Developing green innovations within 4PLs:
Pursuing green logistics

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Philip Stenbrink Gommel and Peter Westerberg
Abstract

Problem – Logistics services worldwide are not considered to be environmental sustainable because of their high emissions of greenhouse gasses (GHG) as well as its air, soil and water pollution. Since fourth party logistics providers (4PLs) manage the entire supply chain they can reduce their harmful environmental impact on a large scale through green logistics innovation. There are however difficulties for 4PLs to innovate in green logistics.

Purpose – This paper investigates how 4PLs generate and manage green logistics innovation. It also explores what drivers and barriers there are for developing green logistics innovation.

Method – This paper is based on a single case study that uses CIMO logic in the theoretical framework to thoroughly explore and clarify the area of green logistic innovation among 4PLs. Semi structured interviews and a questionnaire were constructed as the main source for gathering empirical evidence.

Results – The case company provided evidence for how 4PLs innovate by being close to their suppliers and customers and finding new opportunities for green logistics innovation. Drivers and barriers are also identified for green logistics innovation.

Conclusions – The study shows how 4PLs can manage and generate innovations as well as create their own playing field by developing competence for new areas of business, enlarging the boundaries for 4PLs to innovate in. The study also shows the importance of considering the goods as a factor in green logistics (particularly reverse logistics).

Keywords – green innovation; green logistics; innovation; sustainability; LSPs; 4PL; logistics service providers.
# Table of contents

1. Introduction ................................................................................................................... 1
   1.1. Purpose ..................................................................................................................... 3
       1.1.1. Research questions ............................................................................................. 3
       1.1.2. Structure of the paper .......................................................................................... 3
2. Methodology ..................................................................................................................... 5
   2.1. Qualitative research ................................................................................................. 5
   2.2. Literature review ....................................................................................................... 5
       2.2.1. CIMO ................................................................................................................... 6
   2.3. Case study ................................................................................................................ 7
       2.3.1. Criteria in case company selection ...................................................................... 8
       2.3.2. Interviews and questionnaire ............................................................................. 9
   2.4. Research quality ....................................................................................................... 12
       2.4.1. Construct validity ............................................................................................... 13
       2.4.2. Internal validity .................................................................................................. 14
       2.4.3. External validity and generalizability ................................................................ 15
       2.4.4. Reliability ......................................................................................................... 15
   2.5. Limitations .............................................................................................................. 16
   2.6. Ethical and societal aspects .................................................................................... 17
3. Theoretical Framework ...................................................................................................... 17
   3.1. Systematic literature review approach .................................................................... 18
   3.2. 4PL and the environment ....................................................................................... 19
   3.3. Green logistics within 4PLs .................................................................................... 23
       3.3.1. Green logistics defined ....................................................................................... 25
       3.3.2. Green logistics and its sectors ............................................................................ 26
3.3.3. Drivers and barriers for green logistics ................................................................. 27

3.4. Green innovation within 4PLs .............................................................................. 30

3.4.1. Defining innovation ......................................................................................... 30

3.4.2. Managing innovation ....................................................................................... 30

3.4.3. Service innovation ............................................................................................ 33

3.4.4. 4PLs and innovation ......................................................................................... 35

3.4.5. Green innovation ............................................................................................... 38

3.5. A framework ........................................................................................................ 39

4. Results ....................................................................................................................... 40

4.1. Innovation audit tool .......................................................................................... 40

4.2. Case Company - F.H. Bertling AB .................................................................... 41

4.2.1. Bertling Enviro ................................................................................................ 42

4.2.2. Linkages .......................................................................................................... 44

4.2.3. Generate, select and implement ..................................................................... 45

4.2.4. Leadership ....................................................................................................... 47

4.2.5. Innovative Organization .................................................................................. 47

4.3. Drivers and barriers for innovating green logistics ........................................... 48

4.3.1. Identified drivers ............................................................................................. 48

4.3.2. Identified barriers ............................................................................................ 49

5. Analysis .................................................................................................................... 51

5.1. Generating and managing green logistics innovation ........................................ 51

5.1.1. Is Bertling Enviro’s business a green logistics innovation? .............................. 54

5.2. Drivers for developing green logistics innovation .............................................. 56

5.2.1. Financial drivers ............................................................................................ 57

5.2.2. Performance .................................................................................................... 57

5.2.3. Image ............................................................................................................... 58

5.2.4. Customers and competitors .......................................................................... 59
5.2.5. Regulation compliance ................................................................. 59

5.3. Barriers for developing green logistics innovation ................................. 60
  5.3.1. Costs ......................................................................................... 60
  5.3.2. Performance ........................................................................... 60
  5.3.3. Image ..................................................................................... 61
  5.3.4. Customers and competitors ....................................................... 61
  5.3.5. Regulation compliance .............................................................. 62

6. Conclusion .......................................................................................... 64
  6.1. How 4PLs generate and manage green logistics innovation ................. 64
  6.2. The drivers for developing green logistics innovation for 4PLs ............. 65
  6.3. The barriers for developing green logistics innovation for 4PLs .......... 65
  6.4. Research implications ..................................................................... 66
    6.4.1. Theoretical contributions ......................................................... 66
    6.4.2. Practical implications ............................................................... 67
  6.5. Study limitations ........................................................................... 68
  6.6. Further research ............................................................................ 68
List of tables

Table 1. Interview participants and order.................................................................10
Table 2. Characteristics and limitations for different transport modes. Acquired from
“Centralised distribution systems and the environment: how increased transport work can
decrease the environmental impact of logistics”, by Kohn and Brodin (2008). .................23
Table 3. The drivers and barriers for green logistics....................................................29
Table 4. Classification of new services. Adapted from “New service development: areas for
exploitation and exploration”, by Menor, Tatikonda and Sampson (2002). .........................34
Table 5. Five dimensions of innovation at F.H. Bertling AB. .......................................40
Table 6. The drivers for innovating green logistic for 4PLs. .........................................65
Table 7. The barriers for innovating green logistic for 4PLs. ........................................66
List of figures

Figure 1. Innovation audit tool. Acquired from “Managing innovation”, by Tidd, Bessant and Pavitt (2005)................................................................. 11
Figure 2. The methodology framework............................................................................................................. 12
Figure 3. Types of logistics parties. Acquired from “5-Logistics Parties”, by Seyed-Alagheband (2011)............................................................................................................. 19
Figure 4. Waste Management Hierarchy. Acquired from “Sustainability and the waste management hierarchy”, by Gertsakis and Lewis (2003).................................................................................. 21
Figure 5. Major Potential Environmental Impacts of Transportation Activities. Acquired from “Multimodal transportation, logistics, and the environment: managing interactions in a global economy”, by Rondinelli and Berry (2000)............................................................................................................. 22
Figure 6. The analytical framework of green logistics. Acquired from “Green logistics: Improving the environmental sustainability of logistics”, by McKinnon, Browne, Whiteing and Piecyk (2015)............................................................................................................. 25
Figure 7. The common three-ring sector of sustainable development and also serves as the sectors of green logistics. Adapted from “Environment, economy and society: fitting them together into sustainable development”, by Giddings, Hopwood and O’Brien (2002)............................................................................................................. 27
Figure 8. The simplified model for managing innovation. Acquired from “Innovation and Entrepreneurship”, by Bessant and Tidd (2007)............................................................................................................. 32
Figure 9. The NSD process cycle. Acquired from “New service development: creating memorable experiences”, by Fitzsimmons and Fitzsimmons (1999)............................................................................................................. 34
Figure 10. How companies gained business during their last 12 months. Acquired from “Global Logistics Report 2016”, by Garner (2016)............................................................................................................. 36
Figure 11. How companies expected to gain business over the next 18 months. Acquired from “Global Logistics Report 2016”, by Garner (2016)............................................................................................................. 36
Figure 12. Where do LSPs most often come up short? Acquired from “Global Logistics Report 2016”, by Garner (2016)............................................................................................................. 37
Figure 13. The framework of the paper............................................................................................................. 39
Figure 14. Innovation audit result of F.H. Bertling AB................................................................................................. 40
Figure 15. The Bertling Group organization structure................................................................................................. 42
Figure 16. Bertling Enviro as a trading house. Acquired from F.H. Bertling AB slideshow (2016)............................................................................................................. 43
1. Introduction

The advances that humankind has done during the last few decades in terms of technologies and international trade opportunities have led to a major economic growth for companies worldwide (Wu and Dunn, 1995). The growth of companies has raised global concerns regarding issues of corporations not being sustainable as natural resources are limited, greenhouse gases (GHG) are damaging the environment by increasing the global warming (Dey et al., 2011) as well as the depletion of the ozone layer, a rapid disappearance of rainforests, increased levels of pollution and waste. These environmental problems pose as serious threats to the global quality of life worldwide (Wu and Dunn, 1995). In order to stabilize the climate of planet Earth and avoid destructive impacts of climate change, researchers suggest that the annual GHG emissions must be cut by 50 to 80 percent worldwide by the year of 2050 (McCollum and Yang, 2009). Luckily, this is a fact that many companies as well as concerned civilians have realized. In response to the necessity of change to a more sustainable way of conducting business, a movement of environmental activists worldwide have urged governments and businesses alike to take action and respond to these issues and become more sustainable (Wu and Dunn, 1995). While all sectors of business must be a part of the movement to change into a greener way of conducting business, some believe that certain sectors are more important than others. Service companies are generally considered to have a lesser impact on the environment compared to companies that manufacture products. Logistic service providers (LSPs) offer services but act in the transportation sector that creates a considerable environmental impact. As a consequence, many LSPs in Europe have faced restrictions of transit traffic as well as rewarding systems for environmental friendly transport companies (Skjoett-Larsen, 2000). This is to promote distribution and management of goods in a sustainable way sometime referred as green logistics (Sbihi and Eglese, 2007).

Fourth party logistics providers (4PLs) are a type of LSPs that manage the entire supply chain (Seyed-Alagheband, 2011). 4PLs are affecting green logistics when managing such actions as the supply chain structure, vehicle utilization, warehousing, transportation modes and reverse logistics (McKinnon et al., 2015). Reverse logistics is the process of recycling, remanufacturing or disposal of products or parts from the point of consumption (Dowlatshahi,
Making reverse logistics a key part for green logistics and waste management (McKinnon et al., 2015).

When it comes to the environmental aspect of business, companies are likely to be affected to change to a greener way of conducting business by four main movements: consumers, governments, competitors and their own ethical responsibility (Wu and Dunn, 1995). 4PLs, as well as any other company, are affected by these movements by constantly working with the greening of their logistics and changing their ways of operating and conducting business. Despite their efforts, 4PLs still have a long way to go before they become truly sustainable, as there are many significant issues in terms of pollutions, GHG emissions and resource depletions that are hinder to the greening of their logistics (Rodrigue et al., 2001). Green logistics is a field of research that has been thoroughly investigated where much information can be found (Dekker et al., 2012). Environmental sustainability for the entire spectra of LSPs is a major concern with a growing interest from academics and practitioners (Colicchia et al., 2013). In order for green logistics to develop, there must be a demand to innovate in this area. Garner (2016) found that logistics companies gained 27 percent of their business during 2015 from innovating to create new business areas and also found that 46 percent of logistics companies expect to gain business over the next 18 months by innovating and creating new offerings. Bessant et al. (2005) mentioned that innovation is about creating something new and valuable and it might therefore be an important area or tool for 4PLs to change towards green logistics.

In order for 4PLs to conduct green logistics, they must be able to innovate new solutions that are also green. 4PLs have logistics as their core competence and it is therefore likely that their innovation will be in the logistics area. However, 4PLs do have the option to innovate outside their core competence creating green innovations in other sectors. Green innovations are the innovations that affect products or processes that save energy, prevent pollution, recycle waste, create green product designs or affect the corporate environmental management (Chen et al., 2006). While the literature provided a lot of evidence for LSPs’ drivers and barriers to green logistics there is still a gap with little research from 4PLs perspective about how they actually innovate in green logistics and what drivers and barriers there are for green logistics innovation (McKinnon et al., 2015; Colicchia et al., 2013; Carter and Dresner, 2001).
When 4PLs develop green innovations they move towards becoming more sustainable and their organizational alignment moves towards becoming of a green logistical orientation. This paper will investigate how 4PL manages green logistics innovation. It will also identify what types of drivers and barriers affect the green logistics innovation internally and externally, by looking at both internal factors that appear inside the company borders and external factors that appears outside the company borders. This paper will investigate how F.H. Bertling AB innovate within green logistics. Through their innovation the drivers and barriers of green logistics will be identified to fill the gap of research within the field. Since LSPs’ effect on the environment is considered large (Skjoett-Larsen, 2000), investigating how they innovate in green logistics can provide useful information to find new solutions to reduce the total environmental impact discharged by the transport sector.

1.1. Purpose

The purpose of this paper is to investigate 4PLs’ ability to generate green logistics innovation. The paper will also investigate what types of drivers and barriers 4PLs may face in the process of innovating green logistics by looking at both internal factors that appear inside the company borders and external factors that appears outside the company borders.

The study is limited to mainly focus on the environmental aspect of green logistics and will not directly investigate aspects outside the environmental sector such as the societal or economic sectors. However, society and economy may be discussed in this paper because of the environment’s indirect impact on these sectors.

1.1.1. Research questions

- How do 4PL generate and manage green logistics innovation?
- What are the drivers for developing green logistics innovation for 4PL?
- What are the barriers for developing green logistics innovation for 4PL?

1.1.2. Structure of the paper

This paper follows a basic IMRaD structure, with introduction, method, results and analysis. The following chapters of this paper are:
• Chapter 2 present the methodology that was used for this thesis in terms of qualitative research, how the literature review was conducted with the CIMO logic, the case, research quality, limitations as well as ethical and societal aspects.

• Chapter 3 shows the theoretical framework that is based on the CIMO logic with the context of 4PL and the environment, the intervention of green logistics within 4PLs, the mechanism of green innovation within 4PLs and the outcome of environmental benefits. Chapter 3 also presents the framework of this paper.

• Chapter 4 consists of two parts, firstly the results from the questionnaire used and secondly, the results from the interviews which were presented in 5 sub sections. The chapter moreover shows the drivers and barriers for developing green logistics innovation.

• Chapter 5 represents the analysis of the paper where the findings from the questionnaire and interviews are analyzed through matching them with the theory.

• Chapter 6 consists of the conclusion, where the research questions are answered and the research implications, study limitations and further research are proposed.
2. Methodology

2.1. Qualitative research

The paper uses a qualitative study approach in order to answer the research questions and aims to interpret individual perceptions of events with a phenomenological research approach. The methodology of this study explains how and why a qualitative study approach was chosen, how the literature review was conducted, how data and information are acquired. It also defines the research quality in terms of its internal and external validity as well as its reliability. Quantitative and qualitative research are two opposing headings within research strategies, where quantitative research refers to research that is concerned with quantities and measurements, and qualitative research is linked to in-depth exploratory studies where the opportunity for quality responses exist (Biggam, 2008). The qualitative research approach was chosen because of the need to conduct an in-depth exploratory study to explain how 4PLs conduct and develop green logistics in terms of their management of green logistics innovation. The qualitative research is the study of things in their natural settings, where the researcher attempts to make sense of, or interpret, phenomenon’s in terms of the meanings people bring to them (Biggam, 2008). The study at hand will answer what drivers there are for green logistics within 4PLs, what might be the difficulties for green logistics innovations and what do the factors investigated, drivers and barriers mean for the 4PLs ability to create green logistic innovation, not how many companies that are conducting green logistics and so on. This study follows a qualitative strategy, as the purpose is to make sense of 4PLs ability to conduct green logistics through green innovations, meaning that the study will focus on interpreting, not measuring.

2.2. Literature review

The first step of the study was to gather information within the area of green logistics to construct a relevant literature review. In order to find valid, reliable articles and studies, the search engine Google Scholar was used, where articles, theses, books and abstracts from academic publishers, professional societies and universities could be acquired. In order to gain an in depth understanding of the green innovation and green logistics concepts within 4PL, an extensive literature review have been conducted. When using the two keywords of “green innovation” and “green logistics” in a conjoined search on Google Scholar, 194 articles were found between a time range of articles and books written from 2006 to 2016, meaning that there has been a fair amount of research done within the field of green logistics
and green innovations during the last 10 years. From this pool of literature, certain articles were chosen depending on how they connected to LSPs, 4PLs and their ability to green logistic innovations. Besides “green innovation” and “green logistics”, a few other keywords have been used, such as “innovation”, “sustainability” as well as “LSPs”, “4PL” and “logistics service providers”.

