship the product to either the supplier or to another partner. The opportunity of saving costs and decreasing the amount of carbon emissions from transportation carriers can be successful if it can be avoided to expedite small shipments. And also when reducing the carbon emissions the company reduces their carbon footprint.

The third subject is repair operations. To reduce turnaround time (TAT) with the lowest cost and keeping a acceptable quality level is the achievement a company wants. Total costs of the current operations should be considered in reverse logistics no matter if it is outsourced or executed within the company. Energy consumption, reuse/recycling programs, supplier networks and waste generation must be considered within the repair facilities. In consumer electronics decision makings TAT is considered and used as a main element. But TAT is no longer the companies customers focus but instead there is a greater importance on “not falling short of product for customer replacements”. (Steele & Rodrigues 2008, 30) the right metric should be days of on hand inventory and not TAT. In order to use this approach it would be needed a change in metrics that are used. Such as a closer relationship with the customer so visibility of on hand inventory can be provided and also being able to track stock out situations. So if there was a reduction of the pressure on repair providers it would lead to better and more accurate handling, a reduction in the emissions coming from transportation

providers, a reduction in the cost of freight and lastly a reduction in emissions in repair facilities, this would be achieved from a more linear and more efficient flow in the repair process.

The fourth area is recycling and reuse which can be challenging for several companies because of forecasting field failures and the ongoing need for parts. Two examples of how companies handle this is that they keep a product for years hoping that they will recover some value from a customer who is willing to take the obsolete part or product. The other example is that they have a standing policy to sell off or dispose products that have had no demand in 90 or 120 days. Here reverse logistics can affect and have an opportunity to affect awareness and the results of part planning. This can be achieved through good products that handle forecasting and planning of part supply. When these products are implemented properly they can provide a more precise picture of when parts/products should be liquidated. A significant benefit happens when the number of total demand of products or parts decreases by selling away excess or obsolete product in a timely fashion and not waiting several years before selling. Another favorable option is when reuse programs are implemented for parts. These reuse programs exist to reduce the amount of new parts that are either procured or consumed as a part of the repair and refurbishment process. When there is a proprietary design involved or when the demand has decreased it is easier to move the parts into recycling at the right time. When there are lower inventories it decreases the energy use and emissions from the warehouse. Also through reclamations and usable materials the company can get some value back.

The following topic is the product design for environment and service. This means that the packaging and the product should be designed in a sustainable way, such as materials and packaging. But here reverse logistics need to be involved to help with the design process and factually demonstrate the impact that it has on their operation. Since reverse logistics needs to easily service products and reduce amounts of materials waste.

These activities have a remarkable impact on reverse logistics costs. It also affects the carbon footprint. Even when considering this they are not exclusively under

the control of reverse logistics. Since demands are put on reverse logistics that costs should be lowered and also expedite handling, repair and shipping. This causes difficulties but to be successful with green initiatives it should have a positive impact on the company's carbon footprint and achieve cost savings. A way of doing this is through launching corporate initiatives through evaluating product design, packaging and manufacturing. But there needs to be a consideration for all of the factors and functions that affect the environment in order for a company to be truly green. (Steele and Rodrigues, 2008)

3.5 Reverse logistics and the process

There are different options that companies can choose from when the goods are returned. If it is a possibility to return the product to the supplier for a full refund it would be the primary option. A second option is if the product has not been used it can be re-sold to another customer or perhaps be sold through an outlet store. The third option if the quality of the product is not sufficient enough for option one and two, the goods can be sold to a salvage company, which sells the goods to foreign markets.

If the product is faulty and is not in enough good quality to be sold as it is, then it can be remanufactured, reconditioned or refurbished in order to increase the selling price. These actions should and are usually done before selling the product. For this action a third party firm can be hired if the company itself does not do it within the company. But after these actions have been taken, the product should be sold as reconditioned or remanufactured, not as a new product. And if there is no possibility for recondition the product in any way, the company will dispose the product for the least of costs. But all valuable material that can be reclaimed or material that can be reused should be removed and reclaimed before disposing the goods.

With packaging materials that are returned to a company will be reused. Packaging materials such as pallets and totes will be reused many times before it is disposed of. This kind of packaging can often also be refurbished and then be returned. If companies do not want to handle these themselves or cannot there are companies that fix pallets and refurbish packaging as a company aim. Also with the packaging all salvageable materials should be reclaimed before disposal.

The European firms are required by law to take back transport packaging that is used for their products. Because of this the European companies tries to reduce their costs by reusing as much of the material as possible and also reclaiming material when they cannot be reused anymore. (Dr Rogers D, Dr Tibben-Lembke, 1998)

3.6 Adapting a reverse logistics model

According to Rupnow (2011) there are seven things to think about when adapting a successful reverse logistics model. Firstly he suggests that the company should centralize their returns operations. This indicates that the company should with “so many people, scattered across so many departments, at so many geographical locations, from several different companies, are all needed to process one returned item. Reorganizing all returned items, types, people and processes into one centrally managed group can be the cornerstone for change and success.” (Rupnow, 2011) The following step is to find a leader. Department managers have the secondary accountability for the returns. A leader should be appointed since returns are easily pushed over to someone else since someone else has made a mistake. Appointing a leader for the returns can handle and appoint assignments regarding the returns. The following step is to develop a very defined business processes. Since returns are complex, multi process transactions and every return needs to be handled differently. With a good process it will enable you to quickly react and find a resolution for the customer return and regain the highest value possible for each returned item. The fourth step is to link your business processes. Your process should be built with a system that is streamlined through each action

and through each group with “one touch” and “automated” handoffs for the components and the relevant data. When adapting these parts it will generate the largest processing savings and also reduce issues or errors and finally it will significantly reduce reconciliation time between groups. The following step is to gather accurate data. If the information for returns are not gathered, unnecessary errors might occur and faulty handling or costly assumptions might occur. With a data collection that is careful and detailed it can result in big payoffs and good metrics to assess performance. The sixth step is to ensure real-time visibility. By adapting these 3rd party service providers, managers, clients and customers can resolve these issues immediately. The last step is called no firefighting. This means that a aggravating work environment is created by ongoing issues that need to be resolved as soon as possible. By monitoring any process regarding to firefighting that is then followed by immediate action will in the end release the stress that is related to the situation, what will then in the end improve the companies system. (Rupnow 2011)

According to Curt Barry (2003) who states eight steps to be successful in Reverse Logistics. These eight steps are:

1. Analyze your returns process and the reasons for returns; then develop detailed returns reporting.
2. Develop a detailed analysis of your current returns-processing costs.
3. Analyze your customers’ expectations in terms of speed for processing the returns and issuing credit.
4. Factor returns into your initial buying plans, and count on resalable returns to fill customer orders.
5. Determine your requirements, functions and business metrics
6. Evaluate all your options for returns processing before selecting a third-party vendor.
7. Compare your business requirements against all viable options, and check references from all vendors.
8. Evaluate all the alternatives and costs in conjunction with product turnaround time and crediting customers.

3.7 Centralized reverse supply chain

The reverse supply chain, also called reverse logistics is usually fragmented between different actors. This leads to that no one has the overall responsibility. This then again leads to inefficient solutions and sub-optimization. But it is possible to identify the responsibility and where the initiative should be for managing the reverse flows through adapting a centralized control over the reverse supply chain. This is a system where one organization is responsible for collection, sorting and redistributing of return items.

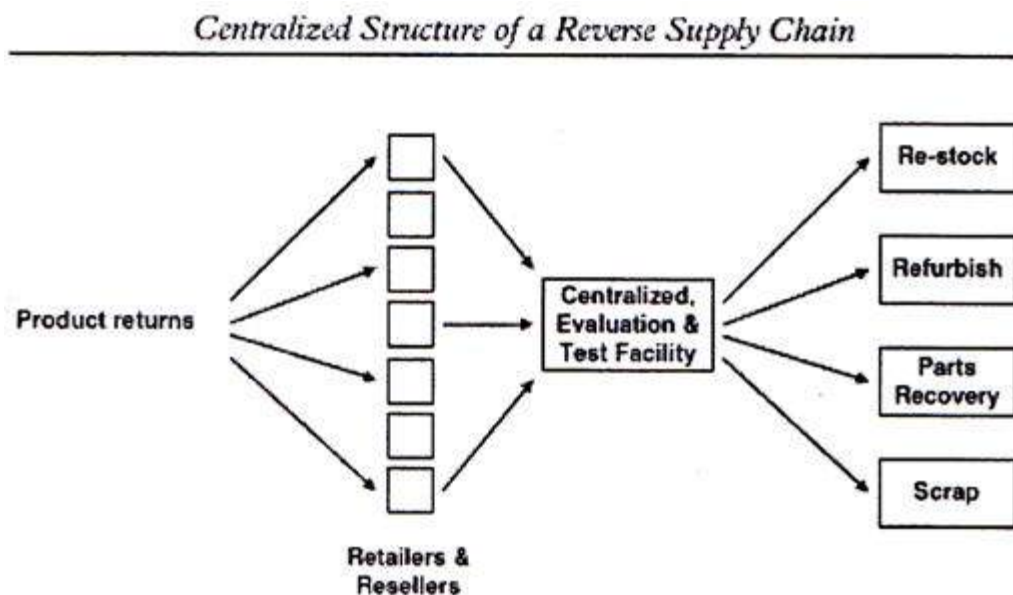


Figure 1 (Larsen, Schary, Mikkola Philip: 2009,298)

Above a model of a reverse supply chain is demonstrated. The point with this system is “that the gate-keeping activities of collection, inspecting and sorting are centralized within on organization. The same organization or another company at the up-stream levels of the supply chain may take on the physical processing.” (Larsen, Schary, Mikkola and Philip: 2009,298) This can be organized in several ways. It is possible to integrate it into and manage by the company’s forward supply chain. It is likely that remanufacturing of the products are needed they will be conducted at the upstream levels of the supply chain. Larsen, Schary, Mikkola

and Philip explain an example of this type of model through IBM's closed loop supply chain. Here the returned items are such as PC's, laptops and printers. These products are used as sources for spare parts. The efficiency here may be improved by certain a pool of returned products through an industry consortium. So in this example the first step is to get the photocopiers back from the customers that will then serve as inputs to the remanufacturing process. The returned photocopiers will then be returned to one of four centralized logistics return centers. Here they will be inspected, tested and assigned to one of four grades. The first is repair, second is remanufacture, the third is part remanufacture and the fourth is recycle. In the repaired and remanufactured grades the copy machines will be distributed to customers through the traditional forward supply chain. The financial benefits of equipment remanufactured and parts reuse amount to several hundred million dollars a year. A thing to keep in mind is that sometimes the reverse flow requires a special competence from personnel regarding inspection and disposition of the returned items. (Larsen, Schary, Mikkola Philip: 2009)

3.8 Decentralized reverse supply chain

This type of reverse supply chain consists of multiple organizations involved in the collection, sorting and distribution of returned items.

