Master's degree thesis

LOG950 Logistics

Analysis of information flow in base-to-base transportation. A case study of Bring Offshore & Energy

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Molde University College
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Preface

This thesis is submitted as the final mandatory assignment for completion of the Master of Science in Logistics at Molde University College, where we have specialised in Supply Chain Management and Information Systems.

Through a case study of Bring Offshore & Energy, we have had the opportunity to apply the knowledge we have gained the past years, in a real life context with practical issues to be solved. We are grateful that the case firm has taken such good care of us all the way, and made sure that we could travel around conducting our research. The visits at the various departments have been intriguing, and essential for the extensive knowledge we have gained. We especially thank Atle Solheim, Bjarte Holstad, Jan Erik Oppedal and Nina Gudmundseth for the solid support through our research study.

Further we would like to thank our supervisor Bjørnar Aas for helping us seek out the direction of our thesis, the encouragement along the way and for quick feedback throughout the whole process.

Thanks to Molde University College for two educational and inspiring years.

Henriette Indreeide Grimstad

Tale Ørving

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Executive Summary

This thesis is an extensive single case study that addresses the information flow between Bring Cargo Offshore and Energy and their supply chain partners. The information flow mainly relates to the customers booking of transportation from Bring, with a focus on Statoil and their suppliers. Bring has the sole responsibility of the transport of goods to and between supply bases, on behalf of Statoil.

Bring had some concerns that the current booking routines and the related information flow were not optimally executed. The offshore and energy sector has strict demands with regard to the execution of the transportation. The complex goods and the urgency prevailing in this industry propose challenges for Bring in order to conduct a cost efficient transport service. In light of this, Bring wanted to see if it was possible to face these industry challenges by improving the handling of the information flow in the supply chain.

We defined the research problem as: "*How can the information flow between Bring, Statoil and their suppliers potentially be improved in order to achieve better quality of the processes and a more cost efficient supply chain?*" The objective of the thesis was to detect areas of improvement in the handling of information in the supply chain and use these findings to derive suggestions for improvement. Bring acknowledge that they may have limited abilities of persuasion when it comes to suggesting changes in the supply chain. It was thus important to Bring that the proposed changes would benefit the supply chain as a whole. We proposed the following hypothesis: *"There is a potential for improvement in the processes and activities related to the information flow in the interaction between the actors in the supply chain."*

We conducted in depth interviews to increase our understanding of the supply chain, detect possible issues and gather suggested improvements. The main challenges we detected related to the information flow were inadequate quality of the information exchanged and lack of integration between the supply chain actors. The consequences of inadequate quality could be poor utilization of the resources of Bring and the other actors in the supply chain. A lack of integration between the actors is a contributing factor to the time pressure in the supply chain. Such time pressure minimizes the ability of Bring to plan a cost efficient transportation.

In order to prove our hypothesis we applied relevant theory to analyse the findings from the depth interviews. The conclusion was that there is potential for improvement in the processes and activities related to the information flow. Further we proposed that the issues could be met by measures in short-term and long-term perspectives. The short-term solution proposes to establish clear requirements for the content of a booking ideally through better utilization of electronic means of booking. While the long-term solution, reaches for a totally integrated supply chain through an information loop.

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If not otherwise stated by reference, all tables are developed by the authors.

List of abbreviations

ADR	the European Agreement concerning the International Carriage
D&W	Drilling and well
DOS	Disk Operating System
EDI	Electronic Data Interchange
HSEQ	Health, safety, environment and quality
JIT	Just-in-time
M&M	Maintenance and Modification
OCTG	Oil Country Tubular Goods Of Dangerous Goods by Road
OTIF	On Time In Full
OX	Oil Express
PDA	Personal Digital Assistant
PO	Purchase Order
RD	Return Document
RDT	Resource Dependency Theory
RET	Relational Exchange Theory
SCM	Supply Chain Management
TA	Transport Administration
TCA	Transaction Cost Analysis
TMS	Transport Management System
TOC	Theory of Constraints

1 Introduction

As an introduction we will reflect on our incentives for writing our thesis about this exact subject, and further present the case, its market context and how we have chosen to structure the thesis. This is to give a basis for understanding before we introduce the research problem and the chapters concerning methodology and theory.

1.1 Why we have Chosen this Subject

Through our master program in logistics at Molde University College we gained interest in the offshore and energy sector, and especially the offshore upstream logistics. On the basis this interest we contacted Bjørnar Aas. Based on our conversation, he recommended that we could contact Bring Offshore and Energy, which is a provider of freight forwarding and transport services towards the oil and gas industry. After conversations with Bring, they offered us to write a thesis for them. Bring introduced some challenges they had experienced related to the information flow between them and the other parties in the supply chain. The timing for this assignment was ideal considering that Bring was in the early stages of trying to find improvements to these issues themselves. In addition, the topic was a good match with our specialization in information systems from the logistics master. Based on these factors we formed a research problem that we further introduce in Chapter 2.1.