2.2.1. CIMO

This paper uses the CIMO-logic, which constitutes the logic of the design proposition, not its specific form. The CIMO-logic was chosen as it presents a clear view of the context of the paper, the problem and how it will be solved, which also serves as the structure for the theoretical framework of this paper. Denyer et al. (2008) explain that CIMO stands for the four critical factors of context, intervention, mechanism and outcome. Many believe that it is enough to follow a simply IO-logic, meaning that they purely focus on finding an intervention to reach an outcome, without dwelling on the context dependency of the outcomes or the mechanisms that produces the outcomes.

When dealing with organizational changes and such, it is common to express objectives as “if A then do B”, meaning the IO-logic, which is not recommended (Denyer and Tranfield, 2009). In order to avoid this fatal error, this study will include all of the components of the CIMO-logic. In order to truly understand the components, the cycle of CIMO will be more clearly explained. The CIMO-logic starts off with a problematic Context where a design proposition of a certain Intervention type will solve the problem through a specified and generative Mechanism, which will have an intended Outcome (Denyer et al., 2008). Booth et al. (2011) states that the CIMO-logic explains the critical factors as:

- Context. Which individuals, relationships, institutional settings, or wider systems are being studied?
- Intervention. The effects of what event, action, or activity are being studied?
- Mechanisms. What are the mechanisms that explain the relationship between interventions and outcomes? Under what circumstances are these mechanisms activated or not activated?
- Outcomes. What are the effects of the intervention? How will the outcomes be measured?
According to the explanation given by Booth et al. (2011) the Context of this paper is 4PL and the environment, which will use the designed Intervention of green logistics though the mechanism of green innovations in order to reach the outcome of environmental benefits.

### 2.3. Case study

This research will be conducted through a single case study, where one company will be investigated. As single case studies are able to investigate and follow a particular event more properly than multiple case studies, the single case study analysis has been selected. A case study is the preferred method of conducting social science research when “how” or “why” questions of a social phenomenon are being posed, when the investigator has little control of the events being investigated, and when the focus on the investigation is of a contemporary phenomenon within a real-life context. The stated research question of how 4PLs manage and generate green logistics innovation is a clear how question. However, the next two questions of searching for drivers and barriers might be interpreted as questions of measurement but this is not the case. This study aims to analyze how drivers and barriers affect green logistics innovation in 4PL, giving the drivers and barriers context to how they influence the green logistics innovation process. The case study approach opens up multiple sources of evidence, which is why it is superior to other ways of investigating a case (Yin, 2009). Researchers conducting case studies are often inclined to use interviews as their main mean of data collection, but many researchers also chose to gain data and information through a mixture of methods to form a triangulation of data, such as through a mixture of questionnaires as well as individual and group interviews in order to not only gain a rich output, but also higher marks (Biggam, 2008). This study will consist of interviews, but also of a questionnaire in order to gain a richer output. The case study approach allows the researchers to maintain the holistic characteristics of the real-life context, including individual life cycles, smaller group behavior, organizational and managerial processes, changes of environment, performance, relations and the maturation of industries. The interview findings are analyzed by dividing the relevant information into themes of stages of the innovation process, drivers and barriers for green logistics innovation. The analysis model also accounted for who of the interviewees stated what to build context to the statement. The purpose of the case study approach is to be able to expand and generalize previous theories, not to enumerate any statistical generalizations (Yin, 2009). The case study at hand will require a holistic view of the real-life context in order to reach valid data and information which is why one of the research methods of reaching data is through a case study according to the definitions of Biggam (2008) and
Yin (2009). Yin (2009) also writes that the essence of a case study is to try to illuminate a decision or a set of decisions, which should answer why they were taken, how they were implemented and with what result. This case study will investigate how 4PLs generate, manage and succeed with green logistics innovation.

2.3.1. Criteria in case company selection

The criteria that was set out focused mainly on the need for a company to be a 4PLs pursuing green logistics with a sustainable business plan. When a case company was chosen it was therefore important that the company fulfilled the set out criteria in order to be seen as suitable for this study. The case company should also be recognized as a LSP in Delfmann et al.’s (2002, p. 204) definition: “companies which perform logistics activities on behalf of others”. It also fit the definition given by Seyed-Alagheband (2011) of a 4PLs whereas the company act as a supply chain manager. The criteria for a case company was specified to fit our needs in terms of travel distance and availability. The case company should also have conducted green logistic innovations that could be investigated in depth, meaning that the different phases for managing innovation (generating, selecting and implementing) described by Bessant and Tidd (2007) could be discussed with the interviewees. This also sets some requirements for the interviewees to be knowledgeable about the innovation process at the case company. With the help of Jennie Johansson, coordinator from CLIP at the University of Gävle, two contacts were obtained. Out of the two company alternatives F.H. Bertling AB fulfilled all of the criteria for this study and was therefore most suitable as a case company for this study. The set out criteria was the following:

- The company must be willing to offer sufficient amount of time for interviews and questionnaire.
- The company must be a 4PLs which offers logistic services.
- The company must be pursuing green logistics, with a clear agenda and purpose of why they want to become green.
- The company must be conducting green logistics innovation and can explain how previous green ideas has been generated, selected and implemented.
- The company must preferably be within range, meaning that they can be reached within the borders of Sweden. If the company is Swedish or not does not matter, as long as they have an office and conduct business within the country.
By talking to Jennie from CLIP and by doing some research on the internet F.H. Bertling AB was selected as the most suitable company for the study as they fulfilled all the set out criteria.

2.3.2. Interviews and questionnaire

In order to collect empirical data and information this paper will use two main ways of information gathering; by conducting semi structured interviews and by a questionnaire to several of F.H. Bertling AB’s managerial staff. Yin (2009) states that one of the most important sources of case study information is the interview, where an interview is a guided conversation rather than a structured query, meaning that the researcher may want to pursue a consistent line of inquiry but will actually get a more fluid and dynamic interview rather than a rigid interview. This means that an interviewer must maintain two jobs during an interview; (I) to follow the protocol and follow the researcher line of inquiry and (II) to ask the actual conversational questions in an unbiased way, which also serves as the line of inquiry, showing how the jobs are connected. In order to conduct the interview in a structured and guided way an interview protocol was written, which follows a line of inquiry that is reflected by the theoretical framework that has been investigated for this paper. The interview protocol was based on the literature review and follows the areas of the simplified model for managing innovation (Figure 8), in terms of the proactive linkages, the processes (generate, select and implement), innovative organization which also includes learning, and the strategy, covering the strategic leadership, direction and deployment. The semi structured interview will also cover some basic information about F.H. Bertling AB and the interviewees in order to truly understand their relationships to green innovations and their contribution to the company's green logistics. Semi structured interviews were chosen as a structure in order to acquire a broader perspective by having the ability to go outside a fixed interview protocol. Yin (2009) writes that a thoroughly conducted interview should contain a structured interview protocol as well as a skilled interviewer, who should have a set of required skills. The following skills that a skilled interviewer should have are acquired and interpreted from Yang (2009, p. 69) who listed them as:

- The interviewer should be able to ask good questions and should be able to interpret the answers to said questions.

- The interviewer should be a good listener without being trapped by previous acquired ideologies or preconceptions.
The interviewer should be adaptive and flexible, so that newly encountered situations can be seen as opportunities instead of threats.

The interviewer must have a firm grasp of the issues being studied, even in an exploratory mode. This grasp reduces the relevant events and information into manageable proportions.

The interviewer should be unbiased by previously acquired notions, which includes the notions derived from theory. The interviewer should therefore be sensitive and responsive to contradictory evidence.

This list was used by the interviewers as guidelines of how to operate and behave during the interviews. The interviews took place at the Scandinavian Head Office for F.H. Bertling AB in Göteborg. The managerial staff in Göteborg the interviewees consisted of:

- Göran Andersson, Director of F.H. Bertling AB.
- Niklas Amour, Director of Operations at Bertling Enviro.

Four main interviews were conducted and three of the interviews was recorded for this research, and the interviews followed the order of table 1:

Table 1. Interview participants and order.

<table>
<thead>
<tr>
<th>Interview order</th>
<th>Interview participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Interview 1 was conducted with Göran Andersson.</td>
</tr>
<tr>
<td>2</td>
<td>Interview 2 was a lunch meeting interview with both Göran Andersson and Niklas Amour that was not recorded.</td>
</tr>
<tr>
<td>3</td>
<td>Interview 3 was conducted with Niklas Amour.</td>
</tr>
<tr>
<td>4</td>
<td>Interview 4 was conducted with both Göran Andersson and Niklas Amour.</td>
</tr>
</tbody>
</table>

The context of the interview is based on the study’s literature review and consists of four major areas: background, green logistics innovation, barriers and drivers to innovate green logistics and managing green logistics innovation. These areas were chosen to answer the research question and is fitted under the CIMO logic that the study has followed (Denyer and Tranfield, 2009). The complete interview protocol consists of 59 questions in total and they are written in Swedish, for complete view of the interview protocol see appendix 1. The interview is based on the theoretical framework of this paper, which was conducted through a
literature review of relevant articles and books. The questionnaire will counteract biased opinions as the answers will be anonymous and will therefore not risk of being of a biased nature. The questionnaire was originally developed by Tidd et al. (2005) with the purpose of investigating how well a company manages innovation. The questionnaire was translated into Swedish by the authors of this paper and can be found in appendix 2, otherwise there was no other changes compared to the original questionnaire by Tidd et al. (2005). The questionnaire is linked to an innovation audit tool presented as figure 1 and makes it possible to assess how a company targets some of the vital areas of innovation management. The questions in the questionnaire are divided into the five categories of strategy, processes, innovative organization, linkages and learning. The questions are given scores between 1 to 7 where 1 equals not true at all and 7 equals very true. The innovation audit tool is based on the questionnaire and is used to define the advantages and shortcomings of an innovative organization. Figure 1 also presents an ideal score which symbolizes a fictive organization with a perfect balance between the areas of innovation management.

Figure 1. Innovation audit tool. Acquired from “Managing innovation”, by Tidd, Bessant and Pavitt (2005).

Figure 2 presents the methodology framework. The figure shows how the questionnaire and literature review is based on the theoretical framework. The results from the questionnaire will be presented in the innovation audit tool in the results section.
The purpose of the interviews is to create a deeper understanding of the case company's innovation capabilities as well as to understand how they generate, manage and develop green logistic innovations. The questionnaire will result in an overview of the case company's innovation capabilities. The results from the questionnaire will investigate how well the case company manages innovation and the interviews will compliment by explaining the innovation processes as well as investigate directly how green innovation is managed. By using the questionnaire to investigate the general innovation capabilities in the case company the interview results will compliment by adding the green logistic innovation aspect. Since green logistics innovation is seen as subgroup in innovation it is therefore important to include the certain specific characteristics that applies to generating, managing green logistics innovation and what drivers and barriers it possess. The developed research model is shown as appendix 3 and will apply the general innovation capabilities described by Bessant and Tidd (2005) as a base to develop green logistics innovation. The interview will also look at what factors act as barriers and drivers for green innovation. Together the interview and questionnaire will answer how well the innovation is managed as well as how green innovation is performed through the case company innovation management structure. The study is also complemented by secondary data in the form of slideshows acquired from the case company when the interviews took place and information from the Bertling Group’s official webpage.

2.4. Research quality

This study uses a research design that has a purpose of representing a set of logical statements that can be judged in terms of its quality, which should be able to withstand certain logical tests. Concepts of what types of judging tests that can be made consist of trustworthiness, credibility, confirmability and data dependability (Yin, 2009). Biggam (2008) stated how
important it is that the research conducted is defined in terms of the chosen strategy as well as justifying it and how it meets the research ends. The four tests used to justify the strategy of research are according to Yin (2009) the following:

- Construct validity
- Internal validity
- External validity
- Reliability

The four tests by Yin (2009) are the base for this paper's research quality section. Biggam (2008) name these as research strategy sub-sections, with the purpose of underlining the research method. When dealing with case studies it is important to remember that these tests should be applied throughout the entire case study, meaning that they can not only be used in the beginning of the study. This means that working on the design of this case study continued throughout and beyond the initial design plans (Yin, 2009).

2.4.1. Construct validity

The purpose of constructing validity in this study is to identify and correct operational measures for the concepts of being studied and the construction of validity is especially challenging within case study research. Since Yin (2009) state that many researchers often fail to develop a sufficiently operational set of measures, as well as stating that subjective judgements are used in order to interpret and gather data. In order to truly construct validity within this case study it is important that the researchers use the following three tactics by Yin (2009) in order to make sure that the researchers have identified the correct operational measures for the concepts that are being studied. The three tactics by Yin (2009) are the following:

- To use multiple sources of data
- Establish chain of evidence
- Have key informants review draft case study report

The case study will reach information through both interviews from several people and through a questionnaire, which also will be answered by said several people. This follows the tactic of using multiple sources of data that Yin (2009) presents, which validates the way that the study reaches information. A chain of evidence is acquired from data collection, just as the first tactic and is validated by comparing the collected data with previous conducted studies.
within the same area of research. By allowing the company contacts access to the draft of gathered data, the raw information compiled from interviews can be validated and reviewed, which fulfills the last tactic presented by Yin (2009). This case study therefore fulfills all of the tactics that can be seen above. In order to fully validate the context of this study, it is important to remember that valid research is a research that has been accepted by the research community (Biggam, 2008). In order to make sure that this study becomes accepted, a thorough relation with the projects supervisor is conducted with interim meetings, where the supervisor throughout the project has access to information concerning the study and contributes with advices as well as constructive criticism.

2.4.2. Internal validity
The test of internal validity has been given the greatest level of attention amongst the four tests of the judgment of strategy within experimental and quasi-experimental research as there has been several threats to validity identified. Internal validity is for explanatory or causal studies only, not for descriptive or exploratory studies. Internal validity is to seek and establish causal relationships, whereby certain conditions are believed to lead to other conditions and can be explained by the factors z, x and y, where one great threat is the one of the incorrect explanation of the relationship between factor x and y without including the factor z that may have caused factor z, and results in a threat to the internal validity to explanatory studies. Luckily, this is not a threat to descriptive or exploratory studies (that are case studies, surveys or experiments) as Yin (2009) states. Because this research consists of a case study that conducts exploratory interviews as well as a survey it is therefore not an explanatory study. This means that this threat is inapplicable to this exploratory study. A threat to the internal validity when speaking of case studies on the other hand is the threat of inferences, that is a much broader problem. Yin (2009) explains that an inference occurs in a case study every time that an event cannot be directly observed and is very common within case studies. This may be through interviews and documentary evidence that has been collected earlier, where an occurrence may have occurred. It can therefore be questioned if the inference is correct, if all the rival explanations or possibilities has been considered as alternative options or if the evidence is convergent. It is hard to fight this type of threat within case studies especially. The internal validity can be achieved through “in-depth discussions” as Biggam (2008) mentions, meaning through a combination of both interviews and questionnaires that is a solid way of addressing internal validity. In order to furtherly address internal validity within this study different types of analytic tactics will be used when dealing with the interview and questionnaire data, such as building explanations to why data is stated
as it is by comparing it to the literature review conducted before contact with the company as well as using logic as Yin (2009) describes.

2.4.3. **External validity and generalizability**

External validity is to define the domain of which a study’s findings can be generalized within. External validity often faces a problem of knowing whether the findings of a study is generalizable beyond the study itself. The problem is therefore the insecurity of if the change of a case study is applicable to another case or not. Researchers has found this external validity problem as a major barrier to doing case studies, where there is much criticism to doing single case studies as they are a poor basis for generalization (Yin, 2009). This limits the generalizability study as this is a single case study. However, the case study is not only based on an interview with one interviewee, but with two interviewees that will also answer the questionnaire. The interviews have one flaw, whereas interview 4 that consisted of Göran Andersson the director and Niklas Amour the manager of operations, and this may be a factor that affects the validity of the paper. When conducting an interview with several interviewees the case could be that the interviewees are affected by the directors’ opinion which leads to a change of opinion for the others being interviewed, meaning that the interview becomes of a biased nature (Yin, 2009). Since Göran is the Director of F.H. Bertling AB and participated in interview 4 individual interviews were also conducted to avoid biased opinions. In order to clarify, interview 4 was conducted with both of the interviewees. This was counteracted by also interviewing them individually.