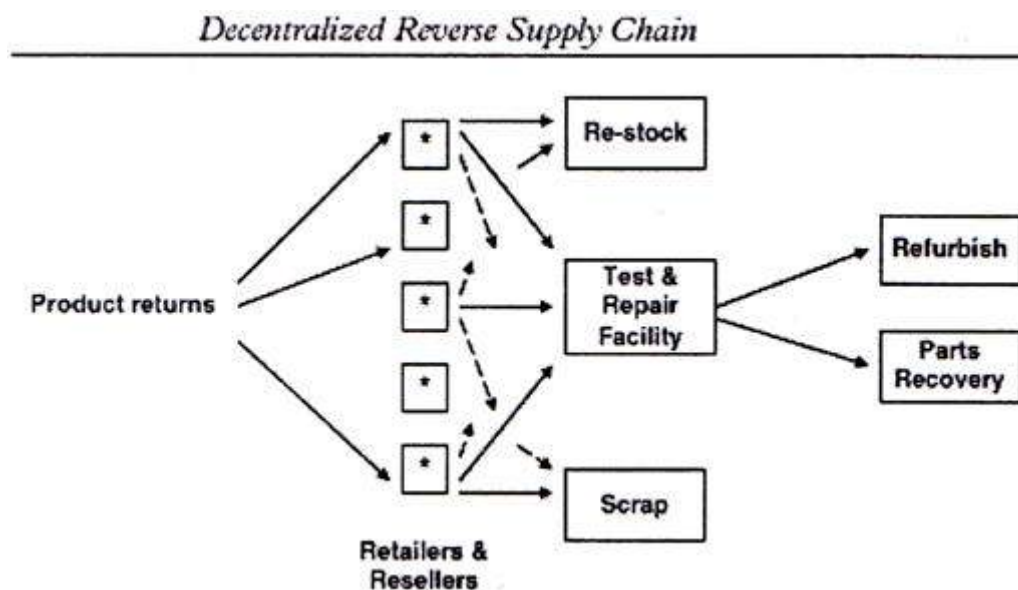


Figure 2 (Larsen, Schary, Mikkola Philip: 2009,300)

This model starts from the left where products or items enter the reverse supply chain at a retail level. Then the particular sales outlets serves the function of a “gate-keeper”. It evaluates the product and then gets sent further to one of the three actors. The three actors can be seen in the middle in the figure above. Specific Guidelines are needed in order to determine the condition of the product, also local skills are needed so that initial inspections can be performed, and lastly a logistics infrastructure to pass on the items or products further into the activities represented at the right side of the above figure (Refurbish, parts recovery). A advantage with this is that the products and items can be sent directly to the correct form of value of reclamation. This model favours time-based strategies, in order to support value reclamation efforts such as refurbishment of high-value products. (Larsen, Schary, Mikkola Philip: 2009)

3.9 Reverse logistics and product return types

According to Larsen, Schary, Mikkola and Philip (2007, 292) they use the term reverse supply chain instead of reverse logistics. This is because of that the management of return products has to encompass the entire chain. They define three major types of return items. These are defined as the following:

1. End-of-life returns
2. End-of-use returns (leased)
3. Commercial returns.

The first type of return that is the end-of life- returns are usually mandatory and regulated by EU directives or national legislations. Products or materials that can be included in this category are the following: packaging materials, tires, batteries, cars, white and brown goods, and electrical and electronic equipment. Product management strategies for these kind of returns are to repair and reuse, recycle with disassembly, refurbish, recycle without disassembly and incineration. If repair/reuse is possible the highest recovered value will be achieved. The lowest value will comes from if incineration as fuel is the only option. If recycling with disassembly can be done the components can be returned to the supply chain and

can be reused in the production process, or recovered materials and be sold at secondary markets. Different materials are separated based on material types when it comes to recycling without disassembly and is often carried out through a grind and sort process.

The following is the end of use returns and they are often products that are leased for a period of time and are then returned to the lessor and if possible refurbished and returned to a secondary market. Usually leasing companies are organizing these returned themselves.

The third product return group is commercial returns. The kind of type that commercial items are is: clothes, PCs, furniture, books etc. The faulty part of these products are usually that the products do not fit the customer, returns because of customer dissatisfaction, or that the product is shipped to the customer in error. The flow of the returns can either be from customer to retailers, through distributors to the manufacturer or it can be outsourced to a third party operator, they then collect the items at the customers location and return them to the manufacturer's location or a dedicated return center. (Larsen, Schary, Mikkola and Philip ,2007)

3.10 Reverse logistics and outsourcing

When a company has a good reverse logistics they are able to “remanufacture or refurbish products and parts that can convert damaged inventory into salable goods and recapture value that would otherwise be lost.” (Anderson, 2009, 41) The benefits with having a good reverse logistics system is firstly the profits the company can make from it, secondly it keeps the customers satisfied by improving service which then leads to a competitive advantage. Other benefits are also to comply with environmental regulations, reduction of operating costs and to improve product uptime and quality. But since it is hard and complicated to adapt a good reverse logistics model many companies outsource their reverse logistics

(Curtis, 2011). And as Curtis states the three most common reasons why companies outsource their reverse logistics is because of:

1. To get reverse logistics expertise quickly and with less risk.
2. To achieve greater flexibility and faster speed to market
3. To create a protective barrier against outside forces and limit potential liabilities. (Curtis,2011)

Outsourcing can be a smart alternative if the company does not have the expertise needed in order to adapt a good model. But there are issues and patterns that companies might be left out with outsourcing. A benefit from outsourcing reverse logistics is that the company can have in a short period of time a functioning and well running reverse logistics. With outsourcing it can take six months to get it functioning, but if it is done within the company it can take twice that time to get it running. A second benefit from outsourcing is the money a company can save and also the risks that can be minimized. They can negotiate a yearly/monthly fee for the service or some form of variable pricing. In this way the company can control costs that are seen as non-controllable expenses. These expenses are among workers compensation expenses and medical benefit costs. Risks that can be minimized when outsourcing are among that if the 3PL do not meet the expectations they can be fired and replaced with another 3PL.

A negative part of outsourcing is the underlying information in the reverse logistics. Information and data such as detecting or preventing product quality and design issues, also and understanding of customers buying patterns might get lost. This is something that might occur if the company outsources both the data and the process. But by maintaining the data one can use it in a effective and gaining way. (Anderson,2009 and Curtis,2011)

3.11 Conclusion of reverse logistics

Reverse logistics is a sustainable method to keep profits up through returns. In order for reverse logistics staff to succeed in reverse logistics since the business need has changed they need to build expertise and capabilities. And as Steele &

Rodrigues (2008, 30) concludes that “The reverse logistics operation in many companies have provided improved service at reduced costs” they then continue “reverse logistics has often been the recipient of bad financial decisions regarding inventory of parts and products and of unwelcomed demands from sales and customer service to support programs that have not considered the impact on reverse logistics. “.

The definition of Reverse logistics can also be defined in different names such as; reverse-flow logistics and also green logistics. Which brings us to the next topic. (Steele & Rodrigues, 2008)

4.0 Green logistics

When I started to research about this thesis I thought about “the green perspective”. But after reading about the subject I came to the conclusion that the green perspective is green logistics. Since the green perspective can be defined as “thinking green” and “environmental friendly”. That is what green logistics is about. Sbihi and Eglese (2007) defined green logistics as: Green logistics is concerned with producing and distributing goods in a sustainable way, taking account of environmental and social factors”. Another definition comes from Rodrigue, Slack and Comtois (2001: 339) they have divided the words and explained them separately and put 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 and environmentally friendly and efficient transport and distribution system.” The third definition of green logistics is by Larsen, and more (2009, 292) as “efforts to measure and minimize the environmental impact of logistics activities, these

activities include a proactive design for disassembly”. Activities that are dealt with in green logistics is measuring the environmental impact of different distribution strategies, reducing the energy usage in logistics activities, and reducing waste and managing its treatment. In order to be able to deal with these topics companies are now days measuring their carbon footprints, so that the environmental impact of the company’s activities can be monitored.

4.1 Why green?

Reasons why companies choose to “go green” is such as it is a market for their business being green. It gives the company a competitive advantage. Since the customers are demanding now days that the businesses will be green. And as Shrivastava (1996, 56) concludes that customer are demanding green products and packaging more friendly to the environment. He then continues that some consumers are willing to pay higher prices for environmentally sound products, and they are seeking more information about contents, use disposal and recyclability. But it is not the only reason why businesses are going green and adapting green logistics. And as Thiell, Zuluga, Montanez and Hoof (2011, 335) concludes that transportation of the logistics operation has an significant impact on the environment. This is when one considers how much CO₂ that vehicles, aircrafts and vessels generate. It is often considered one of the main causes of the global warming effect that is threatening the world today. Also according to Wu Haw-Jan and Steven C (International Journal of physical distribution & logistics management 1995) another reason why being green and using green logistics is of an importance is because of the serious environmental problems that have arisen from the economic growth. Reasons like depletion of the ozone layer, rapid disappearance of rain forests, pollution of air and water and scarcity of landfills pose threats to the global quality of life. They also state that there has been an increasing demand for green products in the marketplace, more stringent pollution regulations set forth by government and more environmentally responsible business management. Another factor that is mentioned in the article is that to be “able to achieve the business goals and objectives, a company must respond to increasing consumer demand for green products, comply with ever tightening

environmental regulations, and implement environmentally responsible plans as a good corporate citizen.” A factor that also needs to be considered is the governmental reasons. The roles of government in preserving the environment are as a regulator, facilitator and buyer. The government sets standards such as vehicle emission standards, recycling requirements in federal, state and local levels, they also set standards in noise control. In Europe and Canada there has also been set stringent standards on source reduction, material reuse and waste recycling. A benefit from the government is that they support research and provides investment and regulatory incentives for business to develop new environmental technologies. When it comes to logistics they support the development of transport infrastructure and regulations, which includes high-speed rail and alternative fuels. And there is also benefits from handling the environmental issues in a proper manner. This is to avoid legal and financial consequences of environmental mismanagement, coupled with bad publicity.

4.2 Adapting Green logistics

The reason why companies usually adapt a green transport system is in order to reduce traffic congestion, reduce pollution, promote social harmony and to save transportation costs. But since there is a huge competition between transportation systems it increases the waste of transport resources. So when an system of green logistics infrastructure is established it sets the basis system for the entire green logistics system.

In order to achieve a integrated green transport system and integrated transport hub should be established, since it is a connection of road network and an inter-city transport corridor. And it has a direct impact on the overall efficiency of transport systems. But modern management is needed in order to achieve this, since both sea, land and air and other various means of transportation will be found in a transportation hub.

With transportation should the company also consider the form of transportation that is being used for the goods. The company should take advantage of water as a

transport option. Since a large amount of volume can be transported, it leaves a small footprint; it has low energy consumption and also a small pollution.

A part of having a successful green logistics model is to have a platform for the information system. If there is an existing information system it can provide information and precisely monitor every process of logistics activities. In this information system the members of the logistics team can monitor the product packaging, storage, transportation; distribution processing, loading and handling etc. When they are monitoring these activities they can then comply with the requirements of environmental development and can implement easier the environmental logistics decision-making. The system includes eight models which is show in this figure:

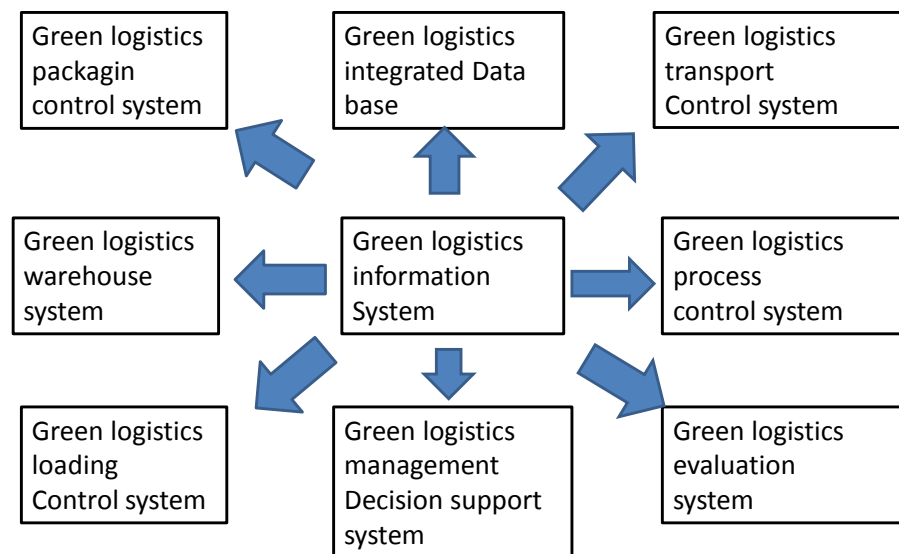


Figure 3, Green logistics information system structure

Picture model taken from Zhan Yingjung & Liu Juanjuan,

Now these different part of green logistics will be explained a little bit further.