1.2 The Case

The case is based on Bring Cargo - Offshore and Energy, and their information flow both internally and in cooperation with the other actors in the supply chain. Bring consider Statoil as their main customer in the Offshore and Energy services and therefore the focus will be on Statoil and their suppliers. The service that Bring Offshore and Energy offer, and what is our unit of analysis, is the transportation of equipment for offshore oil and gas production, to and between supply bases on the Norwegian West Coast. This service is called the Oil Express, and is a large part of the Offshore and Energy division.

The main purpose of the study is to detect whether there are areas with potential for improvement in the handling of the information flow between the actors in the supply chain. With regard to the information flow, the main focus from the beginning has been to study the booking solutions that Bring has in cooperation with their customers, and how the information from them and the interaction are further handled. An important task is therefore to fully

understand and describe the interaction, the interfaces, what processes is in fact being practiced and what are the aids applied.

The reason for the management wanting to explore these aspects, was that the offshore segment does not make use of electronic solutions for bookings to such an extent as other parts of Bring does. They wanted to examine how this affects their logistics service and if there are anything that could be changed in order to improve the performance for the entire supply chain.

1.3 The Market

The following section will describe some characteristics of the environment for the operations of Bring Cargo Offshore and Energy. This is done to provide a better insight in what influences from the market might affect the performance of Bring and the supply chain. We will first present a short description of the transportation sector, followed by a brief reflection of the current trends prevailing in the oil industry.

1.3.1 The transportation Sector

To give a brief overview of what characterizes the transportation sector we have used the book "Moderne Transportlogistikk" by Bø and Grønland (2014) as a basis. The significance of transportation in a value chain is increasing. Norway is an elongated country with a difficult topography that leads to costly transportation, and therefore becomes an important part of the logistics. The area of transportation has experienced a significant growth the last 20 years and some of the main trends that have contributed to this growth are:

- Increased globalization
- Greater degree of centralization
- Greater degree of specialization in production
- Increased demands from customers with regard to delivery service:
    - Shorter lead times
    - Smaller timeslots
    - Increased delivery frequencies
    - High degree of flexibility in deliveries
    - High variety of products

The profit margin in this sector is rather low, and the need for integration between different actors in order to improve efficiency in the supply chain is thus great. Road transport is the dominant mode of transport measured in tons. This is reinforced by the fact that transports by sea or rail often also require transport by road for collection and final distribution (Bø and Grønland, 2014).

Statoil and their suppliers are complex customers that have high demands with regard to the delivery service. This in turn will have a great impact on the possibility for Bring to execute transportation in a cost efficient manner. As further stated by Bø and Grønland (2014) the delivery service to customers might often influence the transportation cost for the carrier in the sense that fulfilling the demands could make it difficult to utilize the transport materials as desired. In addition, many customers wish to have a minimal level of storage space and thus frequently place small orders. These factors contribute to more transportation work for the carrier that has to be flexible towards the customers. Providing the customers with the possibility of urgent and flexible delivery service might be costly to the carrier and such costs need to be carefully considered (Bø and Grønland, 2014). The complex requirements that Bring has to meet in order to satisfy their customers in the offshore and energy sector makes it even more important for the company to find ways to optimize the supply chain and be more cost efficient in their work processes.

1.3.2 The oil and gas industry

Bring and their services towards actors in the offshore and energy sector, is naturally affected by circumstances prevailing in the oil and gas industry.

The oil industry is currently experiencing a downturn due to significant drops in oil prices. This situation is causing uncertainty, but at the same time also requirements for innovative thinking. At the Offshore Logistics Conference 2015 in Kristiansund, these industry challenges were a recurrent theme. The atmosphere at the conference can be characterized by a consciousness of the need for change. In addition to cost reduction, some of the main initiatives proposed were more integrated supply chains, larger focus on value creation, centralization, sustainability and continuous improvement. This shows that there is a growing need and desire among the actors to think holistically and streamline the supply chain to become more competitive.

1.4 The structure of the thesis

The thesis is structured in order to present our research in the best possible manner, from how have studied the case all the way to the conclusions we have drawn.

- In Chapter two the research problem and the accompanying research questions of the thesis are presented followed by a description of the methodology applied in solving these.

- Chapter three addresses the theoretical background of the thesis that is used in the discussion of our analysis and to support our findings.

- Chapter four presents the supply chain that forms the basis of this research, including information about the actors and the activities conducted in cooperation between them.

- Chapter five addresses the information systems that Bring applies in their bookings routines, internally for transportation and information exchange with the other supply chain actors. In addition a solution from another segment of Bring, and the offshore division's improvement database is presented.

- Chapter six gives a presentation of the flow of goods and information in the supply chain with an emphasis on the information flow. Chapter 6.1 and 6.2 address the flow of outgoing and returning goods respectively. Chapter 6.3 and 6.4 examine the information flow related to the two types of goods flow.