Biggam (2008) mentions questionnaires as a valid data collection method when dealing with case studies. In order to summarize this section, the external validity is validated by the fact that this study is an analytical case study and gains data and information from both interviews and questionnaire, this overcomes the major external validity problem of case studies being a poor basis for generalization (Yin, 2009). The domain that the results can be generalized within is mainly in the case company of F.H. Bertling AB but other companies in the logistics service sector might be affected by the same barriers and drivers for innovating green logistics but the conclusions drawn from this case study is mainly generalizable to F.H. Bertling AB only.

2.4.4. **Reliability**

The last test of the judgment of strategy is the test of reliability. This test is something that most people are probably already familiar with (Yin, 2009). Biggam (2008) writes that
reliable research focuses on the need for a record of evidence that a researcher actually did conduct the research in a fair and objective way, but this is not a clear definition of reliability, nor does it clearly state why it is needed within a case study. The purpose of reliability is to minimize the errors and biases in a study, where the definition of reliability is quoted by Yin (2009, p. 45) as:

“The objective is to be sure that, if a later investigator followed the same procedures as described by an earlier investigator and conducted the same case study all over again, the later investigator should arrive at the same findings and conclusions.”

Therefore, this study demonstrates that the operations within the study, whether it be data collection methods or any other way of gaining information, can be repeated and still get the same results (Yin, 2009). To strengthen the reliability of the study a detailed interview protocol with questions, and information about the participants is included in the report. The procedure for under what circumstances the questionnaire was performed by our participants is also described. A further reliability to the study is that the interviews were recorded and the audio files are available upon request. The study also provide detailed information for how the literature review was performed in terms of structure and what information did the authors look for and how was it analyzed. Biggam (2008) stated that purely reliable research methods are not simply a way of making research valid, but that it must be questioned and compared with other tests of reliability. Yin (2009) mentions one way of approaching the reliability problem, without having purely reliable research methods only, that is to take as many steps as possible in an operational way, as well as conducting all research as if someone is always looking over one's shoulder. By constantly being ready for a paper to be audited a reliable paper is constructed, that could easily be repeated by another author who would reach the same results. In order to make this work reliable, all changes and steps taken will be on an operational level that will be clear to understand. This will be reinforced by good communication with the supervisor who will serve as a temporary auditor, or the man constantly looking one over the shoulder, during the course of this project.

2.5. Limitations

Time was a major limitation to this project as only a 10-week window was provided for the entire work. The distance to F.H. Bertling AB was also a limitation as it made communication between the researchers and interviewees harder consequently limiting our opportunities for conducting interviews. Also, the number of interviews and interviewees are limitations as the interviewees consist of only two people that resulted in four interviews all together. The study
did only investigate people in management positions which can in this case contribute to a biased result and views as no opinions from employees below them are included in the study. Further management may represent a subjective view of the company by not consider views of employees.

**2.6. Ethical and societal aspects**

In order to conduct this paper in an ethical way the interviewees were given the choice of being anonymous. The case company was also offered the opportunity to be anonymous in the publication of this paper. If the interviewees felt that the name of the company should be a secret, they have the option of stating it and it will result in that the company will be anonymous. The interviewees were first asked if they were comfortable with the interview being recorded and the authors made sure to have their consent before starting to record. The interviewees were met with respect and consideration in terms of what information they want to present in order to follow an ethical and societal manner. Reducing the environmental impact from logistics services are a concern for the entire world. This paper may contribute to the development of green logistic services and reducing its negative impact on the environment.
3. Theoretical Framework

The theoretical framework consists of five headings and starts with the systematic literature review that also explains how the framework is structured and why the systematic literature review approach CIMO way of presenting the framework was chosen. Thereafter, the three areas of the context, intervention and mechanism are presented that covers 4PL and the environment, green logistics and green innovations. The last part of the theoretical framework shows the entire framework of the paper, defining what areas that are included and how they are connected.

3.1. Systematic literature review approach

This paper will follow a systematic literature review approach which means that the theoretical framework structure will follow the acronym CIMO that is presented by Denyer and Tranfield (2009). These critical factors are presented as the main headings of the theoretical framework. Therefore, the theoretical framework will begin with a presentation of the four chosen critical factors of the paper so that the reader may understand the logic of the structural design of the paper as well as the connection between the factors.

- **Context:** *4PL and the environment.* 4PLs effect on the environment has been a great subject of research for the last couple of years (Dey et al., 2011), where researchers have drawn the conclusion that 4PL have a negative impact on the environment through GHG emissions as well as increased pollution and waste (McCollum and Yang, 2009; Skjoett-Larsen, 2000). In order for 4PLs to reduce their negative impact on the environment it is necessary that they conduct their business in the way of sustainable logistics.

- **Intervention:** *Green logistics within 4PLs.* The intervention of this subject is green logistics, where its drivers and barriers are identified for 4PLs. Dekker et al. (2012) define green logistics as the research of practices that aims to reduce the negative impact on environmental areas such as emissions of GHG of logistical operations that contributes to the distribution of a sustainable balance between the economic, environmental and social objectives. Green logistics is a phenomenon that 4PLs constantly try to develop (Colicchia et al., 2013), in order to reduce the negative environmental impacts that 4PL provide (Rodrique et al., 2001). The greening of logistics requires innovative solutions and new ways of conducting business, leading us to the papers mechanism.
• **Mechanism: Green innovations within 4PLs.** 4PLs way of conducting green innovations is characterized by their core business of providing logistics service to other firms, meaning that their innovation is likely to be in the area of logistics innovation defined by Flint et al. (2005 p. 143.) as "any logistical related service from the basic to the complex that is seen as new and helpful to a particular audience". The logistic innovation for 4PLs is then combined with green innovation to form green logistic innovation. Green innovation is related to green products or processes, the innovation in technologies that are involved in energy-saving, pollution-prevention, waste recycling, green product designs, or corporate environmental management (Chen et al., 2006).

• **Outcome: Environmental benefits.** Green logistics innovation within 4PLs may help to decrease the emissions of GHG (Dey et al., 2011), avoiding depletion of the ozone layer and prevent pollutions (Wu and Dunn, 1995). Also, by reducing and improving waste disposal according to the waste management hierarchy set out by the EU (Gertsakis and Lewis, 2003), the environmental benefits can be furtherly increased.

### 3.2. 4PL and the environment

A logistics service provider is a company that manage the flow of goods and materials between points, from a start to an end destination. This include such actions as: handling, shipping, inventory management, warehousing, packaging and security functions for shipments. Delfmann et al. (2002, p. 204) simply define an LSP as “companies which perform logistics activities on behalf of others”. LSPs can be divided into subgroups depending on what services they are offering. One way is to divide them as Seyed-Alagheband (2011) into five categories of 1-5PL as seen in figure 3;

![Figure 3. Types of logistics parties. Acquired from “5-Logistics Parties”, by Seyed-Alagheband (2011).](image-url)
The categories 3PL-5PL described by Seyed-Alagheband (2011) can be seen as LSPs by the Delfmann et al, (2002, p. 204) definition in terms of performing logistics activities on behalf of others. The forwarder (3PL) is in this case referred to a firm that offers several logistic services as shipping, warehousing and packaging. The supply chain manager (4PL) connects range of logistic companies to offer a tailor made logistic service and overlook the entire supply chain by managing raw materials to end products. The e-business manager (5PL) manages the entire supply chain as well as e-business (Seyed-Alagheband, 2011).

4PL is a business process outsourcing provider and is neutral when managing the logistics process regardless of what carriers, forwarders or warehouses that are used. 4PLs are now seen as the logical alternative for business process outsourcing as they provide visibility and integration across multiple enterprises. A 4PL can be seen as more of a strategic partner than a tactical partner. This is because 4PLs are supply chain integrators that synthesize and manage resources, capabilities and technology by offering a broad strategic package using its own organization, together with complementary service providers to deliver a comprehensive supply chain solution (Mukhopadhyay and Setaputra, 2006). The supply chain manager (4PL) can also manage the reverse logistics defined by Dowlatshahi (2000 p. 1.) as “a process in which a manufacturer systematically accepts previously shipped products or parts from the point for consumption for possible recycling, remanufacturing, or disposal”.

McKinnon et al. (2015) describe reverse logistics as a key part of green logistics, which incorporates the reuse for products and packaging by recycling and disposing, meaning that the proportion of waste dumped in landfiling sites or waste being incinerated decreases through recycling. To deal with waste disposal companies can follow the waste management hierarchy set out by EU that is presented by Gertsakis and Lewis (2003) in figure 4. It presents the 5 types of ways that a company may use when dealing with waste and also shows what goal that is the most and least desirable outcomes. The waste management hierarchy follows the order of disposal, treatment, recycle, reuse and lastly reduce that also is the most desirable outcome.
Reverse logistics can also include actions like redesigning packages to use less material or reduce the energy and pollution from transportation (Salema et al., 2007). 4PLs offer different services and therefore their impact on the environment will be depending on what service they offer. Service firms are usually not considered having a big impact on the environment but 4PLs however stand out. 4PLs act in the transportation sector that include operations that have a high fuel consumption and large emissions of GHG, pollutants and waste disposal (McCollum and Yang, 2009). It is therefore argued by Skjoett-Larsen (2000) that the LSPs impact on the environment is larger than other service sectors. One of the main concerns of 4PLs regarding the environmental impact is what type of transportation mode is used. The common transport modes can be divided into four categories: Ship (Water), Truck (Road), Train (Rail) and Plane (Air). They all have distinctive impacts on the environment. Rondinelli and Berry (2000) presents the potential environmental impacts of the four different transportation modes. Figure 5 shows that different transport modes possess different environmental impacts and risks that need to be considered when managing a supply chain and selecting transportation mode.
The transportation sector’s main environmental concern may be the emissions of GHG contributing to the global warming (McCollum and Yang, 2009). When looking at the four main types of transportation modes they all release different amount of GHG. By looking at the GHG emissions per kilometer a metric ton is transported ship (water) have the lowest amount of emissions followed by rail, road and last air (Chapman, 2007), but when choosing transportation mode, the environmental impact is not the only factor to consider. Kohn and Brodin (2008) describes the characteristics of the four transportation modes in table 2. The table presents how different transportation modes has different characteristics and limitations that needs to be considered when selecting a transportation mode for an entire supply chain.
Table 2. Characteristics and limitations for different transport modes. Acquired from “Centralised distribution systems and the environment: how increased transport work can decrease the environmental impact of logistics”, by Kohn and Brodin (2008).

<table>
<thead>
<tr>
<th>Financial characteristics</th>
<th>Road</th>
<th>Rail</th>
<th>Water</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost level</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Balance fixed/variable costs</td>
<td>High level of variable costs; low level of fixed costs</td>
<td>High portion of fixed costs</td>
<td>High level of variable costs, low level of fixed costs (inland, USA)</td>
<td>High variable costs, low fixed costs</td>
</tr>
<tr>
<td>Market coverage</td>
<td>Point to point</td>
<td>Terminal to terminal</td>
<td>Terminal to terminal</td>
<td>Terminal to terminal</td>
</tr>
<tr>
<td>Predominant traffic/goods</td>
<td>All types</td>
<td>Low-mod value; mod-high density</td>
<td>Low value; high density; large load sizes</td>
<td>High value; low-mod density; small shipments</td>
</tr>
<tr>
<td>Length of haul</td>
<td>Short to long</td>
<td>Medium to long</td>
<td>Medium to long</td>
<td>Medium to long</td>
</tr>
</tbody>
</table>

The topics of sustainability and the environment have been increasing in the logistics literature as well as in practices according to Dey et al. (2011). One reason for this might be the concern for the Earth's environment but also Rao and Holt (2005) claimed that firms pursuing green operations and logistics may benefit from efficiency improvements and several long-term benefits such as greater market shares and increased profit margins. There have been several studies on how the entire transport sector need to change both technologically and in human behavior to avoid further global warming (Chapman, 2007; McCollum and Yang, 2009; Loo and Li, 2012). This means that the change towards green logistics should be broad and include views outside the technological dimension. Wu and Dunn (1995) argue that logistics environmental issues should be seen with a holistic view to fully understand the complexity of all logistic operations a product will undergo during its life cycle, meaning that firms should consider the entire supply chain including the reverse logistics.

### 3.3. Green logistics within 4PLs

The area of logistics is an important function of modern transport systems, where the terminology itself not only include factors as cost, efficiency and reliability, but the terminology also include negative environmental impacts based on GHG emissions, air pollutants as well as waste disposal (McCollum and Yang, 2009; Rodrigue et al., 2001). In
order to fully grasp the framework of green logistics, a model has been included in this paper named figure 6, presenting the complex relationships between logistics activity with its related environmental effects and costs. The framework for green logistics presents how actions like freight transport operations (movement of goods) as well as warehousing, material handling and logistics IT services are connected to each other in green logistics. The framework can be applied to both forward and reverse logistics equally (McKinnon et al., 2015). The figure can be used to analyse logistics activities (aggregates, key parameters and determinants) impacts on the environment in a holistic way to fully grasp the chain of events included in green logistics.
3.3.1. **Green logistics defined**

Green logistics is considered to be a good business practice and has been identified as a concept with a positive impact within the financial and operational areas (McKinnon et al., 2015) and there are many similar definitions of green logistics as there has been much research done within this field (Dekker et al., 2012; McKinnon et al., 2015; Rodrigue et al., 2001; Sbihi and Eglese, 2010; Sbihi and Eglese, 2007). Despite the vast number of articles investigating the greening of logistics there is still a great need for green logistics within the
logistics industry and 4PL as there are many significant issues such as GHG emissions, pollution, congestion and resource depletion showing that the logistics industry still is not very green (Chapman, 2007; McCollum and Yang, 2009; Rodrigue et al., 2001). Green logistics can be interpreted as the production and distribution of goods in a sustainable way (Sbihi and Eglese, 2007) and is supported by Dekker et al. (2012) who presented a broader picture of green logistics, as they define green logistics as the research of practices that aims to reduce the environmental areas related to emissions of GHG, noises as well as accidents of logistical operations which contributes into the distribution of a sustainable balance between the economic, environmental and social objectives. This explanation of green logistics supports and adds to Sbihi and Eglese’s (2007) view on green logistics who stated that the concept concerned the environmental and social aspects, and also adds the economical aspect to a part of green logistics in order to create a sustainable balance. In order to fully grasp the concept of green logistics it is important to know that green logistics includes the reduction of freight transport externalities, city logistics, reverse logistics, logistics in corporate environmental strategies and green supply chain management. Green logistics also includes the measurement of the environmental impact of different distribution strategies, the reduction of energy usage within logistics activities, the reduction of waste as well as the administration of the treatment (Sbihi and Eglese, 2010).

3.3.2. **Green logistics and its sectors**

Green logistics mainly concerns the environmental and social aspects of logistics (Sbihi and Eglese, 2010), but green logistics also has an effect on the economic sector. Authors has different views on the dimensions of green logistics, as some mention that green logistics takes all the sectors into account, whilst focusing and understanding the dependence of the environment and society (Giddings et al., 2002). Others only believe green logistics to effect the environment and society (Sbihi and Eglese, 2010; Sbihi and Eglese, 2007), so what sectors that green logistics affects must be defined for this paper. The majority of literature found concerning this has shown that green logistics affect all the sectors, meaning that green logistics share the same sectors as sustainable development does, as Giddings et al. (2002) presents in Figure 7. Figure 7 shows the sectors that green logistics follows with the environment and society (Sbihi and Eglese, 2010) in relation to the economic sector (Giddings et al., 2002). There has been little research done concerning sustainability of green logistics or the environmental sustainability for 4PL (Colicchia et al., 2013) and Martinsen and Björklund (2012) describe the greening of 4PLs most often concerns their environmental routines, such as their management system and environmental education internally that are
two key points to become sustainable. Lele (1991) has a rather negative view on the three sectors within sustainable development, as many fail to see that the sectors affect each other, by not understanding that the sectors dependent on each other, that is also supported by Giddings et al. (2002) by adding that there are major weaknesses in the model if the sectors are separated, leading to a weak sustainability as no trade-offs can be made, despite common beliefs (Lele, 1991). In order to simplify this paper will focus on the environmental sector of green logistics, but may discuss the other sectors in relation to the environment.