We start with the green packaging control system. In this part the company should promote production departments to use as simple as possible and biodegradable

material when producing the package. And to be able to monitor and control the enterprise's product packaging other green system evaluation indicators should be adapted. Then after this we focus on the green transport control system. Here it should be evaluated the activities that are causing goods damaged during the transport and also consider the environmental pollution. In the green warehouse control system it is one of a series of system to monitor any non-green in warehouse sub-factors. The following is the green process control system, this is a system to monitor productions from product places to the final consumption places. Also issues such as packaging, segmentation, measurement, assembly, commodity inspection etc. can go under the process control system. The following is the green load and unload control system. In this part activities such as transportation, storage, packaging or carrying of goods are controlled and monitored. The sixth is the green logistics evaluation system. Here there are mainly four aspects that should be considered; the environmental performance logistics system, resource performance logistics system, economic performance logistics system and the technical performance of logistics systems. The last one is the green logistics management decision support system. Here in this system the main goal is to create and establish many models of green logistics so that members involved in logistics can optimize the decision-making and choices. (Zhan Yingjung & Liu Juanjuan)

In order to adapt a green perspective also called a green logistics companies should think about the following six tips that Engel (2008) stated. First the company has to create generic, less expensive and more lighter packaging for refurbished products. The following tip is that they need to be able to utilize biodegradable packaging that would preferably be made from recycled material. The third tip is to use the regional recycling experts so that transportation costs can be minimized. Another tip is to in a timely manner recycle the material so that the market viability can be maximized. The last tip is to get the whole organization involved and encourage them to contribute to the company's green causes. (Engel,2008)

4.3 Establishing a green logistic system model.

The green logistics system must include green management, green information system, green supply, green production, green transportation, green distribution, green packaging, green distribution processing and waste recycling. In other words the whole supply chain needs to be green. Within green logistics completion requires the close cooperation of several parts such as government, public, and corporate. If there is only an emphasis on one or two of these parties in the whole system, green logistics will not be achieved. The system architecture refers to the systems external and internal environment as well as the components in itself. There should be a consideration for green logistics that it is not an isolated system, but it needs exchange information and energy with outside parties. So with other words a green logistics system is a large integrated system. Following is shown a green logistics system that can be divided into five both interlinked and antagonistic parts.

	Green Logistics Monitoring System			
Green Supply Chain System	Green Suppliers	Green Manufacturer	Green Retailers	Green Consumer
Infrastructure	Green Logistics Information System			
	Green Logistics System (Distribution, recycling, packaging, etc.)			
	Integrated Green Transport System (Transport hub, means of transport, transport network)			

Figure 4, Green logistics framework model

Picture model taken from Zhan Yingjung & Liu Juanjuan,

So when establishing an integrated green transport system it is mainly in order to reduce traffic congestion, reduce pollution, promote social harmony and save transport costs. But since there is an excessive competition between different transportation modes it brings a significant waste of transport resources. So in order to establish system of green logistics, a integrated system of green logistics infrastructure needs to be established. Since transport systems are a combination

of point, line and plane all three factors needs to be put together to have a rational planning of the comprehensive green logistics infrastructure system.

Wince comprehensive regional transportation hub of plays an important role in the integration of green transport systems, it has an overall efficiency of transport systems. A construction of an integrated transport hub needs to consider the information and intelligent as a goal and using modern management as a mean to reasonably organize the sea, land air and various means of transportation. There should also be considered that there will not be any duplication. When it comes to the selection of transportation means, there should be a full comparative advantage of water such as it is able to transport large freight volume, it has a small footprint, a low energy consumption, small pollution. There should be a fasten construction of waterways since it is one of the cargo distribution and transportation systems in major shipping ports.

The structures should be adjusted for integrated transport networks and it should be under the principles of saving resources, establishment of a environment-friendly transport system so it can be promoted to build an integrated green transport system.

The construction of a green supply chain is relevant for implementing a green logistics system, green supply chian creates a green environment for green logistics in a sustainable development which the again paves a green channel towards green logistics and at the same time it supports and promotes development of green logistics. But there is a need to understand and grasp that the essence of green supply chain starts from reducing pollution and that it is conserving resources. A real sense of green operation can be achieved from the supply chain management.

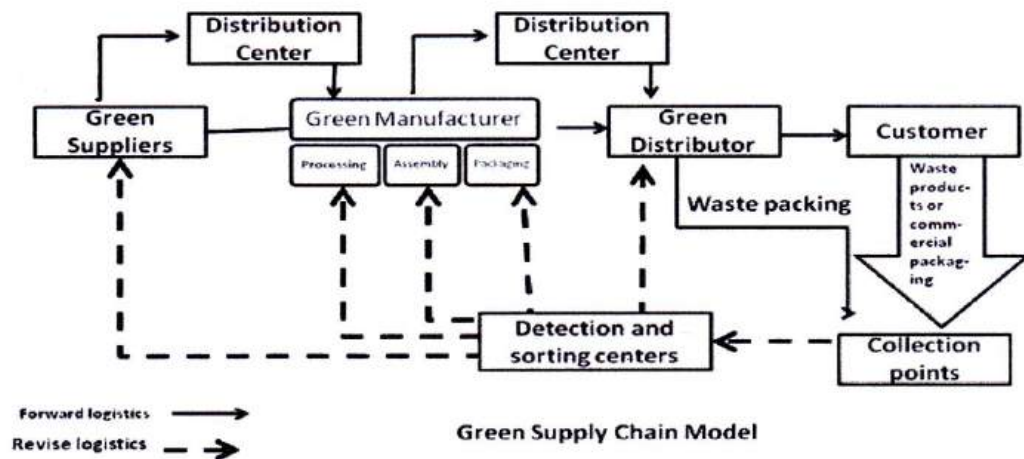


Figure 5, Green supply chain model

Picture model taken from Zhan Yingjung & Liu Juanjuan,

In this green supply chain model that goes through specialized collection centres. It can handle damaged returns, stock returns, end of life and discarded products from the supply chain's downstream members, it can centralize recycling products and perform some value recovery activities. After that the value has been recovered, it can either enter an old product chain, and it can also expand into other product chains. In this model both forward and reverse logistics has been adapted, and together they form a cycle based logistics system. The resources can be unified management and unified re-used. And this ensures a closely co-ordinated and efficient operation among the members that can be part of the upper, middle or lower supply chain. But when constructing a green supply chain based logistics system there are three levels that should be followed. Firstly the supply chain enterprise must take actions to be able to reach the green standards, secondly there should be formed a common inter-firm green platform and a network for the green supply chain. The third is that it will extend to the production chain, and make the most of the reverse logistics as well as it should enhance the feedback mechanism.

Green logistics is not only an issue for companies but also an issue for governments. Some issues that should be dealt with from the perspective of a government and companies logistics systems are:

1. Management of pollution sources. Regulations of emission of waste should be considered according to the air pollution control act. It refers to the amount of NO₂ emission that comes from motor vehicles so there can be a restriction the types of vehicles that are on the road. The purpose is to promote the usage of eligible vehicles, and also the promoting of control of vehicle noise.
2. A guidance of different options of transportation. Governments should rationalize and guide the usage of optional transport means. They should also encourage enterprises to select appropriate modes of transport. This can be done through taxes or administrative policies so that the companies logistics and pollution will be efficient.
3. To be able to control the traffic flow, government's are mainly responsible for the construction of roads. And also making a whole plan of roads and railway development, they should also modernize traffic control systems, develop rules to control road parking activities and so on.

From the consumers point of view they have their own requirements for green productions. This should be a key drive for companies that are taking measures in green logistics. By understanding the consumers important role in green logistics it can be beneficial for the company. (Zhan Yingjung & Liu Juanjuan)

4.4 Green logistics and logistics systems

Following are issues that logistics managers need to face when dealing with the green logistics. Logistics managers needs to understand their impact on the companies images and the green issues a company faces. Their decisions also affect the environment. So the logistics managers should maintain a green view through the decisions so that the company is able to keep their green environmental image. When logistics managers add another objective to the system it becomes more environmentally responsible logistics approach, this objective is to minimizing environmental impact. In order to achieve this the logistics manager needs to evaluate the environmental impact from the total system perspective. So in the follow section the challenges of how to incorporate

environmental management principles into a daily decision making process will be discussed. Where logistics elements will be considered.

4.4.1 Raw material acquisition

The environmentally friendly raw material use increases dramatically because of the fact that consumers are asking for more environmentally friendly products. Logistics managers are now facing the fact if they should buy from low cost vendors or from more expensive ones that are more environmentally responsible vendors. This has a constraint on the logistics network. Since the location of certified environmentally responsible vendors might put a limit on the choices that logistics managers can choose between. This then leads to the affect on the transport option as well. There might not be any other option for moving the materials through trucks. Which then are one of the least environmentally friendly transport option.

4.4.2 Inbound logistics.

The term inbound logistics includes activities such as receiving, storing, and movement of raw materials. The decision management faces is freight consolidation, mode and carrier selection, materials handling, backhaul management and warehousing. Freight consolidation improves vehicle efficiency, which then is regarded as environmentally responsible. But here logistics managers needs to consider trade-offs between transport costs and potential freight delays, consolidation savings and information systems investments and consolidation savings and inventory carrying costs. The benefit of freight consolidations is that it yields big savings. But the negative part is that it might lead to longer lead times and they might be deemed as unacceptable. The selection of transportation has also a profound impact on the environment. For example rail and barge use energy more efficient or use energy less than other transportation options such as road haulage and air cargo. Both directly and indirectly the decision for transportation mode affects air pollution and congestion. For example rail is seen as a more environmental friendly option when comparing to

road transport, this is because of that rail uses more efficiently land, it can use renewable energy sources, it helps to relieve traffic congestion in urban areas, do not cause as much pollution and finally generates less noise. When logistics managers are choosing between different transportation options, they should consider the environmental impact versus the financial costs.

The following topic that needs to be considered in inbound logistics is the carrier selection. This can be compared to buying green from raw materials suppliers, the companies have become more aware of what kinds of transport purchasing there are doing.

Within the materials handling, changes can yield both economical and environmental benefits. For example, by using bulk packaging, they save money by using less energy, labour and packaging materials. This is seen as environmental friendly since it uses less resources. There are also possibilities to saver operating costs when it comes to good warehouse layouts. Since warehouses generate much of the packaging waste in the supply chain, reusable containers can help to reduce operation costs and packaging wastes in warehouses. Another benefit with a good warehouse layout is that it can cut storage and retrieval movements. Some warehouses have now started to perform freight consolidation functions and break-bulk operations. These actions have potential of utilizing transport capacity more efficiently. Which then leads to that the environmental impact of the transportation system minimizes. A new trend in warehousing is cross-docking. With this means that the goods are not stored in warehouses but are moved from manufacturers or distributors to wholesalers and retailers, directly crossing their warehouses. There is a possibility to achieve maximum efficiency through cross-docking. This operations is considered to be environmentally responsible since the space in the warehouses and movement within the warehouse are reduced.