- Chapter seven presents and discuss the findings of the research including both the discovered issues and suggested potential improvements with regard to the handling of the information flow in this supply chain.

- Chapter eight serves as a summary of the most critical findings of our thesis and reasoning towards a conclusion.

- Chapter nine identifies strengths and weaknesses in the thesis and recommends areas for further research.

2 Research Methodology

In the following chapter the research methodology will be presented. After we have defined the research problem and the hypothesis, we describe the research design and the phases of the research. The chapter also seeks to clarify some thoughts about the validity of the study and some limitations that have been made.

2.1 Research Problem

Our research is based on a perception in the management of Bring Offshore and Energy, that they have somewhat out-dated procedures with regard to the information flow in comparison with the rest of the organisation. They wished to uncover what might be the challenges in order to detect potential improvement that could result in a gain for themselves and the supply chain as a whole. As Grønmo (2004) implies the research problem of a thesis will determine direction and progress of the research project, at the same time the development of the project may also lead to rephrasing, specification and clarification of the research problem throughout the process.

Research Problem:
"How can the information flow between Bring, Statoil and their suppliers potentially be improved in order to achieve better quality of the processes and a more cost efficient supply chain?"

Hypothesis:
"There is a potential for improvement in the processes and activities related to the information flow in the interaction between the actors in the supply chain."

Research Questions (RQ):

1. *Description of the supply chain*
   - *1.1 Who are the actors?*
   - *1.2 How is the supply chain structured?*
   - *1.3 How is the interaction organised?*
   - *1.4 What information systems are applied?*

2. *Are there issues concerning the handling of information?*
   2.1 How do the issues occur?
   2.2 What is the cause?
   2.3 What are the consequences?
   2.4 How can the issue potentially be improved?

3. *Is there a need for change?*
   3.1 In what areas is there a need for change?
   3.2 How can the overall handling of information potentially be improved?
   3.3 What will the consequences be for the supply chain?

2.2 Methodology and Research Design

Our thesis is based on qualitative research through a single case study, in order to obtain a combination of empirical knowledge with a basis in theoretical understanding.
The thesis follows an exploratory research design from Chapter 4 through Chapter 6, where we examine the case company and the flow of information between them and the other actors of the supply chain. Further, from Chapter 7 it enters an explanatory design when we analyse our descriptions in order to uncover issues and potential improvements.

2.2.1 Research Design

A thorough reflection of research design is important in order to obtain valid research in a structured manner. The study follows an *exploratory* design where our research seeks to provide a picture of the supply chain, the actors and the activities and processes related to it. Exploratory design is according to Selnes (1999) applied when the research problem is either unclear or very roughly defined. Exploratory design often requires a flexible approach and the data collection should be adapted based on the continuous learning process throughout the study (Selnes, 1999). This research gives us a foundation to further analyse the potential issues that we discover. When we elaborate in to the discussion, the thesis enters to some extent into an *explanatory* design where the purpose is to describe the relationship between the different variables (Selnes, 1999).

Based on our need to explore the supply chain fully, we are dependent on extensive information. Qualitative *research* seeks to provide insight and understanding (Selnes, 1999). Exploratory research is therefore naturally often based on qualitative approaches (Grønmo,

2004). Such an approach is according to Grønmo (2004) characterised by a need to collect a large amount of information about a phenomenon. The selection of the information will not be standardised but rather very flexible, which is necessary in order to explore the research problem in this thesis. Through this research our goal is to uncover some variables, and by a qualitative approach we have the best ability to do so. Our data collection is characterised by typical methods for qualitative studies, like case studies as we now will present and further depth interviews (see Chapter 2.2.3).

2.2.2 Case Study

To solve our research problem and research questions we have applied a case study as research method, where the main tasks are defined by Yin (2009) data collection, analysis and finally presentation of the results. The need for case studies arises when the desire is to understand a complex social phenomenon (Yin 2009). To solve our research question and gain a better understanding we first had to investigate in great depth the case, namely Bring Offshore and Energy. We needed to obtain an overview and understanding of the main processes conducted by Bring in relation to the other actors in the supply chain, in order to be able to detect possible areas of improvement in the logistics. This reinforces the choice of case study as a research method, as Yin (2009) further states that the case study method enables the investigators to keep holistic and meaningful characteristics of events such as organizational and managerial processes.

Yin (2009) provide three conditions that need to be fulfilled in order for case study to be the preferred method:

- The form of research questions proposed is “how” and “why” questions
- Have little control of actual behavioral events
- Focus on contemporary events within a real-life context.

“How” and “why” type of questions addresses operational links needing to be traced over time and not just the mere incidence (Yin, 2009). In our research, we have asked questions as “how” and “why” in order to be able to gain a better understanding of the complex processes internally in Bring and the processes prevailing in the supply chain we examined.