![Diagram](image.png)

Figure 7. The common three-ring sector of sustainable development and also serves as the sectors of green logistics. Adapted from “Environment, economy and society: fitting them together into sustainable development”, by Giddings et al. (2002).

### 3.3.3. Drivers and barriers for green logistics

There are many drivers and barriers for green logistics (McKinnon, 2010) and managers only see green logistics as successful if the environmental performance is improved and the costs decrease or remain the same (Carter and Dresner, 2001). The main drivers for green logistics is to optimize the logistics flows, improve the corporate image, reduce logistics costs, achieve regulatory compliance, satisfy customer requirements, differentiation from competitors and to develop alternative networks (McKinnon et al., 2015). Therefore, customers and the need to
satisfy their requirements are often seen as a major driver, but LSPs often find that their customers lack a real commitment (Colicchia et al., 2013).

McKinnon (2010) define several key drivers for the greening of logistics and supply chains. The key drivers for green logistics is: to improve public relations, because it is a part of their corporate responsibility agenda, for financial return on investments, government compliance, to decrease fuel bills, to increase supply chain efficiency, lower risk as well as improving investor relations. Costs are seen as both a driver and a barrier, as can be seen in the research conducted by Carter and Dresner (2001) who name the three barriers of costs, customer demands and regulation. The fact that costs can be seen as a driver and a barrier can also be seen in the five greatest pressures that drives the greening of supply chains mentioned by McKinnon et al. (2015), which are the desire to be thought as leaders within sustainability (I), rising cost of energy as well as fuel (II), to gain competitive advantage and differentiation (III), to be compliant with current or expected regulations (IV) and because of rising transportation costs (V).

Colicchia et al. (2013) also mentions the competitive advantage as a driver, but also mentioned that it often did not have an important role since LSP contracts often are short-termed. A common system of viewing drivers and barriers on is to divide them into internal or external, where there seems to be a majority of external barriers, rather than internal barriers (Mathiyazhagan et al., 2013). Colicchia et al. (2013) also found that regulations would be a type of driver to green logistics, but that it also was found to be a barrier as well, stating that being compliant to regulations is of high importance and that a heterogeneity between and within countries made the process of greening the logistics through environmental initiatives harder. Carter and Dresner (2001) lists the barriers to green logistics or environmental projects as the lack of communication and coordination, unreasonable requests, inactivity, technical difficulties and costs. Pålsson and Johansson (2016) see costs and deliveries (time, flexibility, quality) as logistical barriers, lack of competence, IT or motivation as organizational barriers, contradictory laws and regulations and the working environment as external prerequisites and lastly the lack of infrastructure, technical know-how or commercial solutions as technical barriers.

Mathiyazhagan et al. (2013) name regulations, poor supplier commitment and industry specific barriers as external barriers whilst cost and lack of legitimacy are internal barriers.
This gives a perspective on how the barriers can be divided into sub-groups in order to be understood. Carter and Dresner (2001) also lists different techniques for overcoming the barriers of environmental projects as the early identification of problems, buy-ins, training of personnel, coordination, innovation and frequency of interactions, but how to overcome the barriers of green logistics is not a primary objective to this study. From the drivers and barriers found for green logistics, a table presenting these has been developed. Table 3 presents the drivers and barriers of green logistics that are divided into internal and external drivers or barriers according to Mathiyazhagan et al. (2013) who presented the inter- and intra-organizational perspective. The drivers and barriers of green logistics are divided into the five areas of costs, performance, image, customers and competitors and regulation compliance. The areas are also defined with a reference to the source of which paper it was acquired from.

Table 3. The drivers and barriers for green logistics.

<table>
<thead>
<tr>
<th>Drivers and barriers for green logistics</th>
<th>Area</th>
<th>Area defined</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green logistics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Internal/External</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Drivers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal drivers</td>
<td>Costs</td>
<td>Cost reduction (Carter and Dresner, 2001), financial return on investments and decrease fuel bills (McKinnon et al., 2010).</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
<td>Increased environmental performance (Carter and Dresner, 2001) reduce logistics flows, optimize flows, develop alternative networks (McKinnon et al., 2015), increase supply chain efficiency and to lower risks (McKinnon et al., 2010).</td>
</tr>
<tr>
<td></td>
<td>Image</td>
<td>Corporate responsibility agenda, improve public relations (McKinnon et al., 2010) and improve corporate image (McKinnon et al., 2010).</td>
</tr>
<tr>
<td></td>
<td>Customers and competitors</td>
<td>Customers and competitors includes competitive advantage, satisfy customer requirements (Colicchia et al., 2013; McKinnon et al., 2015), differentiation from competitors (McKinnon et al., 2015) and improving investor relations (McKinnon et al., 2010).</td>
</tr>
<tr>
<td></td>
<td>Regulation compliance</td>
<td>Regulatory compliance (Colicchia et al., 2013; McKinnon et al., 2015) and government compliance (McKinnon et al., 2010).</td>
</tr>
<tr>
<td><strong>Internal barriers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Costs</td>
<td>Costs (Carter and Dresner, 2001; Mathiyazhagan et al., 2013; Pålsson and Johansson, 2016).</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
<td>Technical difficulties (Carter and Dresner, 2001), lack of competence, IT, motivation, lack of infrastructure, lack of technical know-how, lack of commercial solutions, the working environment as well as delivery time, flexibility and quality (Pålsson and Johansson, 2016).</td>
</tr>
<tr>
<td></td>
<td>Image</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Customers and competitors</td>
<td>Lack of communication and coordination, unreasonable requests, inactivity (Carter and Dresner, 2001), lack of real customer commitment (Colicchia et al., 2013), poor supplier commitment and industry specific barriers (Mathiyazhagan et al., 2013).</td>
</tr>
<tr>
<td></td>
<td>Regulation compliance</td>
<td>Regulations heterogeneity between countries (Colicchia et al., 2013), lack of legitimacy, regulations (Mathiyazhagan et al., 2013) and contradictory laws and regulations (Pålsson and Johansson, 2016).</td>
</tr>
</tbody>
</table>
Sarkis et al. (2011) presented the idea of an ecological modernization, meaning that a new systemic eco-innovation theory is used in order to jointly achieve industrial development within different sectors as well as environmental protection through innovations and technological developments. By investigating the development of green logistics through its innovations a similar theory is developed. From the logic of a joint theory of developing and protecting the environment at the same time the green innovations within green logistics can be investigated. As green logistics serves as the environmental protection within the industrial development the conclusion can be drawn that the drivers and barriers that has been identified for green logistics, which can be seen in table 3, also serves as the drivers and barriers for developing green logistics by the logic of the joint theory that Sarkis et al. (2011) procured.

3.4. Green innovation within 4PLs

3.4.1. Defining innovation

Many people have put forward their definition of innovation as, what it is and what it means. Bessant et al. (2005, p. 1366) writes: “Innovation represents the core renewal process in any organization. Unless it changes what it offers the world (product/service innovation) and the ways in which it creates and delivers those offerings (process innovation) it risks its survival and growth prospects”. This is similar to Bledow et al. (2009, p. 305) who define innovation as “the development and intentional introduction of new and useful ideas by individuals, teams, and organizations”. People outside the business research area has also put forward their interpretation of the word innovation as the current president of USA Barack Obama who defined it as:” Innovation is the creation of something that improves the way we live our lives” quoted by Nussbaum (2007, p. 6). The common ground for the various definitions of innovation is that it is about creating something new and something that is valuable.

3.4.2. Managing innovation

In order to manage innovations, taking ideas and making them into successful innovations, Bessant and Tidd (2007) point out that innovation should not be represented by a cartoon image of a man with a lightbulb above his head, but innovation is a process that need to be managed for turning ideas into reality. The process of innovation consists of the generation of innovation possibilities, to have the ability to strategically select from the generated options and lastly to implement it to make the innovation happen, as presented in Figure 8. The ability of searching for signals that generate innovation possibilities mean that a manager must be
able to see innovation triggers of all types of technological opportunities, changing requirements on certain markets, even if they come in the form of legislative pressures or competitor actions. Vandenbosch and Saatcioglu (2006) define the key to innovation as the selective encoding, meaning the ability to pick out relevant information, which Bessant and Tidd (2007) define as the generating of innovation ideas in figure 8 and explains the management of innovation, that show how ideas can be generated through proactive linkages, strategic linkages within an innovative organization, but the need for innovations have not been previously explained. Many researchers of innovation have investigated whether organizational innovations are driven by the market demand or by technological shifts.

When organizational members recognize that there is a need for change or recognize that there is a new type of technology, innovation behaviors often commence which can be of a push or pull structure. Innovation is usually triggered when the organizational members find a performance gap in terms of a problem or opportunity that appears. Innovation is triggered by new technology which promises to enhance the organizational performance (Zmud, 1984). This is enhanced and clarified by Chidamber and Kon (1994) who explains that the pull (market demand for innovation) is when an organization innovates based on market needs and that the push (technological shifts) is driven by science when organizational changes in technology takes place. It is important to identify whether a company follows a push or pull strategy in order to truly see how their innovative capability is since both the push and pull strategies can be important for realizing new innovations (Zmud, 1984).
Generating innovation ideas can come from an internal bright idea or an external idea from outside of the organization. No matter how innovation ideas are generated, organizations must have an extensive way of searching and scanning for new ideas in order for the process of innovation to take place. Once the generating of ideas has been completed, the strategic selection of what possible innovations to continue on takes place. The selection is risky in terms of resources that are assorted to the potential innovation commitment and what potential rewards that may be generated from it, as the end result is unknown. The stage of selection circles around the organization's ability to make strategic choices, where the idea should fit the business strategy, or build on knowledge that they already possess and the idea should be possible to continue on with the current skills and resources that the organization has. The implementation of innovation is basically the process of relating new information to pre-existing knowledge in the right way (Vandenbosch and Saatcioglu, 2006). The implementation is the making of the ideas into reality, where a new product, service, change in a process, or the business model is shifted. The implementation is the process of putting knowledge together, whether it be knowledge about technologies, markets or competitor behavior to create the end result which is a successful innovation (Bessant and Tidd, 2007).
Bessant and Tidd (2007) also explain the management of innovation that is through strategic leadership as well as the ability to conduct strategic direction and deployment as can be seen in Figure 8. Vandenbosch and Saatcioglu (2006) stated that managers often have problem with the innovation process, which is why Bessant and Tidd (2007) discuss that the need of an innovative organization is essential for the process of innovation to be successful, where the structure and climate of the organization enables people to deploy creativity and knowledge sharing in order for change to take place. Innovation is not a solo act, so proactive linkages that consists of suppliers, customers, sources of finance, skilled resources and knowledge contributes to the generating of innovative ideas. When outsourcing strategic business functions, it may affect the ability to innovate negatively according to Hoecht and Trott (2006) who claim that outsourcing may cause leakage of information so that a company can lose knowledge about how certain function works and that companies may find it harder to make key decisions when they no longer have full knowledge about the certain function.

3.4.3. Service innovation

Although there are many similarities between service and product innovation (Evangelista and Sirilli, 1998) there has been a distinction of service innovation which inhabits certain specific characteristics according to Nijssen et al. (2006). Services has according to Tatikonda and Zeithaml (2002) a real time production and therefore innovation of new services is closely connected by modifications of the delivery process as well as in changes of the frontline employees’ skills. Meaning that new service development and service delivery has a high interaction and dependence on each other which cannot be compared to a new product development context. New service development (NSD) need to be integrated with new operations and processes with the already existing business activities. Menor et al. (2002) explain that front and back office functions must be integrated in their operation to overcome differences in objectives and time-horizon. Front office meets the customer and is commonly designed to satisfy customer needs while the back office tries to maximize the efficiency. This can create conflicts when new services are being developed. Nijssen et al. (2006) argues this might be reason why envisioning, energizing and enabling capabilities is important as well as communication and coordination for new service development. Fitzsimmons and Fitzsimmons (1999) suggest that the process for service innovation is developing in cycles rather than in a linear way with four major phases (Figure 9). Design and analysis represent the phase for planning the NSD when crucial decisions of the market viability, internal resources and capabilities is considered. The development and full launch can be seen as the
The execution phase of the NSD. The execution phase is dependent by the service delivery system design, use of enablers, cross-functional development efforts.

Figure 9. The NSD process cycle. Acquired from “New service development: creating memorable experiences”, by Fitzsimmons and Fitzsimmons (1999).

Innovation in services can be described with different characteristics as being of an incremental or radical nature (table 4). Radical innovation is about major changes in service offerings or in market targeting. Incremental innovation refers to making a small improvement or a taking small step in a continuous developing process (Menor et al., 2002). The classification of radical and incremental innovations may provide information as to how organizations innovate.

Table 4. Classification of new services. Adapted from “New service development: areas for exploitation and exploration”, by Menor, Tatikonda and Sampson (2002).

<table>
<thead>
<tr>
<th>New service category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Radical innovations</strong></td>
<td></td>
</tr>
<tr>
<td>Major innovation</td>
<td>New services for markets as yet undefined; innovations usually driven by information and computer-based technologies</td>
</tr>
<tr>
<td>Start-up business</td>
<td>New services in a market that is already served by existing services</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>New services for the market presently served</td>
<td>New service offerings to existing customers of an organization (although the services may be available from other companies)</td>
</tr>
</tbody>
</table>

**Incremental innovations**

<table>
<thead>
<tr>
<th>Service line extensions</th>
<th>Augmentations of the existing service line such as adding new menu items, new routes, and new courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service improvements</td>
<td>Changes in features of services that currently are being offered</td>
</tr>
<tr>
<td>Style changes</td>
<td>Modest forms of visible changes that have an impact on customer perceptions, emotions, and attitudes, with style changes that do not change the service fundamentally, only its appearance</td>
</tr>
</tbody>
</table>

### 3.4.4. 4PLs and innovation

Garner (2016) describes the results from the 2016 global logistics survey that innovation among LSPs was the second largest factor for gaining new business in the last 12 months (Figure 10) and that for the coming 18 months (figure 11) innovation was viewed to be the largest factor for gaining new business.
In figure 10 and 11 Garner (2016) shows that logistic companies need to innovate in their logistic services to gain business and how demand for innovation is likely to increase in the future. 4PLs way of conducting innovation is characterized by their core business of providing logistics service to other firms, meaning that their innovation is likely to be in the area of logistics innovation defined by Flint et al. (2005 p. 143.) as "any logistical related service from the basic to the complex that is seen as new and helpful to a particular audience". However, 4PLs do possess the possibility to innovate outside the logistics operation area to other parts of the organization (Busse and Wallenburg, 2011). The innovation process within 4PLs is closely connected to their customers according to Carbone and Stone (2005). 4PLs
has a close relation to their customers, customer’s customer and suppliers due to their role acting as a central part of supply chains. Wagner (2008) explains that firms want to partner with LSPs to ensure speed, cost effectiveness and reliability. The globalization of markets also makes the competition fiercer. Another part of globalization is that manufacturing is outsourced from western countries to low cost countries (Bardhan and Kroll 2003), giving birth to new complex supply chains that creates the need for advanced logistics management. This means that 4PLs core competencies are well desired on the market but they need to be innovative in their offerings according to Flint et al. (2005) as well as collaborating in planning and execution with their customers’ logistic strategies. To manage logistic innovation Flint et al. (2005) describes four key activities as:

- Setting the stage activities - Designing an environment that helps the firm to interact and listening to customers and to become innovative.
- Customer clue gathering - Involving and getting information about the customers.
- Negotiating clarifying and reflecting - Overcoming resistance to make change possible as well as understand the implications of future changes.
- Inter-organizational learning - Is about how LSPs and customer organizations can learn from each other by getting new insights and understandings.

4PLs seem however to have difficulties in their innovative offerings to shippers as Garner (2016) states that LSPs ability to innovate is their largest shortcoming from a shipper perspective Figure 12.