4.4.3 Transformation

The process of taking inputs and converting them into finished goods via assembly, testing and packaging activities is called transformation. Modern

inventory management techniques such as just in time (JIT) require frequent deliveries of materials and parts are creating additional traffic. Trade-offs that are evaluated in most inventory management models are mostly transport costs and inventory carrying costs. Trade-offs between inventory and transport depends on several factors such as value of goods, service level, interest rates and freight rates. When adapting JIT the companies should address congestion issues with short-and long-term perspectives. When it comes to short run, companies should utilize their off-peak capacity, redesign delivery trucks, select less congested routes, and consolidate shipments to improve efficiency. With long-run issues that needs to be re-evaluated are partnerships, location, technologies and channel structure that affect the operations of JIT systems.

Packaging is often required for products to reach their market. You can divide the packaging into three categories, primary packaging, secondary packaging and shipping packaging. With primary packaging means that 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. The third packaging type is shipping packaging, this is packaging that is necessary for storage, identification and transport. And is then discarded the product reaches its destination. Packaging has a significant impact on the environment. Since the elements like shape, size and materials, affect the transport characteristics of the goods. When changing the products size, primary and secondary packaging and pallet patterns, companies can often realize substantial savings in packaging, warehousing and transport. By improving better packaging, with rearranged pallet patterns there can be a reduction in material usage, an increasing in space utilization in the warehouse and in the trailer there can also be an reduction in the amount of handling that is required. The result of this can be less packaging waste, easier handling in warehouses and also fewer vehicles required because of higher space utilization. Which then again leads to less environmental impact.

4.4.4 Outbound logistics

The meaning of outbound logistics is physical distribution activities such as collecting, distributing products to buyers and involves warehousing, storing, materials handling, order processing, network planning and management, and finally vehicle scheduling and routing. The difference between inbound and outbound are the products characteristics. Outbound logistics typically deals with finished goods meanwhile inbound logistics deals with raw materials. Outbound logistics are usually more complicated since it handles higher product values and stringent customer delivery requirements. On the outbound side, managers first need to face network design, planning and management. Several trade-off decisions need to be made with regards to the firm's market, product and logistical resources and customers. Logistics managers have here several options to choose between depending on the firm's strategic goals and available resources. These options are between direct shipping or hub-spoke, central warehouse or distributed network, intermodal or single mode, and third party services or private fleet. If logistics managers wants to choose environmental responsible actions they should choose, fewer shipments, less handling, shorter movements, more direct routes and better space utilization. When there are so many options available, coupled with local and state regulations, logistics managers are challenged to find a good network design that can fit into the firm's existing structure while achieving the goals set by top management. With a reduction in logistical nodes in the operation, logistics managers can be able to run a more efficient operation at lower levels of inventories meanwhile maintaining the same level of customer service. As a result cost savings, and environmentally responsibility can be achieved through storage, energy and excess locations are eliminated in the network. But these savings can be mitigated by the resulting freight movements, which are not environmentally friendly.

With inventory decision in outbound logistics it includes stock levels and also stock points, centralized versus decentralized distribution centers, different service policies for different customers and different items, back order management, and replenishment policies. With environmentally responsible logistics one needs to be willing to trade time for transport savings and trade information systems investment for logistics costs. It is thought that the more warehouses a company

has the better service they are able to provide to customers. But this is not always the case. Logistics managers need to remember that every case is different, and they need to understand the dynamics in the inventory decision and use innovative methods to solve problems in an environmentally responsible manner.

4.4.5 Marketing

Logistics operations are affected by many marketing decisions. Since customer service level and distribution channels have a direct impact on logistics. The same service level can be maintained with a lower inventory and a more speedy and reliable transport or with high inventory but inexpensive transport. With information it can be used to replace inventories in the logistics system. Since many manufacturers are linked to their retailers computers and can checkout counter data real time. A result of this is that there can be made more accurate sales predictions and logistical planning of the goods movements. Better information systems are considered as environmentally responsible since they cut down waste such as excess inventory and inefficient shipping via better prediction and co-ordination.

4.4.6 After-sales service

This activity includes installation, returns, training, repair and parts and supplies. Here logistics managers are concerned about returns handling, parts and supplies management and network maintenance that provides fast reliable service to customers. There has been an increased emphasis and importance on recycling and hazardous material handling in recent years. Industrial and durable goods manufacturers maintain an extensive service network so that they are able to service their customers after the goods are sold. The typical returns handling system reverses the direction of the flow of goods and requires changes in equipment and operational procedures. Some of the changes might include extra storage space, detailed employee and customer training, buy in programs, specialized recycling equipment or the development of new markets for recyclables. When the changes have been made such reverse logistics systems can

be efficient. Such a system could include several warehouses linked in a network to perform functions such as transport to and from retailers for returns, in-house cleaning, refurbishing and repackaging, scrap disposal, inventory management, and hazardous material handling. This can also be defined as that the warehouse becomes a recycling centre that sorts and reuses material. Since the environmental impact is usually smaller from recycled, refurbished and remanufactured parts, logistics managers should be selected carefully so that there will be no sacrifices in quality and performance.

4.4.7 Transport

There are mainly three sources that have an environmental impact from transportation. These are construction of transport networks, operation of transport vehicles, and disposal of transportation vehicles and parts. Regarding fossil fuel (oil and natural gas), transport is a prime consumer; this leads to that it generates noise and emits many toxic chemicals. Often roads, airports, harbours, rail right of ways fill up and often pollute landfills with dismantled vehicles, parts and toxic substances. By using transportation efficiently it can prevent these problems and also protect the environment. Here the logistics manager is able to reduce the use of road transport, increase the usage of alternative fuels of their fleets, and also keep their fleets more energy efficient and less polluting. There is also an option to reduce the number of trips by consolidating freight and balancing backhaul movements. Also efficient loading, scheduling and routing can reduce pollution and traffic congestion.

Another problem with transportation is the maintenance and disposal of vehicles. A proper maintenance programme helps to maintain vehicles in a safe and efficient working condition. This then again leads to prolonged vehicle life, and reduced accident rates, this then again leads to saving in operating costs but will also cut the amount of environmental damage. (Wu, Haw-Jan, Dunn, Steven, 1995)

4.5 Applying green logistics to supply chains

When adapting a green logistics approach on the supply chain there can be put an additional focus on strategies. When it comes to the products design and production planning the most common is that focus is usually put on the products design and development that comes from improvements of its competitive and commercial attributes, these are factors such as price, quality, features and performance. This is something that is common for electronically goods since each new generation for the product is quantitatively and qualitatively improved. Since the sourcing and the distribution is being considered from a supply chain perspective, the concern is about the designing or redesigning the supply chains so that they will be more environmentally friendly. Physical characteristics of the products itself can be involved, it can be characteristics such as lighter, alternative and materials. It might also be production processes that will allow a greater transport density of parts/goods. Suppliers that are closer might also be considered even though they might be somewhat expensive, they are considered so that the transportation costs can be reduced. Products or parts and resources that have been procured in a sustainable manner might also be preferably contract suppliers.

With the physical distribution there are concerning about strategies that will reduce the environmental impact of physical distribution. This is regarding mainly the transportation and warehousing activities. It can involve the handling of facilities that have been recognized as environmentally capable, it can also mean carriers that have following environmentally friendly principles. One of these preferences can be that shipments can be delayed until a sufficient load factor is reached. Also by increasingly applying the using of alternative methods and fuels are favored, this is particularly for city logistics. A consideration for strategies that may lead to greener supply chains are for long distance travel, modal shifts from rail and maritime shipping.

In the material management it is about reducing the environmental impacts that are related to the manufacturing of goods in all of the stages of a product process along the supply chain. A strategy for this involves a better packaging to be able

to increase the load density as well to be able to reduce materials consumption and the waste. It is preferred as industrial inputs to use low impact materials, particularly recycled resources. Products and their components have a tendency to be increasingly recyclable, waste management strategies are being adapted so that the end products are handled properly or being reused.

The reverse distribution is about activities and movements that are related to taking back the consumed good, as well as waste that should be recycled or discarded. This has opened up new market opportunities over specific aspects of material management this is regarding mostly recycling and waste disposal, and also the physical distribution that can also be called collection channels. A greener face do not the transportation industry show by itself, and also reverse logistics adds further traffic load and facilities required to handle them. But the ones that are achieving the environmental credit are the manufacturers and domestic waste producers. (Dr. Jean-paul rodrigue, Dr. Brian Slack, Dr. Claude Comtois, 2009)

4.6 The paradoxes of green logistics

When adapting green logistics there might be some inconsistencies that might arise. The issue is that green logistics is supposed to be environmental friendly, but logistics in itself is not very green. This is because of pollution and waste that is created. So when adapting green logistics there are some paradoxes that arises. Companies wants to get the cheapest way to do things but at the same time they should choose options that are green, which sometimes are more costly to the company. The logistics industry has reacted to the environmental imperatives should not be unexpectedly, this is given by its commercial and economical imperatives. But here there are significant issues that are being overlooked. These are issues such as pollution congestion, resource depletion which are issues that are not very green. The first paradox is Costs. Since the purpose of logistics is to minimize costs, notably transport costs. The cost-saving strategies that are pursued by logistics operators are often at variance with environmental considerations. But often the environmental costs are often externalized. And then a following issue arises is that individuals and companies are becoming less

accepting of these extra added costs. So then the pressure is put on governments and corporations that they need to include more environmental considerations in their operations.

An example of how costs are being saved but not as environmental friendly is the Hub-and-spoke structure. It has characterized the reorganization of transportation networks, most noticed for air, rail and maritime freight transportation. Through this model it has minimized costs and improved efficiently through the consolidation of freight and passenger at hubs. This is least sustainable and environmentally friendly option with the flows, terminals and modes that are being used by ongoing logistical integration. These kind of concentrations increases the local environmental problems, these can be problems such as noise, traffic congestion and air pollution. The conclusion from this is that the paradoxical relationship between logistics against the environment is that reducing costs does not mean that there will be a reduction of the environmental impacts that might occur.

The following paradoxical relationship is time/speed. When it comes to logistics time is often of importance. By reducing the amount of time spent on lead times, the speed of the distribution system is also increased, which leads to its efficiency. And to achieve this it is mainly used the most contaminating and least energy saving transportation modes. The increase of transportation modes such as freight and trucking is partially a result from time limitations that are imposed by logistical operations. There are services available like Door-to-door (DTD) and Just-in-time (JIT). Other transportation modes are not able to satisfy the demands such as a situation creates as effectively. This then again leads to an evil circle, the more physical distribution that goes through logistics is efficient but less production, distribution and retailing activities are limited by distance. This kind of structure then again involves a greater usage of logistics and more ton/km of freight transported. JIT and DTD strategies that are being used has a less favorable environmental result on the traffic it generates.

The third paradox is reliability. Service reliability has a dominant part in logistics. The success is determined on the possibility to deliver freight on time with the

least risk of breakage or damage. To be able to achieve this transportation modes are being used that are seemed as being most reliable, and the least polluting transportation modes are usually send as being the least reliable in terms of on-time delivery and lack of safety and breakage. Bad customer satisfaction is something that ships and railways have suffered from and have also gained a bad reputation. And the two least environmental friendly transportation modes that logistics industry is made around are truck and air shipments.