When investigators analyze contemporary events but with little possibility to control or manipulate the relevant behavior, case study is preferred. Two techniques used as sources of

evidence in the study are direct observation of events and interviews of the persons involved in the events (Yin, 2009). Through our research, we conducted interviews and observations in order to analyze relevant organizational processes and interactions both internally and externally, within its real-life context. We will describe this further in Chapter 2.3.

2.2.3 Sources and Data

We base the layout of our research design on the material that we need in order to conduct an analysis. The background for our research will thereby be the sources and data that are presented in the following chapter.

2.2.3.1 Sources

Theory separates between three types of sources of information; actors, respondents/informants, and documents (Grønmo, 2004). In our research we used all three of the aspects. According to Grønmo (2004) the term respondent can be used when a person provides information about himself, his own opinions and actions. When providing information about other actors' background, opinions and actions, the person is defines as an informant. We covered both terms through interviews.

We have designed our study so that it is based on participant observation, informal interviews and a qualitative content analysis. We observed a selection of the employees in how they conducted their daily tasks. In this case they were *actors* that were observed while performing actions, interacted with each other and expressed opinions on subjects. These actors, and additional employees, were also functioning as *respondents* and *informants* through interviews. Interviews have all in all been our main source for retrieving information about the specific parts of the supply chain that we investigate. The third source is *documents* that we have analysed to gain facts, understand context or interpret point of views of different actors in the supply chain and surroundings. Such documents have been information about the actors, industry and market and internal documents on systems, procedures, policies and guidelines.

The case company is overall the primary source of information, but in addition we had interviews with two customers on the supplier side. We have not examined the supplier side to a large enough extent to say what are the general opinions and needs, but we have performed these interviews to get a hint of what can be some views among the suppliers. One of the suppliers, Swire, was chosen because they have been testing a booking solution in the development process (MyBring). The other supplier, Force Technology, was selected because

in cooperation with Bring they have implemented a great solution with use of electronic bookings (EDI). These customers were also convenient to interview because of their availability to meet and willingness to express their opinions.

Literature research has been conducted at the college's library through reading books, articles and scientific papers retrieved from databases. This was extensively conducted in the beginning, in the mapping phase, and in the end in the analysing phase as further described in Chapter 2.3.

According to Grønmo (2004), sources should be determined with a basis in thorough consideration and not used uncritically. The sources should be considered based on four aspects: availability, relevance, authenticity and credibility.

Availability

We have had a good dialog with the case company and have therefore had good access to sources. Still, there might be relevant information that we have not explored because of lacking availability. This could be statistics, which could help us build upon either the problem or a potential solution, but that are not available because it has not been measured, or that the measurements are not precise enough to be used in this context.

Relevance

Some of the sources provide more information than what is relevant to the actual case. This happened both through interviews and other data collection. Still it is important through a qualitative relatively open study like this not to restrain the flow of information. The decoding and sorting of the data gathered were therefore crucial throughout the process.

Authenticity

It is important that all sources are authenticated. We therefore always considered both academic sources critically as well as we made sure that the actors, respondents and informants were authentic. Most of our sources are directly from the company, and academic literature is retrieved from what is considered reliable databases.

Credibility

The credibility of the source shall always be assessed. It has therefore been important for us to consider the information given based on the background, the purpose of why a document is made, who is behind it, whose interest is kept in mind, the situation an employee is in, who will they sympathize towards, what do they gain or risk, and so on. This is a continuous on-going evaluation that we have conducted.

2.2.3.2 Data

"Data is information that have been processed, systemised and registered in a certain form and with the aim of specific analyses" (Grønmo, 2004).
The data we present is based on the information we gained through the sources mentioned above, but based on the goal with our analyse it has been sorted out and assessed in relation to each other.

Our primary data, that are data collected first hand, are collected through interviews. Mostly, interviews and observation leads to qualitative information, which we have done to a great extent. Still, some quantitative data has also been possible to uncover through our data collection. Roughly said, quantitative data is data expressed through numbers or other quantity terms like few, many, most and so on. Data not expressed in this way are qualitative (Grønmo, 2004).

We have to some extent also made use of quantitative data either provided directly from the company or we have analysed raw material made available to us, to extract data. For example as we have analysed the deviation and improvement database of the company.

2.3 The Phases of the Research

The progress of the research is divided into three different phases, which we have defined as the mapping phase, data collection phase and analysing phase. Although they largely have blended into each other, some important characteristics of our work in each phase will be presented.

2.3.1 Mapping phase

In the first phase our focus was to gather as much knowledge as possible about the subject, the company and the surrounding market. This was necessary in order to be able to find the right area to research, both with regards to uncover where there might be a potential for improvement and where it can be interesting to research from an academic point of view. We did this by studying theoretical/academic literature on different central subjects and former literature written within the area, this was to gather as much knowledge as possible about existing research and theories. We also did research through the company's homepage, studied material provided directly by the company and most importantly through conversations with several contact persons within the organisation and thereby got a good overview of their challenges. These conversations were in way unstructured interviews, where we got answers to everything that might come to mind, which gave us a good basis for the further research.