![Figure 12](image-url)  
Figure 12. Where do LSPs most often come up short? Acquired from “Global Logistics Report 2016”, by Garner (2016).
3.4.5. Green innovation

Green innovation is about making new and valuable creations which in some view also has a beneficial impact on the environment. Chen et al. (2006, p. 334) define green innovation as “innovation that is related to green products or processes, including the innovation in technologies that are involved in energy-saving, pollution-prevention, waste recycling, green product designs, or corporate environmental management”. Green innovation is therefore an important part of green logistics, where the concept is widely investigated and enlightened in order for example, reducing GHG emissions (Dekker et al., 2012; McKinnon, 2010). So making the change towards green logistics will create a demand for firms to make green innovations. The various definitions of innovation imply that there are several ways in which firms can innovate, not only in product/service. The inter-relationship between the different types of green innovations can have a significant effect on each other as well as performance. Cheng et al. (2014) argue that the inter-relationship different types of green innovation can be divided into: organizational, product and process green innovations, where organizational green innovation is the most important one. The green organizational innovation contributes to strengthen the performance of both product and process green innovation as well as business performance by upgrading organization management processes and methods in business practices. Wu and Dunn (1995) also state the importance of economic benefit while acting to preserve the environment, since financial loss would decrease the desire of the environmental friendly action in a competitive business environment. The creation of environmental friendly products/services that also is profitable is sometimes referred as eco-efficiency defined by Dias-Sardinha and Reijnders (2001 p. 73.) as the “reduction of resource intensity and minimization of environmental impacts of production and products/services, together with value creation by continuous incremental improvement”. To further understand 4PL and green logistics Lin and Ho (2008) explored six important factors that would positively influence the intention of adopting green innovations for LSPs consisting of:

- Explicitness and accumulation of green practices.
- Organizational encouragement.
- Quality of human resources.
- Environmental uncertainty.
- Governmental support.
Higher explicitness of green practices helps the firm to spread the knowledge throughout the organization and raise the intention to adopt green innovations. Accumulation green practices would enlarge the knowledge base, making it easier to relate green practices to the logistics operations. Organizational encouragement and support is important to motivate employers to adopt environmental practices especially the support from the top management. High quality of human resources means that employees have the knowledge to adopt and implement green practices. When companies face environmental uncertainty it might create higher instability and chaos that can foster innovation in the company. Governmental support by creating incitements as providing beneficial regulations is one positive influence on LSPs intention to adopt green innovations (Lin and Ho 2008).

### 3.5. A framework

Based on the literature review and the CIMO-logic a framework for the paper has been created. Figure 13 shows the four critical factors and how the drivers and barriers for innovating green logistics are included and connected to green innovations. The context is 4PL as well as their impact on the environmental aspect as illustrated in figure 13 with the intervention of green logistics which is achieved through the mechanism of green innovations. The mechanism is effected by the drivers and barriers of innovating green logistics as illustrated. The intervention of green logistics and the mechanism of green innovation builds a connection as to how green logistics innovation is generated and managed. The outcome of the framework will consist of environmental benefits through green logistics for the 4PL industry. Despite that the framework is following the CIMO-logic this paper will not focus on the outcome of what environmental benefits may occur and what implications they may have.

![Figure 13. The framework of the paper.](image-url)
4. Results

4.1. Innovation audit tool

The following figure 14 presents how the management of F.H. Bertling AB is aligned in terms of the dimensions of strategy, learning, innovative organization, linkages and learning. It is based on the questionnaire and innovation audit tool acquired from Tidd et al. (2005) and was answered by Göran Andersson and Niklas Amour, who manage F.H. Bertling AB as well as its subsidiary company Bertling Enviro.

![Innovation audit result of F.H. Bertling AB.](image)

Figure 14. Innovation audit result of F.H. Bertling AB.

Following Table 5 presents the exact scores of the dimensions presented in the previous figure 14 and was acquired by adding the results of Göran Andersson and Niklas Amour and then divided on the number of questions per dimension.

Table 5. Five dimensions of innovation at F.H. Bertling AB.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Score</th>
<th>Strategy</th>
<th>Processes</th>
<th>Innovative organization</th>
<th>Linkages</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>4.1</td>
<td>4</td>
<td>5</td>
<td>5.4</td>
<td>4.5</td>
<td></td>
</tr>
</tbody>
</table>
4.2. Case Company - F.H. Bertling AB

The Bertling Group was founded 1865 in Germany as a freight forwarding, brokerage and agency business. The Bertling Group has international coverage today and employs about 1100 people, providing expertise services in ship broking freight forwarding and naval architecture. The Bertling Group set up their operations in Sweden the year 1991 by creating the investigated case company F.H. Bertling AB and they have today offices in Gävle and in Göteborg that is the head office for Scandinavia. Since the start in 1991 F.H. Bertling AB have endeavored a lot challenges with fluctuating market demand and continuing changes of their business vision. F.H. Bertling AB have a great deal of independence from the Bertling Group because of the entire concerns business strategy and also due to that the top management in Bertling Sweden are also owners in the company. F.H. Bertling AB provide tailor made logistic solutions for its clients acting as an independent 4PL service provider.

Their forwarding services are wide and include air, sea, road and rail transportations modes. One of F.H. Bertling AB’s biggest area of expertise is in the forest industry which represents about 70% of their total turnover with handling the logistic operations for forest companies. F.H. Bertling AB also provides door to door services (including customs) and warehouse services as packing/unpacking, material control and consolidation/deconsolidation. F.H. Bertling AB have also a specialization of handling the logistics of big projects as moving large structures to place as: big Russian airplanes and living quarters for oil rigs. To fulfil these projects logistically F.H. Bertling AB offers expertise services which include tasks as: transportation, planning, heavy lifting, risk analysis and so on. The structure of The Bertling Group concern is presented in figure 14 where the targeted areas for this study are seen as well as what connection the interviewees have to F.H. Bertling AB. The figure clarify that F.H. Bertling AB include Bertling Enviro.
4.2.1. Bertling Enviro

Bertling Enviro has conducted business since 2014 under the management of the director of operations Niklas Amour and the top management of F.H. Bertling AB including the director Göran Andersson which are also the interviewees of this study. Bertling Enviro is positioned in Göteborg and also has one British employee who deals with the business conducted in the UK where he is also positioned. Bertling Enviro focuses on the waste management industry and is a trading house company working closely with F.H. Bertling AB. Together they offer a business package where Enviro buys, owns and sells refuse derived fuel (RDF) and F.H. Bertling AB provides the logistics. Their business package includes necessary licenses, administration, and door to door transport. Bertling Enviro has since its launch conducted business by importing RDF from the United Kingdom (UK) to Sweden for energy recovery. Their positioning in the supply chain of delivering RDF supply to thermal power plants is presented in figure 16 and also shows how Bertling Enviro gets paid by their suppliers and pays their customers/receivers as well as F.H. Bertling AB for logistics services. Figure 16 also presents how Bertling Enviro conducts business as they move goods from what typically is their final destination with the purpose of creating and capturing value or proper disposal.
Göran said that they performed reverse business as they get money for buying the goods from the supplier and pay money to the customer when selling the goods.

![Diagram of business flow](image)

**Figure 16.** Bertling Enviro as a trading house. Acquired from F.H. Bertling AB slideshow (2016).

The process of importing RDF to Sweden from the UK consists of the customers making orders and the customers are plants in Sweden that produces energy from RDF (I). Once the order is registered the gathering of RDF bales from the energy from waste (efW) plant suppliers in the UK is commenced (II). The last step is the transportation of the bales from the UK to Sweden that is conducted, handled and maintained by Bertling Enviro (III). The transport is multimodal where most of the distance traveled is by ship and is thereafter conducted through truck transportation from harbor to customer. Their three main energy plant customers in Sweden are Renova, Tekniska Verken and Målarenergi. Bertling Enviro manages the transportation from door to door with just in time (JIT) delivery.

Bertling Enviro has six efW plant suppliers in the UK that processes, shreds, separates and packages the RDF to bales. The bales of RDF are then loaded into containers to ship the material in, in order to reduce direct handling of the bales as specified by the three contracted receivers of RDF in Sweden. One crucial part of Enviros innovative business idea was to move these RDF bales in containers and using containerships to ship them to Sweden. The UK was a fitting nation to ship from since it has a lot of import leaving it with an abundance of empty containers. Some regions in Sweden (Gävle, Norrköping, Göteborg and
Helsingborg) have the opposite problem with a lot of export and little import that creates a demand for empty containers in Sweden. Another aspect to the business was described by Niklas who explained that the UK have an incapacity to use the RDF as fuel since their waste management in the past has been focusing on deposition as most of their waste still ends up in landfills they therefore lack the infrastructure to effectively burn the RDF to create energy. Sweden however have many power plants using RDF for fuel to create heating for houses. This process is claimed by Niklas to be much more energy efficient than to create electricity from the RDF although it demands another type of infrastructure which Sweden have, to transport the heat. Both of the interviewees from Bertling Enviro have stated that there is competition but that the competitors are not as advanced as they are because of their early commencement of the importation of the RDF business, making the competitors copycats of inferior design in comparison to Bertling Enviro, despite that some of their competitors may be larger in size. They are however in the process of catching up with Bertling Enviro.

Göran mentioned that there is critique to using RDF as a source of energy from some individuals as the consumption of RDF releases GHG emissions and pollutants. But he also added the energy created from RDF must come from somewhere and other ways of gaining this energy have a greater impact on the environment than RDF so from a broader perspective GHG emissions are reduced by importing RDF.

4.2.2. Linkages
Bertling Enviro is closely connected to its suppliers and customers in their innovation work as they conduct many development projects with their customers/suppliers. These projects mainly concern the process of rationalizing in order to be able to conduct continuous improvements within their business between them and their customers to reach customer satisfaction. Göran also highlights the great importance of relations that is needed to conduct and develop new green innovations and that they work closely with their customers and other external parties. As Bertling Enviro is a small and newly founded company it does not possess the resources to have a large manpower with competence in a broad amount of sectors. In order to counteract their lack of competence in some areas they use external partners to fill the knowledge gap that may emerge at certain times. An example that Niklas brings up took place before the launch of the RDF importation operations where they needed to investigate if it would be completely safe to transport RDF in containers. To clarify there were some who suspected that methane gas could develop from the RDF in the shut containers and be
explosive during the shipping. To do this they hired in external experts to investigate this and it turned out to be a safe method of transporting RDF. They still use external experts from time to time when a dilemma comes up that is not their core competence instead of having a larger labor force. They also used an independent firm to investigate the environmental implications for the RDF importation to analyze the net effect of GHG emissions comparing importation to Sweden and burning them for fuel versus leaving them in the UK for landfill.

4.2.3. Generate, select and implement

Generate

Göran explains how they in the beginning could “reach out their hands through the windows” and grab affairs as if they would be “fried sparrows”, cooked and ready to eat. This is no longer the case however and they have realized that the market competition is getting tougher so they must be able to generate new ideas in order to gain business. Bertling Enviro uses no standardized processes to generate innovations. The way they innovate is by employees coming up with what can be seemed as random ideas although that is not entirely the case. Recently the people at F.H. Bertling AB have started to realize that they need to innovate into other sectors. Göran explained that he sees innovation as a requirement for survival as he expect a lot of their business to be obsolete in the future since digitalization is at risk to replace a big chunk of their logistic services. Therefore F.H. Bertling AB is looking for new business opportunities and in the Enviro case they are trying to find new ways to be innovative in the waste management sector by applying the experience and know-how of logistics that the F.H. Bertling AB possess. Göran express how he thinks that the waste management sector will develop to be more green but as well to be more global. During the 2015 United Nations Climate Change Conference 195 nations agreed to the goal to lower the GHG emissions and avoid global warming reaching higher than a 2-degree increase. The EU has set a goal to reduce the amount of landfill and instead reuse and recycle more of our waste. Göran interprets these events as signals that the world is focusing more and more on the environment and thus strengthen his view that F.H. Bertling AB and Bertling Enviro should innovate in this direction by applying F.H. Bertling ABs’ knowledge of logistics and build environmental knowledge and capabilities in Bertling Enviro to generate new green innovations. They recently tried a workshop to create new innovations in this particular subject. Göran and Niklas states that the workshop was successful and it helped people to think about new ideas and share knowledge and to further develop this process they talk about taking in people from outside with different views and knowledge to further stimulate the
innovation process of the workshop. However, Göran states they do not really have the “man power” at the moment to fully go through with the workshop development. Göran and Niklas seem to be confident in what area they want to innovate in and go from dealing with RDF energy fuel to innovate their business into recycling and reusing materials.

Select and Implement

Selecting what innovations to carry on with is a decision made by the top management. Göran explains how the top management of F.H. Bertling AB are also owners of the company meaning that they have a lot of independence when making decisions. They can make long term plans without any need to satisfy short term demands of return on investment to shareholders but they are deeply influenced by their suppliers and customers. Göran and Niklas explain how they view their suppliers and customers as business partners and how their endorsement of the Enviro case was a big factor for selecting and continuing with the case. Another factor for continuing with Bertling Enviro were the risks of the business operations are completely different from the risk F.H. Bertling AB faces in its other business. The selection seems to be conducted without any standardized process instead the top management can pick what ideas they think is right making the process fast. However, since F.H. Bertling AB have a mother company some considerations may have to be done so that the innovation is in line with the Bertling Group’s way of conducting business and avoid creating any risk for their mother company. Laws and regulations is also a factor for choosing what innovations to select as in the Enviro case. Niklas explains how transporting military equipment to Afghanistan was easier than transporting RDF from the UK in terms of laws, regulations and documents needed making it a major consideration for Enviro.

F.H. Bertling AB have tried different options of transportation route from the UK to the Swedish power heating plants in order to find the most environmental friendly route. The route they use today is mostly by ship as they say that trucks are inferior from an environmental friendly perspective. An example is when they were investigating their route to the customer Tekniska Verken located in Linköping. They discovered that Linköping previously traveled to Hässleholm to get RDF from the Swedish market. As Bertling Enviro already used ships to get to Swedish harbors Bertling Enviro could present a more environmental friendly alternative by travelling 20 kilometers in the UK, taking the harbor in Felixstowe to a harbor in Sweden and then drive 30 kilometers by truck to reach Linköping.
Göran explains how small innovations can be selected and implemented immediately. If an employee comes up with a way to innovate their business making a process a little more efficient the selection and implementation phase can be fast for these types of small innovations.

4.2.4. Leadership

Bertling Enviro is managed by Niklas as the director of operations and also by top management of F.H. Bertling AB including Göran as a director and owner. In order for the management to develop new ideas they believe their past to be important. By looking where they have been they can identify how they have worked and how they have thought previously. This will help them to see how they want to work today and follow a clear direction of where to go and what to do. Göran mentions that it is important for the Bertling Group that owners must be involved in affairs and that it avoid creating institutions with owners who do not understand how the company do business. Göran’s definition of a leader is an individual who makes decisions, whether it is good or bad decisions. It is important to realize if you make a bad decision you can correct it and learn from your mistake. Göran also adds that the worst thing a leader can do is to not make any decisions, but it is preferable if a leader makes more rights than wrongs. F.H. Bertling AB are very independent from their mother organization as they serve as a separate company.

4.2.5. Innovative Organization

Niklas stated that there are remarkable cultural differences between the Swedish and the British way of conducting business and also said that none of the ways was better or worse than the other. Instead of comparing the ways of operating they should learn from each other as Niklas said that the sometimes must learn to be more “British” and that the brits must learn to be more “Swedish”.