Warehousing is the following paradox. Since reduction of inventories is something that modern logistics systems economies are based on, the reliability and speed of deliveries takes away the need to stockpile and store. So this leads to an advantage of logistics when there is a reduction in warehousing. But the inventories have now been transferred to a certain degree to the transportation system, and especially the roads. So the inventories are actually in transit which then contributes to further congestion and pollution.

E-commerce is one of the most active markets. It is made possible by an combined supply chain with data networking between the freight forwarders and the suppliers assembly lines. It might appear as a moving free transaction, but the distribution that online transactions create may use more energy than other retailing activities. But the consequences that e-commerce has on green logistics have not yet been quite understood, but there are some trends that can be identified. The result from e-commerce is that it might involves more packaging and more tons/km of freight that is transported, this is especially in urban areas. (Rodrigue, Slack and Comtois 2001)

Following is a table where the paradoxes of green logistics are shown more clearly.

Table 1

Dimension	Outcome	Paradox
Costs	Reduction in costs by improving packaging and reduction of wastes.the	Externalized environmental costs

	distributors gain the benefit.	
Time/flexibility	Integrated supply chains, DTD and JIT provides a adjustable and competent physical distribution systems	Extended production, distribution and retailing models that are consuming more space, energy and generates more missions (CO ₂ , particulates, NO _x , etc.)
Network	(Hub-and-spoke structure) Through network changes there is a increasing system-wide well organized distribution system.	Environmental impacts on major hubs and along corridors are being considered and the pressure on local communities
Reliability	That freight and passengers can rely on time distribution and its reliability	Transportation methods that are used, truck and air that are the least environmental efficient.
Warehousing	The need for private warehousing operations are reducing	Inventories are partly on roads or containers that are adding more congestion and are taking more space
E-commerce	Diversification of supply chains and better business possibilities	Physical distribution systems changes that requires more energy consumptions

4.7 Conclusion of green logistics

There are several definitions of green logistics. One of them are “green logistics is concerned with producing and distributing goods in a sustainable way, taking account of environmental and social factors.”

Reasons why companies are going green are that it gives a competitive advantage and is required by governments and laws. Being green is also a way for the company to be responsible in their operations. Since logistics are considered to be one of the main causes of the global warming, with the emission of CO₂ that generates from vehicles, aircrafts and vessels. Companies adapt green logistics

systems because they want to reduce congestion, pollution and to save transportation costs.

But there are issues that companies need to deal with in green logistics. There are issues like time or cost. What is more important? Materials, a vendor with lower cost but not as environmental friendly as a vendor with higher costs. The more environmental friendly vendor might also be further away than the low cost vendor, which then can add longer shipping distances. Transportation, freight delays and longer lead times that can come from consolidation of shipments.

Companies deal with a lot of issues concerning green logistics. But the benefits can also be good. Such as a competitive advantage, saving in costs and a better reputation.

5.0 Discussion of reverse and green logistics

So now when reverse logistics and green logistics have been defined and explained. We have now answered the two first research questions. Now it will be dealt with to see what differences they have. After reading about both subjects the researcher would say that they resemble each other in many ways, but the reason behind why companies are doing them are different.

Reverse logistics is about saving money. This is done by reusing materials and selling it further for covering lost profit. Meanwhile green logistics is also about recycling and trying to re-use as much as possible. But green logistics is also about using material friendly options for transportation, being smart when transporting the goods and so on. But green logistics is not all about saving money. It is mostly because of the company's image. Or a conscious decision and a part of the company's profile. Meanwhile reverse logistics is implemented because of saving money and taking back lost profit and getting a competitive edge, it can also be for saving Intellectual property.

In the picture beneath it is shown how the green logistics and goes together with Reverse logistics.

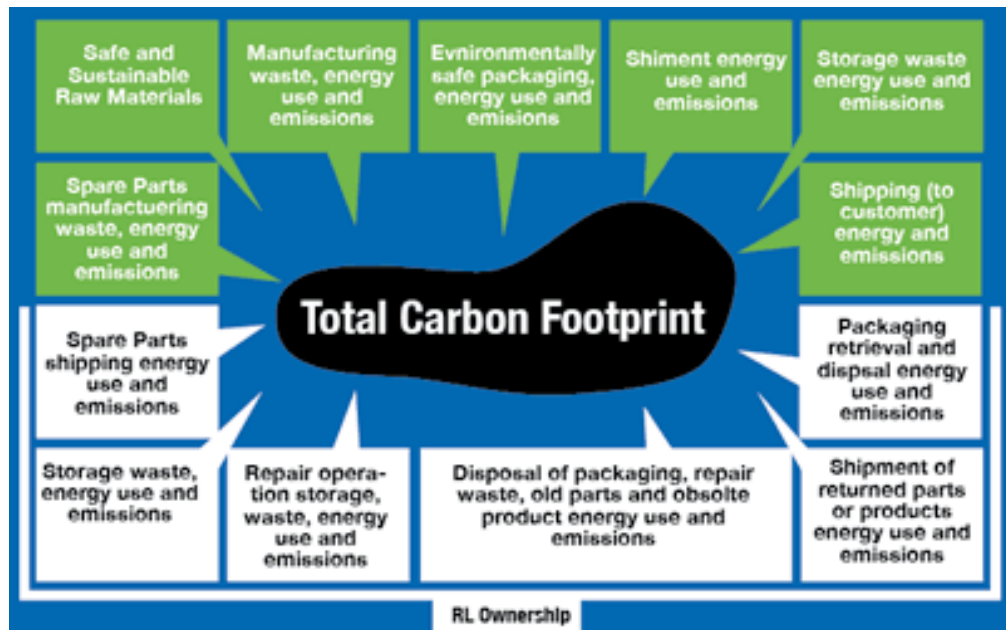


Figure 6, Source: (Steele & Rodrigues 2008, 31)

The white part of this picture belongs to reverse logistics, meanwhile the green part belongs to green logistics. But as shown both reverse and green logistics actions belong to the green perspective.

To demonstrate which fields are connected to each other within reverse logistics and green logistics and what different those from each other the following model will demonstrate this.

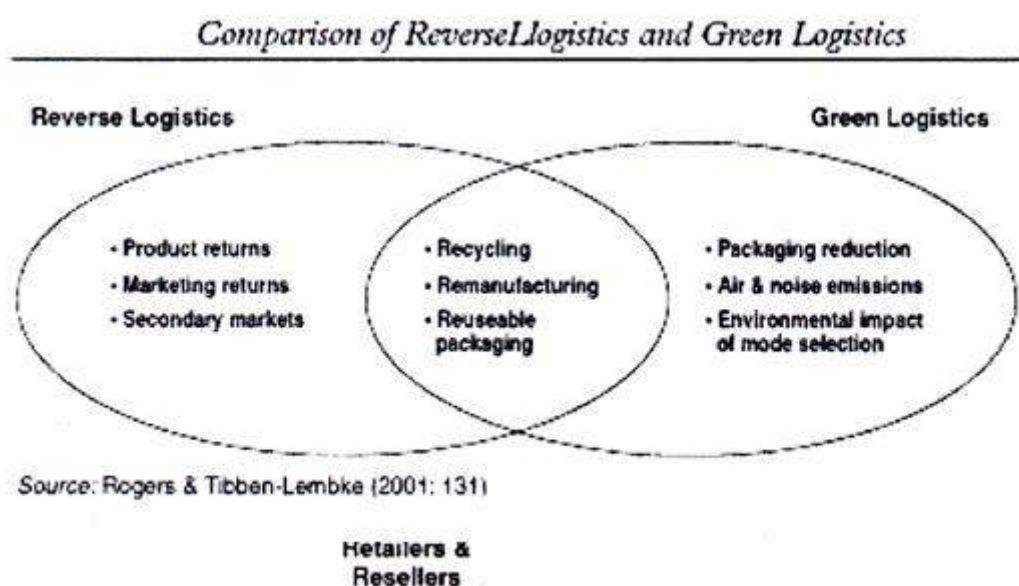


Figure 7, (Rogers, Tibben-Lemke 2001)

Here in this model it is clearly stated what belongs to the Reverse Logistics and what belongs to Green logistics. It also shows what they have in common. To reverse logistics belongs subjects such as product returns, marketing returns and secondary markets. Meanwhile to green logistics it belongs packaging reduction, air and noise emissions and environmental impact of mode selection. The things that they have in common are recycling, remanufacturing and reusable packaging.

With greening it can start right at the source with supply conditions and it can work its way through storage and packaging practices to distribution and to end-consumers. But the reverse flow can take alternative forms, from collection to returned shipments into the distribution channel which then is followed by disassembly and re-use of selected parts. Then used goods can be shredded and scrapped and re-entered into production as raw materials. There might even be a possibility for returned foods or elements of a product to be returned to suppliers and to supply chain partners for them to re-manufacture.

The greening investment can be resource saving, waste eliminating, and productivity improving. So green initiatives can lower the environmental impact of a business, but it can also raise its efficiency. Also there is a possibility to create a major competitive advantage in innovation and operations.

There can be adapted three approaches in environmental management, the reactive, proactive and value seeking approach. In the reactive approach companies commit to a minimal resource to environmental management as they start to procure some products that have some recycled content. They then start to label products that can be recycled and use filters to lower the environmental impact of production. But the filters are an “end of pipeline” initiative used to comply with environmental legislation that do not take away any of the causes of the environmental impact. Meanwhile proactive approach, companies start to preempt new environmental laws by realizing a modest resource commitment to initiate the recycling of products and designing green products. In this kind of approach company assumes responsibility over product re-use and recycling as an

element of environmental management. The third approach is value seeking. The purpose with this approach is that the companies reduce its impact on the environment as a strategic initiative by integrating environmental activities into a business strategy and operating the firms. Operating systems in the value-seeking approach may include redesign of products for dis-assembly, the use of life-cycle analysis and creating an involvement of third parties. In these approaches the third and final phase the company will thrive since environmental management when they act as a whole system which includes customers, suppliers and other players in the supply chain. (van Hoek, 1999)

5.1 Green steps to take

To be able to develop a greening approach there are certain steps to take from reverse logistics to a green supply chain/ green logistics. Firstly they should move away from reactive approaches oriented to complying with regulation to a more far-reaching attempt to seek value, proactively and gain competitiveness. The perspective then changes from greening as a burden to greening as a potential source of competitiveness. This kind of competitiveness could be based on 1. Creating a marketing edge by using greening as a unique selling point with environmentally conscious customers. 2. Leveraging innovation. This can be design for dis-assembly, it can be based on a smart product connectors which are easier to assemble or dis-assemble, lowering assembly lead-times. 3. Cost-saving realized through resource-savings. This is achieved through using less fuel, when lowering trucking miles, emissions will be lowered but there will be also be savings on fuel expenses and the drivers working hours. The actions in a chain has to change from an initial sale to that the entire product usage life-time, this is not only because of the environmental impact during its use but also future reverse flow should be considered. (van Hoek, 1999)

6.0 Theoretical framework for company analysis

After studying the theory the researcher decided to use the centralized structure of a reverse supply chain (model p.23). The reasons why she decided to use this theory is because of that it is a simple model to follow and the companies handle their returns within the company. This model point is that the activities of collection inspecting and sorting are centralized within the organization.