This phase has in many ways continued throughout the entire study, as we constantly gained more knowledge and comprehension of relevant aspects and contexts, and not only through interviews. An important part of this has also been all the informal conversations with employees in the different divisions in Bring. Even if they have taken place at the lunch tables, in the car or at the airport, they have given us essential background information and understanding around our research.

2.3.2 Data Collection phase

The data collection phase is the most important, and is crucial to carry out in a good manner to be able to retrieve interesting information and knowledge. Since we based our research on a case study, the goal here was to explore as much of the supply chain as possible, but still keep a clear focus on the research problem that we decided upon. As mentioned earlier, based on our research problem and our exploratory research design we found it beneficial to rely on interviews.

2.3.2.1 The Interviews

Kvale and Brinkmann (2009) defines "Seven Stages of Research Interviewing", that in detail deals with the practical steps of conducting an interview inquiry and the decisions that are to be made throughout the study. These stages describe the different phases we have gone

through and some of the choices we have made in the process of our research: thematising, designing, interviewing, transcribing, analysing, verifying and reporting.

The Seven Stages of Research Interviewing (Kvale and Brinkmann, 2009):

1. Thematise: The purpose and theme shall be formulated - why and what.

The purpose is to investigate the research problem, based on the hypothesis and the research questions in section 2.1. We formulated the purpose and the theme of the thesis in cooperation with our supervisor and managers in the case company through informal interviews and study of documents, based on the relevance of the topic, the existing literature, the needs and wants from the company and the period of time available. Basically this means that we mapped what our goal with the thesis was, in order to know what we had to look for through our period of research.

2. Design: Planning and design of the study in order to obtain the intended knowledge -how.

Based on our exploratory method, we designed our interviews to be in depth, but informal and with a semi-structure. This was in order to explore as much as possible, and not to lead the interview object in any directions that were coloured by our initial perception or the managers' opinions. At the same time we had to keep focus around the core of the theme, and therefore we had prepared an interview guide with open-ended questions. For each interview we outlined the areas and subjects that we wanted to research, and prepared basic open ending questions in each area. In addition we often had some specific questions prepared, that we asked later in the interview, when the object had used its opportunity to answer freely.

In the beginning of the phase we distinguished which part of the supply chain we wanted our respondents to represent. We early established that we needed to interview representatives from the offices located at the supply bases, as well as people handling the bookings in addition to managers. This was so that we could be able to explore the information flow on all levels of the organisation, and to uncover if there were differences between the different divisions. We also decided that we would shortly interview some suppliers to get a perspective from another parts of the supply chain.

Our approach has been flexible in the way that we continuously have assessed the execution of the interviews and thus taken the experiences we made with us when deciding who to

interview next and how to perform it in the best way possible. The subjects and questions we focus has also changed throughout the interview phase alongside the development of a better understanding of all the aspects concerning. We decided that we would plan to interview about 10 people, but ended up with about 15, in addition to talking informally to several others.

3. Interview: Conducting the interviews based on interview guides.

The questions were not proposed in a strict order, but we tried to follow were the conversation naturally led us, within reasonable limits. By doing so it opened up for uncovering what the different actors were mostly concerned with.

We interviewed employees, mainly in-house personnel, on the supply bases in Sandnessjøen, Kristiansund and Mongstad. Together with people from the head office in Bergen and the manager for all the supply base departments, we came to the conclusion that these bases would be a representative selection. The interview with Sandnessjøen was conducted over telephone while we travelled to Kristiansund and Mongstad to have face-to-face interviews. Next we had extensive interviews with the three employees at the office in Bergen, which gave us a lot of insight in strategies, goals, the company, the chain as a whole, all the processes and the other actors.

Then we followed up with observation and interviews at the Tananger offices in Stavanger, were the outgoing flow of goods in the oil express is handled. Here we got a good overview over the routines, we got to observe the employees in how the performed their tasks and see how they interacted. When we were in Stavanger we also attended a meeting were the domain owner and project leader of the booking-solution under development gave an introduction to the solution and got feedback from the users. This was helpful in order to see the interaction internally in the company, and the synergies in the development of new information systems. We also attended a meeting with these two and a customer, Swire, which have been testing the booking solution for a while to get their feedback as well.

We later also had a short interview with the contact person in Swire, to ask some additional questions. Another customer that we visited while in Stavanger was Force Technology. Again we had a semi-structured interview that gave the respondents liberty to come up with their own initial thoughts.

The interview objects have been made anonymous on a individual level in the presentation of the findings.