F.H. Bertling AB have flat organization meaning that there are few hierarchy boundaries for information to flow through the organization as mentioned by Göran who also claim that the employees have the ability to quickly implement smaller innovations. The idea for the Enivro case was started by the chief accountant who first brought up the idea of transporting waste. The idea was then later developed into Bertling Enviro.
4.3. Drivers and barriers for innovating green logistics

4.3.1. Identified drivers

Bertling Enviro identified many drivers and barriers that they had experienced when conducting business which consisted of both internal and external factors. The main drivers that Niklas mentioned was the opportunities that emerged from Sweden not being able to produce enough waste, as he stated that Swedes are too good at recycling and therefore cannot fill the gap of roughly 2 million tons of RDF that is needed at Swedish energy plants per year which explains the need for importing RDF from the UK. There is also a great need for empty containers in Sweden because of the high level of export which has resulted in an unbalance of containers on the market. Because of these reasons there is a great interest of importing RDF. Niklas also stated that this may not be a business to conduct in 10 years’ time and that they must reach out to other markets. Göran stated that one way of driving them towards becoming more green as well as solving their problem of the market potentially disappearing is to reach higher in the waste hierarchy, presented as figure 4 by Gertsakis and Lewis (2003), and open up a market for recycling and reusing waste instead of only extracting energy from it. No matter what market they will conduct business within in the future both Göran and Niklas sees a bright future for Bertling Enviro as they expect a continued growth by developing and creating a stronger brand on new markets through innovative ideas.

Bertling Enviro has received a strong financial result and although heavy investment in its cradle state Niklas and Göran are expecting Bertling Enviro to reach a full return on investment after a merely one and half years in operation. Göran also said that laws or regulations from authorities and governments may seem like a heavy chore today but that they also will contribute to some good business opportunities in the future. A driver to a potential future green logistics project that they had discovered would be if EU would support Bertling Enviro financially to construct a recycling factory in a country such as Romania where most of their waste go to landfill. Romania is a country that truly needs a higher level of waste management in order to reduce its landfill for the EU to fulfil their goals of reducing landfill to 50% until 2050. Göran thought that their image was important and believed their involvement with Bertling Enviro could increase their image as a company seeking environmental friendly solutions. However, the import RDF is a controversial subject and some critics are not convinced for the environmental benefits and believe it is not the way we should deal with our waste.
4.3.2. Identified barriers

Göran mentioned three major areas for the project that were important to answer to and possess. The three major areas are financing, authorities and information technology (IT). Bertling Enviro follow strict regulations in terms of laws from both the Swedish and English governments as well as from other nations. The regulations concerned the shipping itself and meant that each nation/region have their own regulations, demanding Bertling Enviro to have the correct papers and licenses for each nation/region they enter a harbor in. This created difficulties when rerouting the ships.

The English legislation agency Transfrontier Shipments of Waste (TFS) is governed by EU-rules and regulations which requires Bertling Enviro to have an obligatory document of permit in order to export waste from the UK. TFS also limits how much RDF that can be exported in terms of time and volume that affects all transporters in the chain and requires a detailed route description. In addition to this, approval is required for all involved agencies. Göran explained that the paperwork required for importing RDF to Sweden from the UK is very complicated and requires a lot of work in comparison to other markets where the environmental aspect is not as highly prioritized where the paperwork is close to zero. Permits and licenses do not only demand paperwork they do also cost money in terms of fees. Except regulations from governments there are also internal regulations of which any section of F.H. Bertling AB must follow in order to maintain control and movement of the goods. In order to be able to control movement of containers and ships a type of movement documentation is required as all ships and containers are expected to be found through their documentation. This is achieved by maintaining a document per shipping (meaning container) which follows the goods to the end destination where the information is reported back and documented.

In order to export RDF from the UK the TFS agency requires a financial bond from F.H. Bertling AB to make sure that if an accident happens that leads to any extra costs F.H. Bertling AB will stand for the payment of repairs, taxes or cleaning etc. instead of the efW plant suppliers. The financial bond covers all deliveries in motion and serves as an obligation to demonstrate the collateral value is sufficient and is paid every time a shipment takes place. The bond is repaid to F.H. Bertling AB once the shipment of containers with RDF is delivered to the customers in Sweden. Göran was very clear when saying that regulations are a major barrier to their conduction of business as it leads to more work and increased costs, but he
also mentioned that regulations also serves as a driver in the way that it makes them want to become better and to create a demand for their environmental friendly logistic solutions.

A previous affair conducted by F.H. Bertling AB consisted of supplying troops in Afghanistan with military equipment where they experienced the laws and regulations as less of a barrier than in the Enviro case. The collaboration with Afghanistan required less paperwork when delivering the goods nor did they encounter the complicated environmental regulations as in the Enviro case. To show how complicated and resource demanding the environmental laws and regulations are that affects Bertling Enviro Niklas stated that it was easier to transport military equipment to Afghanistan than shipping RDF to Sweden.
5. Analysis

F.H. Bertling AB is described by themselves as a network integrator in line with the definition given by Seyed-Alagheband (2011) of a 4PL, meaning that they are managing supply chains and most important for F.H. Bertling AB they offer tailor made logistic solutions. Wagner (2008) states how companies want to partner with LSPs to ensure speed, cost effectiveness and reliability in logistics. But in the case of Bertling Enviro the scenario was slightly different and in reverse since F.H. Bertling AB acted on the other side of the deal and not by partnering up with someone they set out to create their own capabilities by creating their own partner. Their creation is called Bertling Enviro and is a trading house dealing with something called reverse logistics meaning that they are handling the logistics after the original product have been consumed (Salema et al., 2007). The questionnaire shows that F.H. Bertling AB got a high test score in the dimension of innovative organization (figure 14) with a value of 5 (table 5). This might explain how they were able to pick the idea for Bertling Enviro’s business that originated from the chief accountant and then further develop the idea to Bertling Enviro by creating a new subsidiary company. Another reason for starting Bertling Enviro was to divide the risks since Bertling Enviro was affected by completely different risks than F.H. Bertling ABs other business as a 4PL. Another circumstance that might have affected the creation of Bertling Enviro is F.H. Bertling AB’s history with environmental uncertainty (Lin and Ho, 2008) making them used to large changes and therefore reduce resistance or hesitance towards new ideas.

5.1. Generating and managing green logistics innovation

F.H. Bertling AB and Bertling Enviro are close connected in their partnership and conduct a lot of innovation together while F.H. Bertling AB brings the expertise in logistics Bertling Enviro builds the knowledge and capabilities for green innovations. F.H. Bertling AB do not have or use any clear structure for their innovation management which also might be reflected with their lowest score in the innovation audit tool seen in figure 14 with the score of 4 (figure 15) but in the case of Bertling Enviro different phases could be identified and events categorized within the model of Bessant and Tidd (2007) as well as Fitzsimmons and Fitzsimmons (1999) although the events and processes lack standardization in the company. However, the actions of Bertling Enviro of changing shipping destinations and trying out
different options shows that the Enviro case is not only a one-way innovation showed by Bessant et al. (2005) but also have the characteristics of The NSD process cycle showed in figure 9 by Fitzsimmons and Fitzsimmons (1999) of continuing improving and more important adjust their service to dynamic externalities as shipping routes. Generating ideas for new innovations is conducted in a search area that is well defined as to look for logistic business in waste management. F.H. Bertling AB and Bertling Enviro decided to search in this area since big institutions as the EU that wants to reduce landfill and UN that wants to reduce GHG emissions as well as others who have indicated that this is a growing sector with possibilities of big opportunities. All these provided signals or what Bessant and Tidd (2007) call trigger to F.H. Bertling AB and Bertling Enviro for generating innovation possibilities. While the knowledge and connections in logistics is broad the green knowledge and connections outside the logistic area is not as well developed. However, F.H. Bertling AB and Bertling Enviro are currently developing these capabilities since they have come to the same conclusion as Vandenbosch and Saatcioglu (2006) and Bessant and Tidd (2007) who emphasize the importance of having linkages to companies, organizations and people with knowledge that can help generating new innovations. As F.H. Bertling AB and Bertling Enviro seem to be aware of the importance of connections outside the company borders they still face the problem of choosing the right connections and picking the right source of information. Although linkages got their highest score in the innovation audit tool (figure 14) with a score of 5.4 (table 5) and know that they need to find information outside to generate the next generation of green logistics innovations they still have the challenge of having a broad spectrum described by Bessant and Tidd (2007) in which they can find innovative ideas. Since F.H. Bertling AB have a lot of experience in the logistics area Bertling Enviro is still a newcomer to the waste management business, as Göran explained how they were looking for new markets in waste management and finding new business partners was important.

Selecting what innovations to continue with is made by the top management with regards to their customers and suppliers since their close connection in business acting as 4PL with a central role in the supply chain (Carbone and Stone, 2005). When selecting to continue with Bertling Enviro the top management also made the decision to create a subsidiary company since the new business would not fit the core business of F.H. Bertling AB since they wanted to handle the entire business and not just the logistics. This strengthen Vandenbosch and Saatcioglu (2006) who explained that selected innovation projects should fit the business
strategy and that the project should be able to continue with the current skills and resources that the company has. The implementation phase is different depending if the innovation is radical or incremental in nature defined by Menor et al. (2002). Incremental innovations in F.H. Bertling AB could have a short selection and implementation period if the top management agreed to the idea. Radical ideas as the creation of Bertling Enviro had a longer implementation phase and needed more strategic decisions as well as considering its effect on other business in the Bertling group concern. F.H. Bertling AB could in some cases draw benefits from its small size and by having a flat organization that could make fast decisions in innovation or as in this case creating a new subsidiary company to fulfil their innovation business plan. However, their small size also means that they have to be scarce with resources making green logistic innovation a standardized process difficult. One may also reflect if standardized processes for green logistics innovation is something desirable since it might interrupt the stage set for innovation (Flint et al., 2005) and make the organization more rigid for how they innovate making the environmental uncertainty more certain (Linn and Ho, 2008). Another issue is their inclusion of the Bertling Group that mean they need to relate certain decisions to a large concern. When possible innovations had some risks that could possibly damage the reputation and image of all other companies under the Bertling logo. During the implementation phase of Bertling Enviro they used outside sources and partnerships to get knowledge. The outsourcing of certain functions and expertise to people outside Bertling Group concern provide Bertling Enviro with information and knowledge without having a large workforce. However, this creates a situation where F.H. Bertling AB and Bertling Enviro must know when and what to outsource. Another issue to outsourcing functions is that the company may lose capabilities to generate new innovations (Hoecht and Trott 2006) and also lose important accumulation of knowledge (Lin and Ho, 2008).

In the case of developing Enviro, F.H. Bertling AB realized an opportunity for business that was new to the market making it a radical service innovation in the terms described by Menor et al. (2002). That was of an unusual event for them since it was not something that the customer directly had demanded or asked for but more an idea that was discovered by themselves and then offered to the customers in what can be called an innovation push according to Zmud, (1984), Chidamber and Kon (1994). Since the innovation was pushed out it might also have contributed to some of the controversy regarding the import of RDF since it was not a direct demand from the customers and especially not by the consumers and stakeholders who might ask themselves how the import of RDF could benefit them. Later on
the RDF import business has continued to develop in incremental innovations in efficiency and operations this shows that F.H. Bertling AB and Bertling Enviro possess according to Zmud (1984) the important ability to do both incremental and radical innovations defined by Menor et al. (2002).

F.H. Bertling AB and Bertling Enviro have a flat type of organization which also contributes to their high level of integration between the departments avoiding some of the conflicts described by Menor et al. (2002). Göran described that there were few conflicts internally and believed that they could probably benefit from having more conflicts since they can be productive.

5.1.1. Is Bertling Enviros’ business a green logistics innovation?

The literature review of this paper has shown that there has been little research done concerning the sustainability of green logistics, or the environmental sustainability for 4PLs for that matter (Colicchia et al., 2013). In order to investigate if Bertling Enviro conducts a business that can be identified as a green logistics innovation it is important to remember what green is and what Bertling Enviro actually do. This paper has presented green logistics with the focus on the environmental aspects, meaning the research of practices with the main objective that aims to reduce the actions related to negative environmental impacts such as: emissions of GHG from logistical operations. This study is therefore limited to focus on the environmental part of green logistics that contributes into the distribution of a sustainable balance between the economic, environmental and social objectives (Dekker et al., 2012). Therefore, in order for their distribution to be seen as green it requires their transportation solutions to have a less impact on the environment such as produce a lower level of GHG emissions compared to other alternatives as it contributes to the global warming (McCollum and Yang, 2009). Their distribution, meaning the transportation of RDF, consists of mainly transporting using ships for the majority of the way which is seen as green from the perspective given by Chapman (2007) who named ships as the transportation mode that releases the least emissions of GHG suitable for this case, superior over rail, road and air. Also, as Kohn and Brodin (2008) state, transportation over water means that ships may only move from terminal to terminal and therefore requires F.H. Bertling AB to also use a transportation mode inland in order to reach their customers. F.H. Bertling AB do use trucks as a transportation mode as previously mentioned and this can therefore be seen as a critique to their distribution of goods in a green manner because of the increased level of GHG as road
transportation being inferior to water as Chapman (2007) has previously mentioned. Luckily, Bertling Enviro investigated different routes by land as they tried to ship through different harbors and roads before they settled with the current route that turned out to be the most efficient one. McKinnon et al. (2015) shows in the analytical framework of green logistics, presented as figure 5, that the increased level of efficiency of vehicle routing is one of the determinants to green logistics, validating the distribution of goods of Bertling Enviro as green and sustainable, showing that Bertling Enviro take the environmental sector of logistics presented by Giddings et al. (2002) into account. This is also reflected in how they gained their customer in Linköping by presenting a more environmental friendly route than they previously used that once again occurs in figure 5 as a higher utilization of vehicles as well as a better distribution of vehicle kilometers in terms of size, weight and type. Also, as Bertling Enviro already conducted distribution to Sweden by ship they could deliver the goods in a JIT manner that is also presented as one of the determinants to green logistics in figure 5 (McKinnon et al., 2015). Another critique to using truck for the inland transportation is that rail would probably be a better choice in terms of GHG emissions (Chapman, 2007). However, it is also likely that rail would not fit as a transportation mode due to its low flexibility in delivery causing more handling of goods and jeopardize the JIT delivery. The study did not investigate the option of rail as inland transportation mode sufficient to give a decisive answer to whether rail would be a better choice in terms of GHG emissions and business strategy goals to fulfil JIT.

As Bertling Enviro can offer distribution of RDF through using transportation modes that mostly go over water and little transportation on land their transport therefore has a low impact on the environment (Chapman, 2007) and can on one hand be seen as more sustainable than other companies with distribution modes according to the definition of green logistics given by Sbihi and Eglese (2007).

But these initiatives do not make the logistics operations green by themselves since the total amount of GHG emissions increases when comparing import of RDF to Sweden for energy burning to using it as landfill in the UK. However, when using a holistic view as recommended by Wu and Dunn (1995) considering the entire life cycle that the RDF creates energy and heating in Sweden the formula for calculating GHG emissions might be changed. Since RDF can create energy and heating in Sweden it reduces the need for other sources of fuel therefore avoiding GHG emissions. This makes the entire operation of importing RDF as
a reverse logistics green when considering the actual goods that cause the logistics operations to indirectly avoid GHG emissions and lower the effect on the global environment. Also it can be shown that Bertling Enviro’s innovative idea of shipping the RDF in containers can reduce the amount of empty containers imported to Sweden. The transport modes as using ships to the furthest extent and containers to avoid GHG emissions (Chapman, 2007; McKinnon et al., 2015) and costs (Kohn and Brodin, 2008) is well described in the research as means for green logistics. However, none of the researchers take the actual transported goods into account (Chapman, 2007; Kohn and Brodin, 2008; Sbihi and Eglese, 2007; McKinnon et al., 2015), missing a crucial part in Bertling Enviros business that greatly affects the environment by reducing the GHG emissions. This means that the literature might be missing one crucial factor in green logistics. One may question if the goods transported should be included in the research of logistics...

The interviewees did on the other hand mention that there is critique towards using RDF as a source of energy but that the consumption of RDF was preferable to other ways of filling the gap in terms of the need of energy. In order to simplify, the consumption of RDF is a way to reduce the environmental impact that would be higher than any other way of acquiring this level of energy today and it also prevents land fillings, so Bertling Enviro do conduct a business that reduce an environmental impact in terms of GHG emissions. This is according to Dekker et al. (2012) a company that conducts green logistics as they reduce the environmental area of GHG and contributes to the distribution of a sustainable balance between the economic, environmental and social objectives by focusing on the environmental aspect. As Lele (1991) mentioned that many fail to see how the three sectors of society, economy and the environment go together, Bertling Enviro seem to have managed to understand this by procuring a level of balance which counteracts weaknesses to the company's sustainability as Giddings et al. (2002) mentioned. By this definition Bertling Enviro do conduct green logistics and a green logistics innovation.