When analyzing the green logistics the researcher choose the theory from green logistics and green logistics systems (p. 36). This theory deals a lot with what managers need to think about and consider in green logistics. And since she was interviewing managers in the researchers' opinion it was a relevant theory to use and would be easy for the interviewees. The questions were limited to the areas of packaging, transportation and warehouse. This is because of that the products itself do not affect these subjects as much as it does on material acquisition. Since depending on the product there might be more options for environmental friendly vendors. For example with fabrics it can be produced in a more environmental friendly way than iron and metal can be.

7.0 Company analysis

In this part the researcher will introduce the companies and also the analysis part will be gone through. The companies in question that are being compared are Wärtsilä Finland Oy and IKEA. Because of the different types of companies the focus within green logistics will be on, packaging, transportation and warehouses. Within Reverse Logistics the whole reverse flow is considered.

The reason for why the Green logistics part is limited is so that it will give a fair comparison between the companies. Since the companies are in different fields it would not give a fair view to compare their material handling. The model for Reverse logistics is taken from the centralized reverse supply chain model meanwhile the questions for green logistics are based on the chapter of green logistics and green supply chains.

The questionnaire is built up in the following way;

The introduction questions within green logistics are; what is the company's view of green logistics, the second question is are there any common goals or models adapted to improve green logistics. These questions I included because of I thought it would be interesting to see if there are any differences between the companies, and also to see how the company sees them and what they are doing to improve green logistics.

The second part is about the packaging. These questions are taken from the part green logistics and green supply chains (p.35). It deals with the issues that logistics managers need to face with in green logistics and supply chains. And since I interviewed managers I thought that it was appropriate to go through the issues that they are facing.

The packaging questions are the following:

1. What kind of packaging material is/are used?
2. Why are these materials used?
3. What are the purposes of the packaging material

- a) Is the packaging used for primary, secondary or shipping packaging?
- 4. Is the packaging material being reused?

I included these questions because of that there are a lot that can be saved both financially and in a green way if packaging is done in a correct manner. There are both environmental friendly packaging and non environmental friendly. Because of the way that the companies pack their goods it might play a huge difference on transportation and warehouse handling. When lighter packaging materials are used it is not as stressful on the transportation method, I other words it does not need to use as much energy (fuel). Also in the warehouses if the packages are easy to handle this can improve the efficiency and does not need as much handling in the warehouses which then leads to less energy consumption. And also the fact if the packaging material is reusable is an important question. Because of that reusable materials are a green option.

The following questions are based on the transportation part. The questions that were included were;

- 1. What transportation method is mostly used?
 - a. Why is this method used
- 2. Does it affect the decision of which shipper is chosen if they are considered to be green?
- 3. When are shipments sent?
- 4. What are the shipping distances
- 5. What is considered to be most important, time or cost?

These questions are included because of that transportation has a huge impact on the green logistics. Because of that there are a various options with shipping, and there are shipping methods that are considered green and less green. For example rail and road are considered to be green options meanwhile air is considered not to be so green. It is also important to know when the shipments are sent, what the filling quotation is. If shipments are sent only half full it is not considered green, the shipments should be sent with a full load so that not so much shipping space goes to waste. The distances also play an part in green logistics. This is because of

if warehouses are placed more closely the shipping distances are shorter, and then options such as rail and truck are easier to use than if the distances are long then air might be a better option. And also if the distances are shorter then there are not as much energy spent on the transportation. The last question that I included I thought would be interesting to get answers to, because usually managers need to choose between one of the options with time and cost. This is one of the issues that managers need to face. Because of the fact that if time is more important the costs usually goes up. And time is often something that you need to sacrifice in green logistics; this is because of that the transportation methods that are considered green are often slower.

The following questions are based on warehouse, warehouse management and handling are important in green logistics. Because of if the warehouse has a good handling and methods then they use less energy and are considered to be green.

1. How are the warehouses positioned?
2. What are the possibilities for recycling in warehouses?
 - a. Can goods, packaging etc. be recycled in the warehouse itself?
3. For how long time of a period are the goods usually stored in the warehouses?
4. Are methods like JIT (Just in time) being used?

With the first question how the warehouses are positioned belongs some to the question in transportation, (how long are the shipping distances). A centralized warehouse with a good layout and system is a good alternative, but when having more smaller warehouses placed it reduces the transportation distances. If there are recycling possibilities in the warehouse there is no need to ship the goods to a recycling provider, which then again saves energy. It also plays an important part for how long the shipments are stored in the warehouse. If shipments are stored for a long time, it is not considered to be green, the less they are stored in the warehouse the greener it is. JIT is a method is considered green. But there are also issues here that managers need to face (read more on p.37).

The following part of the questions deal with the reverse logistics. I have based my questions based on the centralized reverse supply chain model that can be found on p.22. I started with the introduction questions what the companies' view of reverse logistics is, and if there are any common goals or models adapted to improve their reverse logistics. The questions that deal with the model is :

1. What are the most common reasons why products are being returned
 - a. Has it been measured in some way?
2. Where do the returned products go?
3. Is the returned product evaluated at the return?
 - a. Is the product branded with labels so it is easy to notice what problems the product has?
4. Depending on the products problem, what kind of actions are taken?

The first question is based on the first part when the product returns. In order to be able to reduce returns, the company should first find out the most common reason why the products are returning. When this has been discovered the companies are able to reduce the problem before it occurs. It is also important to find out where the products go when they are returned. The following is to evaluate the returned product so that proper actions can be taken. This saves time and helps to get back the lost value. If the products are labeled after the evaluation it is easier to get them to the correct space. This is so that products that are supposed to go back to the shelves, not go for scrapping by mistake. And also it makes it easier the handling process if it is labeled clearly where it should go. The next step is where the lost value can be recovered. Depending on the situation with the product they can go to refurbishing, re-stock, parts recover or for scrapping.

8.0 Wärtsilä

In complete lifecycle power solutions for the marine and energy markets Wärtsilä is a global leader. They are emphasizing technological innovations and total efficiency. Wärtsilä tries to make the most out of the environmental and economic performance of the vessels and power plants of their customers.

Wärtsilä can be categorized into three different categories, Ship power, Power Plants and Services. Within Ship power they sell products for ship engines, and also whole engines. They seek organic growth that will be supported by acquisitions and partnerships. That growth will be achieved by expanding sales to ship owners and operators based on integrated lifecycle solutions where performance and availability are guaranteed.

Within power plants the products are for power plants, examples are gas power plants and floating power plants. Their strategic goal is to “grow large gas power plant markets for utilities by influencing and actively developing selected target markets.” (Wärtsilä homepage) Their goal is to keep their leading position in heavy fuel oil fired power plants.

Within services they sell spare parts for both power plants and ship power. The objective within the service part is to maximize their market share in the marine and power plant service markets. They will develop their services by offering and delivery processing to cost efficiently provide a better value for their customers.

Their environmental target is to supply power solutions that can offer a high efficiency with a low environmental impact. And their objective is to keep on improving the environmental performance of their services and products.

In their code of conduct this statement of the environment can be found: “Wärtsilä's target is to develop and produce for its customers environmentally advanced solutions and services that fulfill essential requirements, such as low emissions and high efficiency. Efforts are made to achieve sustainable

development by means of raw material selection, processes, products, wastes, and emissions through the use of the latest technical advances.” (Wärtsiläs homepage)

8.1 Green logistics

The first company I will go through is Wärtsilä Finland Oy, and the focus is on the service part. The overall focus in this part is on the customers need. The service part of Wärtsilä Finland Oy provides spare parts for both their ship power side and also the power plant side. Usually Time is of essence in the service side. Since time is important, a green alternative might not always be the customers focus. But whenever Green is possible it is taken advantage of.

Packaging materials that are used are wood, cartoon, plastic and veneer. Some other packaging types are also pallets and containers and these ones are re-used. There is also an existing agreement with one supplier that they take back their own packaging material.

The reason why the packaging materials are used is for practical reasons and shipping, since the goods need to be protected from moist. Veneer is the most common packaging material since it is the lightest and most protective. Whenever possible the packaging materials are reused. For example on the inbound side returns are sent in the original packaging in which it was sent when shipped. As mentioned earlier pallets and containers are reused.

The most common shipping method is courier. This is because of the packages size and it is fast and cheaper. They also consider, whenever possible if the shipper is considered green or not.

A method that is used very often is consolidation of shipments. They have adopted a software program that makes consolidations easy and possible. Because of this no shipments are sent alone. This method of consolidation of shipments is considered of high importance.

They have a centralized warehouse in Europe and the shipping distances are often long. But because of the position of the warehouse truck shipments are possible. They also have a smaller warehouse in Vaasa, Finland. The reason for having a centralized warehouse is so that shipments can be sent through truck, shorter distances from suppliers to the warehouse, central storage space saves costs, shorter lead times, lower transportation costs and centralized service. The recycling is done outside of the warehouse. They gather the materials that are going for recycling and the recycling provider picks it up and handles the recycling. Methods that are used within the warehouse is JIT (just in time) and also direct shipments from vendor to customer.

The time period for how long time the goods are stored in the warehouses can be for 30 years, 1 month, 1 week or one day. This is because of the policy that Wärtsilä has. During the machines life time there will be spare parts available for it.

When facing the issue between time and cost, this is up to the customer to choose.

8.2 Reverse Logistics

Within the reverse logistics the goods are returned to the place where they originated. They are also measuring the reasons for why the products are returned. The returned products go to a examination laboratory so that they can find out exactly what caused the error in the product. One of the major reasons are because of that wrong products have been shipped.

At this moment they are trying to improve their global reverse logistics, so that it will be more efficient and cost saving.

The products are always returned if there is something wrong. This is so that their IP (intellectual property) is protected, reputation and because of recyclability. Even though the return might be expensive they are taken back.

When the returns arrive they are evaluated for what actions should be taken. Some of these actions are

- Re-selling (putting back to inventory)
- Reparation
- Re-cycling

But depending on the situation, if the wrong product has been sent, it goes for checking and are then re-sold. But if products are faulty they go also for checking but are always scrapped.

To make the evaluation process easier they include a return form in the shipment for the customer to fill in if a return occurs. They have clearly stated how different returns should be handled in each case.

9.0 IKEA

IKEA is a global furniture store that provides “cheap furniture that as many as possible can afford”. Their vision is to create a better everyday life for the many people. The product range is the core of the IKEA business. It is developed to inspire and to provide solutions to everyday home furnishing needs. When they develop products their starting point is the idea that even with a thin wallet, people should be able to create a beautiful home with well designed functional, safe and healthy products.

IKEA also tries to achieve more social responsibility towards their customers, co-workers, suppliers and the people who work for them, as well as towards the entire community. During the last 10-15 years they have together with partners such as WWF, UNICEF and save the children, developed a broad environmental and social program. Sustainability is an integrated part of their business, as their overall direction. (IKEA homepage)

9.1 Green logistics

Ikeas company view of green logistics is firstly to remove the wooden pallets from the entire supply chain. Instead of wooden pallets they are using Paper/cardboard pallets and so called ledges. Underneath these ledges there are a plastic leg underneath the goods. Because of this approach they are dramatically decreasing transportation, Co2 emissions, PP/LL can be packed with less space than with normal wooden pallets. Also IKEAs Iway monitoring system steer transport partners to use low Co2 equipments. The Iway monitoring system is IKEAS own measuring system. They have conducted standards that are applied to all of their partners. This is so that a standard can be maintained for all of their partners. The partners need to fulfill the standards, and once they are a partner there will be check-ups to control if the standards are met. In the Iway standard there is an own section for environmental requirements that must be fulfilled. The goals for IKEA within green logistics are as the following:

- 2012 60% total flow integrated to non wooden pallets
- 2014 100% of total flow integrated to non wooden pallets
- 2015 all transport partners are fulfilling the Iway standards.