4.Transcribe: *Transcribing the interviews from oral to written to prepare for analysis.*
All interviews and conversations have been recorded with permission from the participants, so that it can fully be used as data in the analysing phase. We found it very useful in the way that we did not have to concentrate on writing everything down which could have interrupted the flow of the conversation. Rather, we were able to be in the moment and focus on listening, and actively ask follow up questions.
We transcribed the recordings from the interviews continuously, to the extent that was possible. This was a time-consuming process, but it were very useful for us to hear the recordings again, as a repetition, in a setting where we had better time to reflect upon the answers. It was also helpful in the manner of assessing our own interviewing skills, so that we could work on how we conducted the interviews throughout the study. This was a process of continuous learning.

We did not use any specialised method for transcribing, but wrote straight forward every part of the interview. Though, we focused on including thinking breaks, "hmm's", sighs and laughter, as that tells a lot of the contexts the answer were stated in.

The transcriptions showed themselves to be very useful throughout our work, and we were very pleased with the fact that we did this part as thoroughly as we did. We have looked trough the transcriptions many times, as we were wondering what it was someone meant with their statement, what led them to this statement, and so on. Without such extensive reports from the interviews there could much more easily have been misunderstandings between the interview object and us as the interviewer.

5.Analyse: Analysing based on the purpose and topic.
Kvale and Brinkmann (2009) propose six steps of analysis that are on going through the interviews. The first step were when the interview objects described their work, routines, their experience, and so on, which left little room for interpretation. The next step were when the interview object further reflects over their descriptions and how they affect other aspects. The third step is then when the interviewer challenges the interview object with follow up questions that he must further consider, so that the interviewer can be sure that his

interpretation is the right one. The interview object gets the possibility to further explain what they meant, if something were unclear and could be interpreted several ways. These steps overlap each other. The fourth step is for the interviewer to analyse the interview, which we did through listening to the recording, writing and reading the written transcriptions. Further we discussed it with each other and compared the different interviews to each other, and towards literature. The fifth step is re-interviewing to clarify uncertainties, which we also sometimes did. Not necessarily re-interviews in the words right definition, but we often had follow-up questions answered either orally over telephone or in writing by e-mail. A possible sixth step is action were as the subjects begin to act on new insights, this one we found not so applicable in our case.

The three first steps show that the analysing have already started in the process of the interview. We found this to be true and that it was a very informative process. So when we started on the analysis and the writing of the thesis we both had a pretty good idea of where the focus should be. Further description of our analysing phase will be given in Chapter 2.3.3.

6. Verify: The findings shall be assessed in terms of validity, reliability and generalizability.
The findings from the interviews were validated through discussion with both the supervisor and our contact persons in the case company.
We assess the validity of our research in depth in Chapter 2.4.

7. Report: Communicating the findings through a scientific written product.
The results of our interviews are presented throughout chapter 4 to 8. All with a basis in the research problem and research question.

2.3.2.2 Collecting data from other sources
In the collection of data from other sources than through interviews we had a continuous process of collecting data in the form of documents from the company. In addition to receiving a great amount of information in the beginning to be able to understand their business, we requested more throughout the whole data collection phase when necessary. This was for example supplementary data about things we discovered along the way, heard about through interviews, identified through our observations and so on.
In addition we got access to Brings' Improvement and Deviation Database, which we examined in order to see if there were areas standing out with deviations related to the

information flow. This was in order to discover if there were any documented issues concerning deviations connected to the information flow. From all the data in the database we extracted the relevant information for our area of research, and made some analyses and statistics based on these registrations.

2.3.3 Analysing phase

The analysing phase is where we gather all our findings, sort them and put them in context with each other to interpret how they potentially affect the supply chain according to the research problem. We base our analysis on theory that we present in chapter three, in addition to basic knowledge gained through our studies. Although we had a thorough process of analysing the transcriptions, the analysing had as mentioned already started throughout the data collection phase.

Our qualitative data were gathered as transcriptions of the interviews. The results from the interviews were analysed in order to describe how the company and the supply chain was organised and to map the human links and the information systems relevant for the interactions. Through reading these, and based on our impression from when conducting the interviews, we formed a perception of what where the central aspects and typical tendencies. Further reflection of and working with the material gave us an increasing understanding and overview of the subject and the patterns in our findings. All of the interviews together provided us a clear picture of both of the organisation and possible issues. The issues were systemised in relation to what were causing them, and further we develop potential improvements for certain areas and processes.

We always considered the context of our findings critically, for an example the position of the interview object and what their personal interest might be, the relationship they had to other discussed parties and so on, in connection to what opinions they had. The interviews were constantly compared to each other in order to check for similarities and differences. The thorough transcriptions of the interviews were very useful in this process. We have presented some of our findings through figures, like for example in Chapter 6 with regard to the descriptions of flows of goods and information, and further in Chapter 8 were we summarise the findings with regard to the issues and potential improvements that we have presented in Chapter 7.

2.4 Validity and Reliability

When conducting research one must always critically consider the quality on all the data, and the methods used to collect them. There are several different concepts of validity that describes how valid our research is, for example construct validity, internal validity and external validity, in addition to reliability. We will present some reflections about our research based on these concepts.