5.2. Drivers for developing green logistics innovation

As the drivers and barriers for green logistics have been identified previously from table 3 they can be used to investigate whether or not they also serve as drivers or barriers for F.H. Bertling AB’s innovation in green logistics. The drivers are divided into subgroups as seen in table 3, meaning that they follow the drivers and barriers of green logistics, but in order to be seen as a driver to the innovation of green logistics they must per definition be a factor that
encourage or ease the generating and management of green logistics. This definition is developed from figure 8 presented by Bessant and Tidd (2007) of how to manage innovation. The subgroups of the drivers are: financial drivers, performance, image, customers and competitors and also regulation compliance.

5.2.1. Financial drivers
Reducing costs in the business can be seen as a driver for innovating in green logistics (Carter and Dresner, 2001) by actions described by McKinnon et al. (2015) that create higher utilization or lower the fuel consumption. Bertling Enviro mostly use ships as their main transport mode and this is according to Kohn and Brodin (2008) also the transportation mode that is cheapest. Chapman (2007) state it to be the transportation mode with the smallest amount of GHG emissions per kilometer a metric ton is transported. A driver to green logistics found from table 3 regarding costs is the financial return on investments and decreased fuel bills (McKinnon, 2010), and is supported by the interviewees at F.H. Bertling AB who had tried to find the most environmental friendly route that also resulted in a reduction of fuel. Another way of reducing costs is the container shipping that uses the imbalance of containers in the UK and Sweden to create a cheaper deal for shipment and also ship in containers that would otherwise be empty. As the interviewees both stated that cost reduction is an important aspect to their conduction of business as presented, it must also affect their development of green logistics in terms of reduced fuel bills (McKinnon, 2010) and cost reductions (Carter and Dresner, 2001) within the environmental sector as presented by Giddings et al. (2002) within of green logistics, meaning that the driver of costs should be relevant to Bertling Enviro.

Bertling Enviro have experienced a great financial return on investment by expecting full return after one and a half years and is one driver to green logistics as mentioned by McKinnon (2010). The financial driver is the most important without any prospects for return on investment for green logistics innovation there would probably not be any since making enough money to survive in the business is such a crucial factor. This makes the question of being eco-efficient valid for green logistics innovations as Dias-Sardinha and Reijnders (2001) explains the creation of value when innovating in green logistics to be important. This therefore presents the driver of return of investments for Bertling Enviro.

5.2.2. Performance
Bertling Enviro work with much documentation and tracking in order to be as efficient as possible as well as maintaining control. As a trading house they must maintain control in terms of transportation over the entire supply chain, from the supplier to the customer and therefore is aligned with McKinnon (2010) who stated increased supply chain efficiency and reduction of risks as drivers to green logistics, but whether or not they also serve as driver to innovating green logistics must be furtherly investigated.

The Enviro project was commenced because of F.H. Bertling AB seeing the opportunity to exploit the situation of a lack of containers on the Swedish market, something that they also see and define as a driver. This could present a new type of driver to develop and innovate green logistics that has not previously been identified. The driver of exploiting market opportunities in order to generate value and green logistics can however be compared to the driver of increased environmental performance (Carter and Dresner, 2001) in a combination to the performance drivers of optimization and reduction of flows or using alternative networks. These drivers do not fully comprehend the exploitation of market opportunities fully though and may mean that a new factor of market exploitation could be added as a driver to innovating green logistics.

5.2.3. Image

When faced with direct question for how their corporate image is affecting the green logistic innovation Göran explained that their business with Bertling Enviro would probably benefit their corporate image and that they are planning on making a website for Bertling Enviro to promote and show their green logistics innovation. The Bertling Enviro website might provide a channel to counteract the bad publicity about the waste management industry especially RDF burning and show how their operations may benefit the environment. As a result of their green logistics their image has been affected, whereas it has been improved to the better and has given Bertling Enviro an improved corporate image, one of the drivers to green logistics discovered by McKinnon (2010). It is still not clear if an improved image was a driver to F.H. Bertling AB. Their main driver to found Bertling Enviro was as previously mentioned because of the opportunity to exploit the market, that was mainly concerning the economic and environmental sectors presented by Giddings et al. (2002), but an improved image accompanies any company that wishes to become greener. This is related to the driver to green logistics of improved public relations (McKinnon, 2010), a driver that is relevant to Bertling Enviro as they have faced critique to their business as negativity towards energy from RDF. In this case public relations might be of importance since their influence over
politicians constituting laws and regulations. The same laws and regulations that are mentioned as being of great importance for Bertling Enviro’s business. Bertling Enviro do want to become even greener as they want to reach higher up in the waste management hierarchy (figure 4) whereas they want to become better. This can be compared to McKinnon (2010) who stated that one driver to green logistics is to affect their corporate responsibility agenda, and should therefore be seen as a driver to innovate green logistics as Bertling Enviro must create ideas and green innovations as described by Chen et al. (2006) as an innovation related to green products or processes involved in waste recycling in order to become greener and more environmental friendly, an example of how can be through a reduction of GHG emissions (Dekker et al., 2012; McKinnon, 2010). In order to conclude this section, Bertling Enviro do want to improve their image and relations to the public, and they know that in order to do that they can innovate within their green logistics.

5.2.4. Customers and competitors

Göran and Niklas did say that there was competition and that their competitors were bigger in size than Bertling Enviro. They stated that in order for Bertling Enviro to remain competitive they had to be better than their competitors. Since the competition for Bertling Enviro was getting tougher it is easy to say that the increased competition pushes Enviro to innovate further as Göran and Niklas also described how they want to move up the waste management ladder. Competitive advantage and the satisfaction of customer requirements are proposed drivers for green logistics (McKinnon et al., 2015) and as Bertling Enviro are constantly working close with the customers they want to be able to give their customers tailor-made solutions. Their competitiveness is based on their ability to provide the best solutions for their customers, and requires them to develop newer and better deals than their competitors. Competitive advantage can therefore be seen as a driver for innovating green logistics and can be related to the improvement of customer relations (McKinnon, 2010) that they are also working with and the satisfaction of customer requirements (McKinnon et al., 2015) as they also must be innovated within green logistics.

5.2.5. Regulation compliance

Göran thought demands from governments and regulations mainly as barriers whereas they led to unnecessary costs and detours in their daily work. But he also thought that different regulatory compliances as mentioned by Colicchia et al. (2013) and McKinnon et al. (2015) as well as governmental compliance (McKinnon, 2010) could be experienced as drivers to become better and to overcome set goals. As they develop their green logistics, new laws and
regulations may appear that will serve as new goals to overcome, and could therefore be seen as drivers to innovate their green logistics. Göran mentioned the goals by EU and UN to reduce landfill and GHG emissions as major drivers for starting Bertling Enviro. The goals set meant that regulations are likely to increase the demand of Bertling Enviros services since it can help EU and the UN to both reach these goals. Further when these big institutions set these goals nations might start to endorse them and change their waste management to fulfill the goals. This means that the business area for Bertling Enviro might grow when nations no longer will put their waste in landfills and instead want to manage it in a way that create the least environmental impact possible.

5.3. **Barriers for developing green logistics innovation**

A barrier to green logistics of F.H. Bertling AB should be a factor that halted the company's ability to generate and manage green logistics innovation. Bessant and Tidd (2007) has previously presented figure 8 where all the steps of innovation generation and management can be seen. A barrier to green logistics should therefore be presented as a negative factor in the generating and managing of green innovation. The barriers are divided into the same subgroups as the drivers: costs, performance, image, customers and competitors as well as regulation compliance.

5.3.1. **Costs**

Costs are of high importance as managers often only see green logistics as successful if their environmental performance is improved and the costs decrease or remain the same (Carter and Dresner, 2001). The literature conducted made it clear that many researchers found costs to be a major barrier (Carter and Dresner, 2001; Mathiyazhagan et al., 2013; Pålsson and Johansson, 2016) and that is why it was not a surprise when it was also identified as a barrier by the interviewees of F.H. Bertling AB. Different costs also came from governmental taxes or regulation fees as well as the financial bonds. The financial bonds that they must pay may not have been seen as a barrier to the interviewees as the bond is returned when deals are completed. Although the bonds created a risk for Bertling Enviro of losing a large sum of money if the goods were not disposed properly.

5.3.2. **Performance**

Bertling Enviro do have some lack of competence as they are a newly founded company of a small organizational structure with few employees, but their lack of competence is substituted by their hiring of external experts and continuously developing their own competence. This
contributes to Pålsson and Johansson’s (2016) statement that the lack of competence would result in organizational barriers.

Pålsson and Johansson (2016) also mentioned delivery time, flexibility and quality as barriers related to performance when conducting green logistics. This is relevant to Bertling Enviro as they previously tried different routes to find the most environmental friendly one, with most of the transportation of the goods being done by ship, meaning that the flexibility of Bertling Enviro is limited to harbor to harbor freight. However, green logistics may affect the delivery time and the flexibility of shipments but Bertling Enviro manage to deliver JIT with high quality as they have decreased the level of exposure of the bales of RDF. As this is the case delivery time, flexibility and the quality of the goods have not been haltered. Also, as they have tried different routes, created stronger materials for handling bales and developed their way of handling bales during transportation following the NSD cycle presented by Fitzsimmons and Fitzsimmons (1999) in figure 9. However, these difficulties affecting the shipment of RDF bales are in F.H. Bertling AB’s expertise making the barrier a problem suited for them solve. This mean that the logistic barriers can be used to Bertling Enviros advantage using F.H. Bertling AB’s expert knowledge in the area creating a distance to their competitors it can therefore be suggested that their innovation of green logistics is not highly affected by these barriers.

5.3.3. Image
The literature review of this work did not find any barriers to green logistics in terms of the company image, meaning that no negative aspects of conducting green logistics was found concerning the image. This was not the case with Bertling Enviro though. If Bertling Enviro would be the cause of any mishaps that may affect the environment negatively it also affects the entire Bertling Group concern image. This creates a barrier to green logistics innovation when it possesses an unclear future with possible risks and controversy.

5.3.4. Customers and competitors
The customers and competitors section bring up poor supplier commitment and industry specific barriers (Mathiyazhagan et al., 2013) and could be relevant to Bertling Enviro. As Bertling Enviro conduct reverse logistics their customers can be seen as either their suppliers of RDF in the UK or their consumers in Sweden, depending on perspective. As their suppliers can be seen as a type of customer, the statement regarding industry specific barriers is relevant. There are actually industrial barriers between the suppliers and Bertling Enviro, one
example is the TFS agency who may be a regulatory compliance per se but can also be seen as a barrier in terms of different industries and markets that could have an impact on how Bertling Enviro develop their green logistics in terms of what they can and cannot do over and between the country borders. Besides from this Bertling Enviro has not experienced any of the found barriers for customers and competitors from table 3. The study on F.H. Bertling AB did not find any barriers in form of lack of communication or coordination, no unreasonable requests or activity as suggested by Carter and Dresner (2001) from their customers nor from their suppliers. As they work closely with their customers and suppliers they experience good customer commitment they do not fit in with the statement of Colicchia et al. (2013) about lack of commitment from customers. Their customers and suppliers are not seen as barriers to their development of green logistics, but rather the opposite. They collaborate with their customers in order to achieve a close relation and achieve customer satisfaction. One may also argue that Bertling Enviro is mainly limited to only create green logistics innovation within the boundaries of their customers and suppliers.

5.3.5. Regulation compliance

The interviewees made it very clear that there are many laws and regulations regarding the importing of RDF which leads to much paperwork, costs and extra aspects to consider. Therefore, they named laws and regulations as a major barrier to the development of green logistics and business as much focus was turned to obligatory documentation and permits. Colicchia et al. (2013) also found regulations as a barrier to green logistics, but also named it as a type of driver, something that the interviewees also did as it may push them towards being better and their business more desirable despite causing much extra work on a daily basis. This could halter their development of new ideas within green logistics and it ties some of their assets that could otherwise be used for research and development.

The interviewees discussed the differences between working with Afghanistan and the UK where the differences concerning different demands from the governments and regulations were substantial, as in the case of shipping military supplies to Afghanistan. As shipping RDF from UK has many regulations and demands, while shipping military supplies to Afghanistan was easier in terms of regulations and laws. The differences between collaboration is something that Colicchia et al. (2013) also noticed, as they stated that the heterogeneity as in differences between countries (and within countries) made the process of greening the logistics harder when dealing with environmental initiatives. This is clear to see in the history...
of Bertling Enviro as the English legislation agency TFS required Bertling Enviro to have a permit stating that they were allowed to export waste from the UK, according to EU rules and regulations. The TFS also affected the efficiency of vehicle routing, one of the determinants to green logistics, by saying how much RDF that can be exported from the UK meaning that the TFS affected the average load on laden trips. By limiting how much that can be exported in time and volume the TFS affect a key parameter to green logistics according to McKinnon et al. (2015). Also, different laws and regulations from different governments on different markets as well as different customers creates difficulties for F.H. Bertling AB. As the RDF business is an environmental initiative that wishes to create greener logistics, the barrier of country heterogeneity mentioned by Colicchia et al. (2013) and contradictory laws and regulations mentioned by Pålsson and Johansson (2016) are also barriers for F.H. Bertling AB to develop green logistics innovation.
6. Conclusion

6.1. How 4PLs generate and manage green logistics innovation

By smart innovative solutions the case company can ship RDF to Sweden from the UK to burn for energy and avoid GHG emissions. This is managed by using ships that usually have a low GHG emission when measuring tons shipped per kilometer (Chapman, 2007). Shipping the RDF in containers from the UK to Sweden is also an important innovative part since it uses containers that otherwise would be shipped empty and can therefore get a profitable deal with the shipping companies and operate their transport with low cost and low emissions as well as avoid GHG emissions globally. Bertling Enviro has been identified as a company that conduct green logistics innovation and this paper has also mentioned how they generate and manage their green logistics innovations as well as measured how well they can innovate within the five dimensions of strategy, learning, innovative organization, linkages and learning. Based on this finding, this study propose that 4PLs are most aligned to innovate within the dimension of linkages, meaning that they were more inclined to innovate through and with their business partners and connections. Based on the innovation audit tool the study also propose that 4PLs are least aligned towards aspects of processes, being their lowest scored dimension. The low score of the process dimension could be explained as the case company do not have a standardized way of generating, selecting or implementing green innovations. The different phases could however be identified for the case company, supporting Bessant and Tidd (2007) and Fitzsimmons and Fitzsimmons (1999) models for innovation.

The study proposes that 4PLs with a flat organization could generate new green logistics innovation without standardized processes and that ideas could be generated from various parts of the company. The ideas could be implemented fast as an innovation if the top management consent to the idea. However, 4PLs serving under a brand name may need to consider how their new innovations affect the entire concern. If something goes wrong when exploring new services and markets, it may bring consequences to all companies serving under the same name. Further ideas generated are generally limited to the 4PLs core competence or the suppliers and customers. But the study showed that a company can break
though these barriers by developing competence and innovate in green logistics to exploit new market opportunities.

### 6.2. The drivers for developing green logistics innovation for 4PLs

Table 6 show the drivers for developing green logistics proposed for 4PLs and are divided into the same areas as in the analysis section for the drivers for developing green logistics. The table also show how the areas are divided into internal and external drivers.

Table 6. The drivers for innovating green logistic for 4PLs.

<table>
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<tr>
<th>Drivers for developing green logistics innovation for 4PLs</th>
<th>Area defined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal drivers</td>
<td>Reducing costs through higher utilization, lower fuel consumption and financial return of investments.</td>
</tr>
<tr>
<td>Performance</td>
<td>The exploitation of market opportunities.</td>
</tr>
<tr>
<td>Image</td>
<td>Improved corporate image and public relations.</td>
</tr>
<tr>
<td>Customers and competitors</td>
<td>Competitive advantage and customer satisfaction.</td>
</tr>
<tr>
<td>Regulation compliance</td>
<td>The strive for reaching goals and the governmental endorsement.</td>
</tr>
</tbody>
</table>

Despite that the case company started out with no defined strategy of a standardized way of working towards green logistics, it still managed to generate and implement a green logistics innovation. This however is not a result of a conscious strategy, but that the green logistic innovation opened up a business opportunity which turned out to have positive green effects. This present the exploitation of market opportunities as a driver for green logistics innovations.