The packaging materials that are being used is mainly cartoon/carboard, up to 99 %. Reasons for why this is being used is because of the fact that is the greenest alternative so it is recyclable. Factors that also affect it is the price of the material and it is easy to use. When asked what the purpose of the packaging is it is two levels of packaging, shipping and primary packaging. Most of the shipping package can be used with selling purposes also or seen as primary packaging. And the paper pallets construct the so called loading unit. materials such as wooden pallets and loading ledges are reused. The rest of the material is recycled through a local country level.

Within the transportation mostly land transportation such as trucks are being used. The reason why this method is used is because of the distance, the speed, price and the accuracy. Because of the Iway standard it is considered when choosing shippers if they are considered green, they have to fulfill the set standards. In order to prevent shipments to be sent with low filling rate IKEA has adapted a filling rate goal for each transportation method. For land transportation they have a 65 % filling rate. If the goal is not reached the shipment will be postponed until the FL is fulfilled. Other methods being used are co-loading, consolidation and part loads between the units. IKEA Finland receives most of their shipments from IKEA Sweden (50 %). After Sweden comes IKEA Poland (35%), and then IKEA Denmark (10 %) and the least goods come from the Far East (5%).

For IKEA the priority order is cost, accuracy and time.

IKEA Finland uses two central warehouses that are located in Sweden and in Denmark. But also each store has their own “warehouse”. Within the warehouses the central ones recycle their own waste but within the warehouses located in stores it is mostly recycled through recycling providers. The warehouse rotation is 5,5 weeks. IKEAs order system is partly based on JIT.

9.2 Reverse logistics

IKEA's company view of Reverse logistics is that it is mainly used for customer service reasons and the return flow. This can for example be quality returns to suppliers. To be able to handle the returns IKEA has set a goal that customer deliveries should reach the customer in time and without any damages. The most common reason why the products are being returned is because of transport damage, or change of mind. The customer might have changed his/her mind about the purchase. It is measured why the products are returned. When the product is returned it is also evaluated so that it can be forwarded in a correct way. The returned product, depending on the case or product, can go back to sales, sold in as is corner at a reduced price or it can be scrapped.

10.0 Comparison

In the following table the differences and similarities will clearly be shown and later on they will be explained.

Table 2, Comparison of Wärtsilä and IKEA

	Wärtsilä	IKEA
Green logistics view	strive to reduce the adverse environmental impacts of their operations and products	A clear view for the company
Green logistics goals	As above	Clear set goals with time frame
Packaging materials	Wood, cartoon, veneer, plastic, pallets, containers	Cartoon/cardboard
Reasons for packing material	Practical, lightest	Greenest, cheapest, easy to use
Purpose of material	Shipping	Primary and shipping
Recycling of	Pallets, containers are reused,	Pallets and loading ledges

packaging material	other recycled	reused, other recycled
Transportation methods	Courier	Truck
Reasons for transportation method	Quick and cheap	Distance, speed, price, accuracy
Are green shippers and issue	When ever possible it is considered	Needs to fulfill Iway standard
When are shipments sent?	Shipments are consolidated so shipments are never sent alone	Needs to fulfill a filling rate of 65% before shipped, co-loading, consolidation and part loads.
Shipping distances	Long distances on outbound side	Distances from SE, PL, and DE
Time or cost?	Customers choice	Cost, Accuracy, Time
Warehouse positions	One centralized in Europe	Central warehouses in SE and DE, every store has their own warehouse
Recyclability in warehouses	Recycling providers handles recycling.	Central warehouses recycle own waste, store warehouses gets recycling from recycling providers
How long are goods stored in warehouses	Depending on which part, can be 30 years, 1 month, 1 week or 1 day	5,5 weeks
Warehouse methods like JIT ?	JIT and supplier-customer also used	Partly JIT is used.
Companys view of Reverse logistics	Important.	Mainly in the customer service
Common goals or models to improve?	At this moment working on improving their reverse flow	95% of the deliveries should reach the customers without

		any damages
Most common reason for reasons of the returns	Wrong parts have been sent, wrong part ordered	Transport damage or change of mind from the customer.
Has it been measured reasons for returns	The reasons for returns are measured thoroughly	Reasons are measured
Where do returned products go?	Quality checks	Depending on the case/product
Are products evaluated what is wrong	At the return customers can fill in their own note what is faulty with the product, this is then checked	Yes
Is the product branded with a label when it goes for further handling	When returned no, only note for customer to fill in	No
What actions are taken with the faulty product	Returned back to inventory/sales, need for part, scrapped	Returned back to sales, sold in as corner with lowered price, scrapped

10.1 Differences

The difference between these companies is that IKEA has set up clear goals with a time frame. Wärtsilä has not any clear goals with a time frame, but they are trying to be green in every action they take. The following difference is with the type of transportation method that is used. Wärtsilä uses courier, which usually goes with flight depending on the priority of the shipment, but IKEA uses truck as shipping method. IKEA also puts more emphasis on if the shipper is considered Green, since the shippers need to fulfill the Iway standard. The following difference is that Wärtsilä consolidates shipments, and has adapted a software program for this, while IKEA has put a filling rate standard that needs to be met. Ikea also has

shorter shipping distances, since most of the goods come from nearby countries, whereas Wärtsilä has a centralized warehouse in Europe that sends out shipments globally. In IKEA the central warehouses handle the recycling and in the stores warehouses recycling providers are handling the recycling. In Wärtsilä recycling providers are handling the recycling. The rotation in the warehouses differentiate a little. Since Wärtsilä has a policy for their spare parts, they are stored longer than IKEA which has a rotation of 5,5 weeks. One can notice that the methods that are used in the warehouses differentiate some also, Wärtsilä uses JIT and also vendor to customer methods, and IKEA has partly uses JIT.

Regarding reverse logistics it is considered as important within Wärtsilä and it is mostly in customer returns within IKEA. The following difference within reverse logistics is the reason why the return happens. Wärtsilä has mostly returns because wrong goods have been shipped or that the wrong parts have been ordered. Meanwhile IKEA has the issue with transport damages or that the customer has changed his/her mind about the product. There is also a difference when the products are returned. Wärtsilä sends the products for quality checks so it can be determined what is wrong with the product. IKEA takes actions depending on the situation.

10.2 Similarities

The similarities with the companies within Green logistics are the following. Both companies have a view of green logistics and goals. The packaging materials are similar, they use the same material cartoon, but Wärtsilä uses other materials also. There are also similarities with why they use the materials, it is because that they are easy to use and practical. The materials are used for shipping purposes. IKEA also uses the materials for primary packaging. In the transportation the methods are chosen for the same reasons, that they are quick and the cheapest. But here it should be considered that different shipment methods are used.

In reverse logistics there are similarities with the models and adaption of models. Both of the companies have adapted models. Wärtsilä is at this moment trying to improve their reverse logistics. So both companies have taken measures in this

case. They are also measuring the reasons for why the returns are occurring. The products are also evaluated when returned to check what is wrong with them. The actions that are taken with the faulty products are also similar. Both companies try to return the products back to sales in one way or another or they are scrapped.

10.3 Conclusion

Within the green logistics both Wärtsilä and IKEA have taken steps to improve their green logistics. But Wärtsilä has the paradoxal issue with Time. Within their field time is often essential essence. Then it is hard to consider the green part, because they sometimes need to deliver the goods as soon as possible, and then the green transportation methods such as truck and train might not be an option. In these cases the fastest transportation method must to be used, which is often air freight. This is considered to be one of the least green options.

In the research and the comparison, can be noticed that they have more differences than similarities, a reason for this might be of the fact that they are in different product fields, and also that they are in different business fields. The part of Wärtsilä that the research was conducted in has more of a pressure from customers and sometimes need to take the customers needs more in consideration. Since IKEA is a retailing business they have more options, since they plan their deliveries. Wärtsilä can have a shipment that needs to reach its destination as soon as possible.

From the interviews it can still be noticed that both companies are taking reverse and green logistics seriously and have taken actions to improve and adapt methods.

Based on the interview Wärtsilä has put more of an emphasis on the reverse logistics part, and are trying to improve and make it easier globally. IKEA on the other hand has more of a focus on Green logistics, this is most likely because of the fact that they are able to. Since IKEA receives the major part of the return because of change of minds, this is an issue that they themselves can not affect.

Wärtsilä can then again try to improve the return flow, since a part of their returns are because the wrong products have been sent.

10.3.1 Packaging

IKEA is using cartoon/cardboard as its packaging material since these packaging materials are environmental friendly. They can be reused and recycled easily. Cartoon/cardboard is also a light packaging material. Consequently it does not put any extra weight on the transport, and this leads to the fact that the congestion that comes from this transport is also less. Referring to Engel (2008) who set up six tips that should be used within green logistics, companies should use lighter packaging and biodegradable packaging. Wärtsilä uses a wide range of packaging materials. These packaging materials can be considered green, since the pallets and containers are being reused. The issue with Wärtsilä why they need to use less environmental friendly packaging materials is probably because the products need more protection. Since the products that are shipped can be made of steel and iron, they cannot get any moist on them during the shipping. Moisture might damage the product and would then result in a return. This statement can be supported then by the reasons why the packaging material is used. Wärtsilä uses these packaging materials because they are practical. Whereas IKEA uses them because they are the greenest cheapest and most easy to use. The reason for which a packaging material is used can back it up, since Wärtsilä uses its packaging material for shipping, whereas IKEA uses their for primary and shipping. Consequently Wärtsilä has more focus on the shipping packaging or, the only focus is on the shipping packaging. IKEA could use containers etc. for their shipping, but since they are using the shipping packaging as primary packaging also it needs to be both protective and practical.

10.3.2 Transportation

Regarding the transportation methods IKEA uses truck, which is seen as an environmental friendly shipment method. Wärtsilä on the other hand uses Courier shipments, which usually goes by flight. They can also go with other options

depending on the priority of the shipment. A Courier can be seen as an environmental friendly way when consolidation of shipments is also used. In other words, they are sent together with other shipments. This is something that Wärtsilä also does. Wärtsilä uses this shipment method because it is quick and cheap. They are not using this transportation method from a green perspective. Here one can notice that the customers' need is in focus. IKEA use their shipment method because of the distance, speed, price and accuracy, the reason distance can be considered green. Since the shipping distances are from Sweden, Poland and Denmark they are quite long distances. Using truck because of the distance is a green method. Green shippers are considered whenever possible for Wärtsilä. Since it is a service field it is not always an option for them to consider the shipper. Also a fact that needs to be considered is that they are using a software program that is choosing the shipper for them. IKEA has adapted the Iway standard that shippers need to fulfill. This is clearly a green method when they have set their own standards that they consider important. Both companies have set standards or methods for when the shipments are sent. Wärtsilä is using consolidation of shipments, which is a green method, referring to to Wu, Haw-Jan, Dunn and Steven (1995) consolidation of shipments improves the vehicle efficiency and it is regarded as environmentally responsible. IKEA has set a filling rate of 65%. These both methods are green in their own ways. Because of the consolidation of shipments, shipments are consolidated from other shippers, and also with their own shipments. By setting a filling rate is prevented that shipments will not be sent alone. Another good thing with a filling standard is that since 65% needs to be filled, the shipping space is taken advantage of, which is also considered green. Also Dr. Jean-Paul –rodrigue, Dr. Brian Slack and Dr claudie Comtois (2009) state that delaying shipments until a sufficient load factor is reached is considered to be an environmentally friendly principle. Both Wärtsilä and IKEA has long shipping distances. IKEA also have short shipping distances. This is when one considers that these are international companies that could have shipping distances from the other side of the world. The question that managers need to choose between with transportation and green logistics is what is more important, time or cost. Because within green logistics it is hard to get both of

them. If they focus on shorter lead times, which usually includes non-green shipping methods the costs go up. If the focus is on cost then slower shipment methods are usually used, these are also shipment methods that are considered green, such as truck and rail. With Wärtsilä it is the customer's choice here again one can notice that there is a difference when it comes to a service part of a company. The customers' need is more in focus. For IKEA cost is most important then accuracy and then time. So when looking at this, it is most important that the costs are low, this means that the company can focus on less expensive shipping options such as truck. Then comes accuracy. With this means that the transporter need to deliver at the time stated. Then comes time as the least important of these three factors.