Construct Validity

An important question to answer is if we actually measure what we wanted to measure. This will depend on how well the data material responds to the researchers intentions of the study (Grønmo, 2004). We find the data collected to be relevant in relation to the objective of the thesis. The research problem and questions has been essential in every phase of our data collection and analysis. Our supervisor at Molde University College has step by step validated the progress of our thesis and we have continuously throughout the process conferred with the case company. Our findings from the interviews were discussed both with our supervisor and our contact persons in the case company. A representative from the management in Bring also verified the facts and descriptions before submission of the thesis. Through this we feel like the communicative validity has been strengthened.

The researchers competence in data collection is according to Grønmo (2004) a necessary but not sufficient prerequisite for high validity. It can be discussed that our somewhat limited experience of data collection through interviews may have affected the validity of our research. Still, with guidance from supervisor and literature we feel like we found a good approach for our data collection. At the same time there might be things that experienced researchers would point their fingers at, but we have had an ascending learning curve with regard to the interviewing and data collection throughout the research. It has therefore been very educational and a good learning experience.

Internal Validity

Internal validity focuses on if the results of a study can be perceived as correct (Jacobsen, 2000). Is there a causal relationship, which means a relation between cause and effect?
We attempt to achieve a level of internal validity by examining many aspects through our

interviews and studies in order to get an as complete as possible picture of what variables are affecting the information flow.
The pragmatic validity of our results is determined of to what extent the research will be a basis for actions or development of certain practices. Though it is difficult to forecast what the specific outcome will be, we have a reason to believe that our results will be useful for the company, and that there is a willingness to do changes on the areas both from the managements opinion and the employees on the more operative level. We cannot say if Statoil will be willing to make changes based on our results, but they have expressed a desire to get input from Bring with regard to improvements in the supply logistics.

External Validity

External validity describes if the findings from a research can be generalised (Jacobsen, 2000). Our research is a single case study, and the findings cannot therefore directly be generalised. But there are aspects gained from the study, literature research and theory presented that may be applicable for similar businesses.

Reliability

Reliability depends on whether the research study in itself, and the way it has been conducted has affected the results (Jacobsen, 2000). Grønmo (2004) emphasises that the reliability is dependent on if the research is based on real empirical findings. When the interviews have been conducted and by whom, will affect the research. We have tried to avoid this in many different ways in the interview process.
There can be several things through interviews that may affect the reliability. Such as the interviewers initial perceptions, the interviewees potential desire to present themselves and their work in a good way or maybe there are relevant issues that we have missed out on. This is something we constantly have considered.

Grønmo (2004) points out that if the transcriptions of the interviews or the recordings are critically assessed at several stages throughout the analysis the, this leads to a better stability and thereby reliability. The thorough transcription of interviews and constant use of these throughout the analysis can have strengthened the reliability of our findings. The fact that we are two researchers analysing the same research material can also be positive with regard to the reliability, in the way that we have compared our perceptions of the data collected.

2.5 Limitations and Clarifications

Limitations:

- We have limited the research in the way that we have not interviewed anyone directly inside Statoil, nor any representatives from the supply base operators or a valid sample of customers on the supplier side. This has been a reasoned priority in cooperation with the company, because of the time-spectre and complexity of the supply chain. We have though interviewed people representing other parties in the way that they have the position as an in-house Bring worker at Statoil. In this way they can see the issues from both Brings' and Statoil's position. These people work closely with the base operators teams and have therefore also presented some viewpoints from their angle. In addition we have viewpoints from some suppliers.

- We have limited the research to mainly focus on the oil express services that are transporting drilling and well equipment. Still, we touch upon other divisions under Bring Cargo for context and comparison.

- A limitation is done in the supply chain description, where the outgoing flow of information does not fully include the processes after the goods have been delivered at the supply base until it reaches the offshore installation. The information that is connected to the order after this point has not been investigated.

Clarifications:

- For the sake of simplicity we often refer to the department of Bring Cargo AS, Offshore and Energy as just Bring. This must not be confused to include the whole Bring organisation. We will state it clear when we talk about other divisions or the organisation as a whole.

- We define outgoing goods as goods that are to be transported from a supplier onshore to one of Statoil's offshore installations.

3 Theoretical Approach

Chapter 3 outlines the theoretical foundation for our research and analysis, in order for us to be able to answer the research questions and respond to the research problem.

The overall object of our research is to look further into parts of a supply chain and the communication within it. Therefore the theoretical approach to this thesis is based on supply chain management, information flow and the use of information systems. Within those aspects there are many interesting theories and approaches that gives us the opportunity to explore different aspects of the case. We will in this chapter point out some theories that have helped us describe the case, analyse, discuss and come up with a conclusion to the research. Our research problem focuses on an improvement of processes that are not functioning optimal, and therefore we present some different theories concerning improvement of the supply chains performance.