### 6.3. The barriers for developing green logistics innovation for 4PLs

Table 7 show the barriers for developing green logistics proposed for 4PLs and are divided into the same areas as in the analysis section for the barriers for developing green logistics. The table also show how the areas are divided into internal and external barriers. The table moreover present how barriers of the performance area can be overcome.
Table 7. The barriers for innovating green logistic for 4PLs.

<table>
<thead>
<tr>
<th>Barriers for developing green logistics innovation for 4PLs</th>
<th>Area</th>
<th>Area defined</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green logistics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal/External</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal barriers</td>
<td>Costs</td>
<td>Governmental taxes, regulation fees and financial bonds.</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
<td>Delivery time, flexibility and quality, but if the right expertise is possessed the barriers might provide competitive advantages.</td>
</tr>
<tr>
<td></td>
<td>Image</td>
<td>Image barriers for developing green logistics may develop if environmental mishaps occurs, affecting the whole concern image.</td>
</tr>
<tr>
<td></td>
<td>Customers and competitors</td>
<td>Industry specific barriers.</td>
</tr>
<tr>
<td></td>
<td>Regulation compliance</td>
<td>Obligatory documentation and permits, country heterogeneity, limitations of transport and contradictory laws and regulations.</td>
</tr>
<tr>
<td><strong>External barriers</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.4. Research implications

6.4.1. Theoretical contributions

The study provided information about drivers and barriers for 4PLs innovation in green logistics that can support some of the literature reviewed of green logistics in this paper and give further explanation as to how the drivers and barriers affect the green logistic innovation but also put forward a new driver of market opportunity exploitation. This study suggest that 4PLs are dependent on their suppliers and customers when developing green logistic innovations. The dependence of the suppliers and customers in the supply chain serve as both a driver and a barrier to the development of green logistic innovations. As 4PLs perform services to other companies without producing the goods by themselves they are dependent on their suppliers and customers to create a playing field for innovation. The playing field sets the boundaries and rules for what area to create green logistic innovation in. Suppliers and customers act as a driver to the 4PLs to innovate for improving their supply chain, but they are also restricted to innovate within this playing field. This case shows how a company can counter act this dependence of suppliers and customers by creating a company themselves by exploiting market opportunities to innovate into business that are not directly in the area of 4PL. The study shows how a 4PLs can create their own playing field by develop competence for new areas of business, enlarging the boundaries for what areas a 4PLs can innovate in. Green logistics generally only consider the goods when it comes to its size, weight or other
aspects that will affect the logistics activities impact on the environment. Therefore, researchers have mainly focused on only the actual transportation or other logistics activities within the field of green logistics. This paper concluded the importance of considering the goods itself as a factor in green (reverse) logistics, since the actual transportation of the goods offered new possibilities to efficiently reuse the energy contained in the RDF and thereby avoid the release of GHG emissions.

6.4.2. Practical implications

The conclusion of this paper may serve as a framework for 4PLs when conducting green logistics innovation as it can help in the process of making decisions and answer how they may operate, in terms of what may work and what may not work. The theoretical contribution of creating an own playing field for innovation may serve as inspiration to others within the field of 4PL to create new business areas and green logistic innovations. The study shows how alternative waste management can be conducted to satisfy Sweden’s need for energy and empty containers, while using the UKs empty containers and their plethora of waste to further avoid landfill. This benefits the environment globally as well as providing financial opportunities for companies.

The study shows what types of drivers and barriers a 4PL might encounter when innovating in green logistics and also reveals how government and regulations are a major factor. As companies doing business in green reverse logistics across regions and countries they need to consider new government and regulations for each border they cross increasing the complexity for how goods can be transported and handled. This presents the importance of regions and countries to create homogeneity regarding laws and regulations to avoid acting as barriers when 4PLs innovate in green logistics by applying a new way of waste management.

The study shows how a company can be profitable by innovating in green logistics providing 4PL companies with a business opportunity to both make greener logistics as well as making a profit presenting one of the most important drivers for 4PLs to innovate in green logistics. The sum of the cardamom is that 4PLs innovating in green logistics makes their logistics greener and their wallets grow thicker.
6.5. Study limitations

The findings in this study are largely based on 4 interviews with two people and this may provide a biased view of the situation. The study also researches a complicated area of how 4PLs innovate in green logistics, a question that can be interpreted in several different ways and finding an objective answer to this question is difficult. To further describe the complexity of the study the purpose is partly to look for everyday behavior for how green logistics innovation is generated and managed. This everyday behavior is difficult to capture in interviews. The study used a questionnaire to further capture information that could answer the research questions for this study. But the findings in this study must be in light with the complexity of finding an absolute and objective answer to how the case company innovated in green logistics. Also, this study did not put focus on the environmental outcomes as how valid Bertling Enviro’s business is in terms of achieving environmental benefits and to what scale their business affect the environment.

6.6. Further research

McKinnon (2010) stated that increased supply chain efficiency and reduction of risks are drivers to green logistics, but whether or not they also serve as drivers for innovating green logistics must be furtherly researched. It would also be interesting to further investigate the environmental implications of importing RDF to Sweden from the UK. This study only briefly investigated the subject with the conclusion that it is green in terms of logistics and innovation. Further it would be interesting to explore how the actual goods in waste management can affect the environmental aspects of reverse logistics. This study proposes a further investigation of the outcome of environmental benefits where the environmental outcome may be measured and discussed on a deeper level.
References


Appendix 1

Intervjuschema

Bakgrund om Berling: Gå igenom Bertlings historia och hur det lett fram till dess nuvarande position och affärsidé samt hur framtiden ser ut. Sen också diskutera kring era erfarenheter och arbetsuppgifter på Bertling.

Grön Innovation: Hur definierar ni innovation?

Hantering av Grön innovation: Gå igenom ämnet grön innovation, vad det betyder och hur det påverkar er verksamhet. Hur kan grön innovation skapa en grönare logistik? Vi vill veta hur Bertling tar fram nya gröna idéer och tjänster dvs. hur processen för att generera idéer ser ut, hur ni väljer ut idéer och hur de sedan blir till verklighet. Gå igenom konkreta exempel där Bertling har tagit fram innovationer som varit gröna och bidragit till en grönare logistik.

Barriärer och drivkrafter för att utveckla Grön logistik: Vad finns det för interna och externa barriärer samt drivkrafter för grön innovation?

Bakgrund om Bertling

Respondent

1. Vad är ditt/ert jobb på Bertling?
2. Hur länge har du/ni jobbat för Bertling?
3. Vad har du/ni för arbetsområden?
4. Tidigare erfarenheter?
5. Vad ser du som Bertlings nutida och framtida utmaningar?

Företag

1. Vad är Bertlings huvudsakliga affärsidé?
2. Vilka tjänster erbjuder Bertling?
3. Vad för transportmedel erbjuder Bertling?
4. Vad har ni för typer av kunder?
5. Vilka är Bertlings huvudsakliga kompetenser (vad är ni “bäst” på, vad särskiljer er från konkurrenterna)?
6. Hur ser konkurrensen ut?

**Grön Innovation**

*Definition av innovation på Bertling*

1. Hur definierar du innovation?
2. Hur ser du på begreppet grön innovation? - Förklara vad vi menar med grön innovation

**Barriärer och drivkrafter för att utveckla grön logistik**

*Drivkrafter och barriärer till grön logistik*

1. Vilka är de interna drivkrafterna för er att utveckla grön logistik (finansiella, operationella)?
2. Vilka är de externa drivkrafterna för er att utveckla grön logistik (varumärke, kunder, konkurrenter, regler och lagar)?
3. Vilka är de interna barriärerna för er att utveckla grön logistik (finansiella, operationella)?
4. Vilka är de externa barriärerna för er att utveckla grön logistik (varumärke, kunder, konkurrenter, regler och lagar)?

**Hantering av Grön innovation**

*Externa parter*

1. Vad är kundens roll i att ta fram nya gröna tjänster?
2. Vad är leverantörens roll i att ta fram ny gröna tjänster?
3. Samarbetar ni med några andra externa parter för att generera nya idéer/tjänster?
4. Använder ni formella eller informella kontakter för att generera nya idéer/tjänster?
5. Hur ser ni på myndigheters och lagstiftares roll i att möjligöra för er att skapa gröna innovationer?

**Processen för innovation (Generera, selektera and implementera)**

1. *Hur genererar ni nya idéer/tjänster?*
2. Finns det en standardiserad process för att ta fram nya ideer?
3. Har du eller Gävlekontoret någon roll i att ta fram nya tjänster?
4. Inom vilka områden arbetar ni med för att ta fram nya gröna idéer?
   a. Produkter (teknik, transportmedel, GPS, utveckla lastutrymme)
   b. Tjänster (alternativa rutter/ transportsätt, fyllnadsgrad, eco-driving)
   c. Organisation (möjliggöra för skapandet av innovationer, kunskapsdelning)
5. Har ni egen R&D?
6. Hur väljer ni ut vilka idéer som är värda att satsa på?
7. Har ni någon standardiserad process för att välja ut idéer?
8. Kan ni beskriva hur det går till när ni väljer att satsa på en ide?
10. Hur påverkas urvals processen av att satsningen har potential att bidra till en grönare logistik?
11. Skiljer sig en grön ide från en vanlig ide? I så fall på vilket sätt?
12. Söker ni aktivt efter idéer som kan bidra till en grönare logistik?
13. Vem tar beslut och vem har ansvaret för att välja ut vilken idé som är värld att satsa på?
14. Hur ser processen ut när en ny idé ska bli en ny tjänst?
15. Finns det en standardiserad process för att implementera en ny tjänst eller innovation?
16. Finns det några milstolpar eller portar i utvecklande processen av en ny innovativ satsning?

**Hur innovativ organisationen är**

1. Kan ni ta fram nya idéer eller tjänster som sedan kan implementeras i hela företaget?
2. Hur stödjer organisationen framtagandet/implementeringen av nya idéer/tjänster? Hur stöder Bertling dig eller andra anställda att utveckla idéer som du eller ni tagit fram?
3. Hur ser Bertlings förmåga ut att använda din idé till hela organisationen? (Dvs. hur kompatibel är en ny idé till hela företaget? Kommer en ny tjänst vara tvungen att anpassas annorlunda till olika sektioner/kontor?)
4. Uppstår det konflikter när nya tjänster tas fram mellan olika kontor/avdelningar?
5. Vad för typer av konflikter?
6. Hur lär ni er av tidigare projekt?
7. Hur motiverar och stödjer ni era anställda till att utveckla innovativa idéer?
8. Hur tycker du att er kunskap om grön logistik är?
9. Hur erhåller ni nya kunskaper om grön logistik?

**Strategiskt ledarskap och riktning**

1. Hur arbetar ni för att ta fram/innovera grön logistik?
2. Hur kan grön innovation skapa en grönare logistik?
3. Vad motiverar Bertling till att innovera inom grön logistik?
4. Innovation kan ju ske inom tjänster, produkter, processer och organisationen hur ser ni på utvecklingen av dessa områden inom företaget?

5. Hur präglas utvecklingen dessa områden av grön logistik?

6. Hur skiljer sig ert arbete med att ta fram nya tjänster mot företag som tar fram produkter?

7. Vad är den största drivkraften till att utveckla grönare logistik, marknadens efterfrågan eller den interna drivkraften för tjänsteutveckling (market pull or market push)?

8. Vilken roll tror ni grön innovation kommer ha för Bertling i framtiden?


10. Varför blev projektet framgångsrikt? Vilka var de avgörande faktorerna?
    Kan du säga ett exempel på ett mindre framgångsrikt grönt innovativt projekt inom Bertling?
Appendix 2

Detta enkla verktyg för självutvärdering av Tidd och Bessant riktar uppmärksamheten på några av de viktiga områdena kring innovationsledning. Nedan hittar du uttalanden som beskriver " hur vi gör saker här" - det beteendemönster som beskriver hur organisationen hanterar frågan om innovation. Betygsätt varje påstående med en poäng mellan 1 (= stämmer inte alls) till 7 (= mycket sant).

<table>
<thead>
<tr>
<th>Påståenden</th>
<th>Poäng 1= Stämmer inte alls</th>
<th>Poäng 7= Mycket sant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Vi har en klar uppfattning om hur innovation kan hjälpa oss att konkurrera</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Vi har processer på plats för att hjälpa oss att hantera utvecklingen av nya produkter/tjänster på ett effektivt sätt från idé till lansering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Vår organisationsstruktur hämmar inte innovation, utan stödjer innovation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Det finns ett starkt engagemang för utbildning och utveckling av människor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Vi har goda &quot;win-win&quot; relationer med våra samarbetspartners/leverantörer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Vår innovationsstrategi kommunikeras tydligt så att alla vet målen för förbättring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Våra innovationsprojekt är vanligtvis klara i tid och inom budget</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Människor fungerar bra tillsammans över avdelningsgränserna</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Vi tar tid att granska våra projekt för att förbättra våra resultat till nästa gång</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Vi är bra på att förstå behoven hos våra kunder/slutanvändare</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11 Folk vet vad vår särskiljande kompetens - som ger oss en konkurrensfördel

12 Vi har effektiva mekanismer för att se till att alla (inte bara marknadsföringsavdelningen) förstår kundernas behov

13 Människor är involverade i att föreslå idéer för förbättringar av produkter/tjänster eller processer

14 Vi fungerar bra med universitet och andra forskningscentra för att hjälpa oss att utveckla vår kunskap

15 Vi lär oss av våra misstag

16 Vi blickar framåt på ett strukturerat sätt (med hjälp av prognosverktyg och metoder) för att försöka föreställa oss framtida hot och möjligheter

17 Vi har effektiva mekanismer för att hantera processförändringar från idé till ett framgångsrikt genomförande

18 Vår struktur hjälper oss att fatta beslut snabbt

19 Vi samarbetar med våra kunder för att utforska och utveckla nya koncept

20 Vi jämför systematiskt våra produkter/tjänster och processer med andra företag

21 Vår ledning har en gemensam syn på hur företaget kommer att utvecklas genom innovation

22 Vi söker systematiskt efter nya produkt/tjänstidéer

23 Vår kommunikation är effektiv och fungerar top-down, bottom-up och över hela organisationen

24 Vi samarbetar med andra företag för att utveckla nya produkter/tjänster eller processer

25 Vi träffas och delar erfarenheter med andra företag för att hjälpa oss att lära
| 26 | Det finns engagemang och stöd till innovation från högsta ledningen |
| 27 | Vi har mekanismer för att involvera alla avdelningar så tidigt som möjligt för att utveckla nya produkter/tjänster/processer |
| 28 | Vårt belönings- och igenkännningssystem stöder innovation |
| 29 | Vi försöker att utveckla externa nätverk av människor som kan hjälpa oss (med specialistkunskaper till exempel) |
| 30 | Vi är bra på att ta till vara på vad vi har lärt oss så att andra i organisationen kan dra nytta av det |
| 31 | Vi har processer på plats för att granska nya tekniska eller marknadsutvecklingar och vad de betyder för företagets strategi |
| 32 | Vi har ett tydligt system för att välja innovationsprojekt |
| 33 | Vi har en stödjande klimat för nya idéer - människor behöver inte lämna organisationen att få dem att hända |
| 34 | Vi samarbetar med lokala och nationella utbildningssystemet för att kommunicera våra behov för kompetens |
| 35 | Vi är bra på att lära från andra organisationer |
| 36 | Det finns en tydlig koppling mellan de innovationsprojekt som vi utför och den övergripande strategin för verksamheten |
| 37 | Det finns tillräcklig flexibilitet i vårt system för produkt/tjänsteutveckling för att tillåta små projekt ett "snabbspår" |
| 38 | Vi arbetar bra i team |
| 39 | Vi samarbetar med ledande användare (lead users) för att utveckla nya innovativa produkter och tjänster |
| 40 | Vi använder mätning som hjälp för att identifiera "var" och "när" vi kan förbättra vår innovationsledning |
Appendix 3

Research model for green logistics innovation through the general innovation model