10.3.3 Warehouse

Regarding the warehouses Wärtsilä has one centralized warehouse in Europe. This is a green option. Since having one centralized warehouse uses less energy than several small ones. The negative part is that the shipping distances become longer. But options such as truck and rail are available to be used because of its location. IKEA has central warehouses in Sweden and Denmark, and also they have "warehouses" in every shop. Since they have stores all over the world warehouses are an essential part of the business. The shops have their own warehouses, which can be considered green in one way. Since it is a self service pick up warehouse it uses less energy, not as much personnel needed etc. But it is also negative in that sense that it uses energy to keep it running. But also it would be hard to not have these kind of warehouses in the shop. Because the issue then arises where the pickup of the goods would be. Wärtsilä has recycling providers that handles the recycling waste, whereas IKEA is handling their own recycling in the central warehouses and the store warehouses use recycling providers. By recycling in the warehouses less energy is used, because of that there is no need for shipping of the waste between the warehouse and the recycling facility. This is a green method. When it comes to the time that warehouses have their goods stored, a shorter time is preferred. This is because of that it uses less energy to store. Since Wärtsilä can have goods stored for a long period of time this is not

seen as environmental friendly. The reason behind it is their policy that spare parts will be available for the machines during their whole lifetime. IKEA then has relatively a short time the goods stored in the warehouse. Since they are a retailing business, the goods go out of “fashion” and redesigns are made. So they are able to plan and ship the within a short time. The methods that are used in the warehouses are within Wärtsilä JIT and direct shipments from supplier to customer. These are methods that are considered green, since they do not usually have to be dropped of at the warehouse and be processed there. This saves energy. IKEA uses partly JIT. According to Wu, Haw-Jan, Dunn and Steven (1995) there can be savings made regarding to warehouse layouts. By reusing packaging materials, costs can be reduced. They also mention that freight consolidations have the potentiality of utilizing transport capacity more efficiently, they also bring up the subject about cross-docking, which is when the goods are not stored in warehouses but are moved from manufacturers or distributors to wholesalers and retailers. According to them this is an environmentally responsible action since the movement within the warehouse is reduced.

10.3.4 Reverse logistics

By knowing why the shipments are returned returns can be prevented. That is why it is important to measure the return reasons. For example in Wärtsilä, the most common reason that the products have been returned is because the wrong products have been sent. When they have this information they can prevent it by improving the awareness when the products are packed. For IKEA it is the transport damage and change of mind of customers. That customers change their minds is something that they can not affect. But the transport damage can be prevented with more careful handling of the products. Since they are trying to keep the packaging material green with cartoon, and easy to handle the packaging material would probably not be an option to change. So by increasing the awareness with the transportation handling might improve this. Both companies are measuring this, and they have realized the importance of it in the return flow. At Wärtsilä the returned products go for quality checks which is following the centralized return system model. IKEA it depends on the case or product where

the product goes. When the products are returned they are evaluated, which one this is in accordance with the model of a centralized return system model. When products are evaluated they are redistributed to back to sales or scrapped. Both IKEA and Wärtsilä use back to sales and scrapping. For both companies this part is also matching with the model. Consequently one could draw the conclusion that the companies are using a centralized structure of a reverse supply chain.

11.0 Conclusion

When the thesis started to take shape, there were some obstacles. It was not so easy to find companies that were willing to participate. Some of them did not think that they had enough material, that they were not developed enough in the subjects etc. The aim of the thesis has changed over the time. So when the researcher think about the difficulties there were, in their opinion they were able to do a good research about interesting and different companies about subjects that are relevant in the world of today.

Some of the information that the researcher obtained from interviews has also been supported with information from the companies own WebPages. This is because the researcher wanted more information after having conducted the interviews, and also the researcher wanted to see that they were able to find the information from the company in a public way. An example of this is the Iway system that IKEA has, another example is the Green view that Wärtsilä have.

Recommendation for further studies could be to draw up a model for the return flow for these companies, so that would be clearly stated who is responsible for what part of the return flow. By drawing up this model, they are able to follow it precisely, and also inform the personnel involved in the return flow how it should be handled. When the persons involved know their part, it is easier for them to do a good and correct job. Further studies could also be conducted on how Green logistics can be implemented in the Reverse flow. This regarding the packaging of the returned products, warehouse management and transportation of returned items. Within the green logistics suggestions would be for Wärtsilä to explore the options of other shipment types than courier. Since the warehouse is placed centrally in Europe there are possibilities to utilize shipment methods such as truck and rail and even sea. This is of course something that can be considered when the option is available, when it is not regarding shipments that need fast deliveries. Further studies could also be done on issues and difficulties that managers are facing within reverse and/or green logistics. Since these subjects are

difficult and have paradoxes that needs to be considered in the decision making process.

The final words go to the interviewees that spared me the time so I could interview them for this research. I also conducted a brief interview with a person responsible at the warehouse in Wärtsilä, but he wanted to stay anonymous.

Outi Panu, Transportation manager, Wärtsilä Finland Oy, Services

Personal interview conducted on Tuesday 24.4.2012, Vaasa, Finland

Janne Joki, Retail logistics Manager, IKEA FI

Phone interview conducted on Friday 27.4.2012, Vaasa, Finland.

12.0 References

Waters D. 2007, Global Logistics - New directions in Supply chain Management, 5th edition, Kogan Page publishers

Dr. Jean Paul Rodrigue, Dr Brian Slack & Dr Claude Comtois, 2009, The Geography of transport systems, Routledge,

The chartered institute of Logistics and transport, 2008

<http://www.ciltuk.org.uk/pages/home>

Dr Ashok S. 2009, Supply chain management, collaboration, planning, execution and co-ordination, Global India Publications PVT LTD, New Delhi

Mir Saman P. Kamran K. Behrooz K. 2009, Reverse logistics network design using simulated annealing, Springer-Verlag London Limited

Dowlatshahi S. 2000, Developing a theory of reverse logistics, Interfaces 30: 3 May-June 2000 p 143-155

Hawks K, 2006, What is reverse logistics, Reverse logistics magazine

<http://www.rlmagazine.com/edition01p12.php>>

Skjøtt –Larsen T, Schary P, Mikkola J, Kotzab H, 2007, Managing the global supply chain, Liber

Steel K. & Rodrigues E, 2008, Reverse Logistics- turning green to gold

<http://www.rlmagazine.com/edition12p28.php>

Rodrigue J, Slack B, Comtois C, 2001, The paradoxes of Green logistics, The handbook of Logistics and Supply-chain management, London, Pergamon/Elsevier

Greve. C ,2011, Outsourcing Reverse Logistics,

<http://grevedavis.com/2011/03/28/outsourcing-reverse-logistics/>

Dr Rogers D, Dr Tibben-Lembke, 1998, Going backwards: Reverse Logistics Trends and Practices, Reverse Logistics Executive Council, Nevada

Rupnow P, 2011, 7 steps to successful Reverse logistics operations,

<http://www.logisticsdigest.com/inter-article/inter-logistics-insight/item/6611-7-steps-to-successful-reverse-logistics-operations.html>

Barry C, 2003, How to develop a reverse logistics strategy, Success Magazines,

<http://www.fcaco.com/Portals/163466/docs/Reverse-Logistics-Strategies.pdf>

Sbihi A. Eglese R, 2007, Combinatorial Optimization and Green Logistics, Springer-verlag

Shrivastava P, 1996, Greening Business, profiting the corporation and the environment, Thomson Executive Press, Cincinnati Ohio

Haw-Jan Wu, Steven C. Dunn S, (1995) "Environmentally responsible logistics systems", International Journal of Physical Distribution & Logistics Management, Vol. 25 Iss: 2, pp.20 – 38

Zhang Y, Liu J, The establishment of green logistics system model

Engel R, 2008, Going Green with Reverse logistics, EE times,

<http://www.eetimes.com/design/smart-energy-design/4013545/Going-green-with-reverse-logistics?pageNumber=0>

Wu, Haw-Jan, Dunn, Steven C, 1995, International Journal of physical distribution & Logistics management 25.2

Rogers s, Tibben-Lembke R, 2001, An examination of reverse logistics practices, Journal of business logistics Vol.22 No 2, 129-146

Van Hoek R, 1999, From Reversed Logistics to green supply chains, supply chain management 4. 3

James Neil. 2007, Qualitative versus quantitative research: key points in a classic debate,

<http://wilderdom.com/research/QualitativeVersusQuantitativeResearch.html>

Michaela Mora Quantitative Vs. Qualitative research- when to use which, 2010

<http://www.surveygizmo.com/survey-blog/quantitative-qualitative-research/>

Joppe, M. (2000). The Research Process.

<http://www.htm.uoguelph.ca/MJResearch/ResearchProcess/home.html>

Factor, R (1996) Logistics trends, Materials Management and Distribution, June, pp 17–21

www.wartsila.com

www.ikea.fi

APPENDIX 1

Interview Questions used in interviews

Green logistics

1. What is the company's view of green logistics?
2. Are there any common goals or models adapted to improve green logistics?

Packaging

1. What kind of packaging material is/are used? Ex. Cartoon, plastic etc.
2. Why are these materials used? Ex. Cheapest, practical, greenest.
3. What are the purposes of the packing material?
 - a. Is the packaging used for primary, secondary or shipping packaging?
4. Is the packaging material being reused? Ex. Return of packaging materials, pallets are being reused etc.

Transport

1. What transportation method is mostly used?
 - a. Why is this method used?
2. Does it affect the decision of which shipper is chosen if they are considered to be green?
3. When are shipments sent? Ex. Are shipments sent even though they do not fill up a shipment? Consolidation of shipments?
4. What are the shipping distances? Is there a long distance between warehouses and to customers/retailers
5. What is considered to be most important, time or cost?

Warehouse

1. How are the warehouses positioned? Ex. Several smaller warehouses, One centralized warehouse.
2. What are the possibilities for recycling in warehouses?
 - a. Can goods, packaging etc. be recycled in the warehouse itself, or does it need to be sent to a recycling provider?
3. For how long time of period are the goods usually stored in the warehouses?
4. Are methods like JIT (Just In Time) being used?

Reverse Logistics

1. What is the company's view of reverse logistics?
2. Are there any common goals or models adapted to improve Reverse logistics?
3. What are the most common reasons why products are being returned?
 - a. Has it been measured in some way ?
4. Where does the returned product go? Ex. Warehouses, recycling facilities.

5. Is the returned product evaluated at the return? i.e. what is faulty with the product so it then gets distributed forward in a correct way.
 - a. Is the product branded with labels so it is easy to notice what problems the product has?
6. Depending on the products problem (i.e. broken, guarantee, wrong product) what kind of actions are taken? i.e. does it go to recycling, reparation or back to the warehouse to be sold again.