We will describe some aspects of Supply Chain Management and the Service Supply Chain before we explore the theories around Lean and Agile supply chains and strategies, and the Theory of Constraints in order to assess the company and the supply chain. We will further present some definitions of quality and productivity, as we are analysing processes performed. The chapter also touches upon theory of Integration and Transaction Cost Analysis. At last but not least, important aspects of Information, Data and Information Technology are described.

3.1 Supply Chain Management

Bowersox, Closs and Cooper (2010) explain the term supply chain as a multi firm collaboration within a framework of resource flows and constraints, where value is added through the synergy among the firms in the supply chain. The synergy results from five critical flows namely information, product, service, financial and knowledge. The supply chain perspective has experienced a shift from a traditional focus where the businesses involved were loosely connected to each other, to becoming a managerial tool frequently used to increase market impact, overall efficiency, continuous improvements, and competitiveness.

Supply chain management (SCM) is defined as, *the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders* (Lambert, Cooper and Pagh, 1998, p.1). Bowersox, Closs and Cooper (2010) further explain the SCM aspect as a collaboration of firms that seek to leverage strategic positions and improve operating efficiency.

In order for individual businesses to succeed in today's competitive environment SCM is vital. Companies compete largely as a supply chain as well as a single unit and are increasingly dependent on integration with the other supply chain actors in their network. The conceptual framework of SCM consists of three elements; the supply chain network structure, the supply chain business processes and the supply chain management components. Each element constitutes a step in designing and managing a supply chain (Lambert, Cooper and Pagh, 1998). A brief explanation of the three elements will be presented next.

In order to be able to manage a supply chain it is important to understand the structure of the network. The structure includes the members of the supply chain and the links between them. A company should start by sorting out which members in the supply chain that is most significant to the success of the firm and the supply chain as a whole and give these members the most attention and resources. Further, it is necessary to detect the structure of the supply chain in terms of number of tiers across the chain, number of suppliers/customers at each tier and the specific firm's position within the supply chain (Lambert, Cooper and Pagh, 1998). In order to solve our research problem it is vital that we investigate the structure of the supply chain and detect what position Bring has within this supply chain.

The business processes are related to activities that give value to the customers, and supply chain actors should integrate these activities into key business processes. Such business processes have to give meaning to all the actors in order to be successful. Also, not all business process links should be integrated and managed to the same extent because some links are more critical than others. In a large supply chain with many interfaces it would be difficult to try to manage all the links. Therefore, the level of integration will not be the same for every link in the supply chain and the scarce resources allocated to each business process link is an important task (Lambert, Cooper and Pagh, 1998). In our case, when investigating the supply chain and searching for areas of improvement it will be helpful to detect what links should be granted most attention.

The management components refer to variables that contribute to integration and management of business processes. The number and level of components added to a business process link will affect the degree of integration and will vary from link to link. In our case it would be interesting to see whether an increase, decrease or an altered weighting of these components could enable Bring to better manage the processes in the supply chain. The authors list nine components that should be the focus of the management in order to achieve successful SCM and increased integration:

- Planning and control: Joint planning is expected to contribute to success of the supply chain and control is the best way of measuring this success.
- Work structure: How the firm conducts the activities.
- Organizational structure: The integration of processes in the supply chain.
- Product flow facility structure: Sourcing, manufacturing and distribution in the supply chain.
- Information flow facility structure: The type of information and how often this information is updated is key in accomplishing an efficient supply chain.
- Management methods: The philosophy and techniques of the management. This might differ between the actors in the supply chain.
- Power and leadership structure: Will affect the structure of the supply chain including the commitment of the actors.
- Risk and reward structure: The belief that this is a shared matter might contribute to long-term commitment.
- Culture and attitude: Important that these aspects are compatible between actors in the supply chain (Lambert, Cooper and Pagh, 1998).

Integrating business processes and successful SCM might be challenging if the members of the supply chain have different activity structures such as functional structures, process structures or a mix of the two. This will make it difficult to link processes across firms. In addition, firms in a supply chain might use different names for the same process or the same name for different processes, which could result in friction across the supply chain. Failure to achieve inter-firm consistency will lead to inefficiency in supply chains. Therefore, for firms in a supply chain to succeed in integrating key business processes it is important that the managers make use of the same terminology and speak the same language

Failure to integrate, streamline and manage the supply chain will lead to more friction and thus waste of resources (Lambert, Cooper and Pagh, 1998). We will elaborate further in more detail on the concept of waste in Chapter 3.3.

3.2 The Service Supply Chain

Through our research we analyse a logistics service supply chain. Logistics is as a process that occurs within the supply chain management, and involves the work required for moving and geographically position goods. Logistics is the combination of activities related to order management, inventory, transportation, warehousing, material handling and packaging (Bowersox, Closs and Cooper, 2010).

According to Deming (2000) there are several characteristics you find in most service supply chains:

- Direct transactions with masses of people (actors in the supply chain and external)
- Large volume of transactions (sales, taxes, charges)
- Large volumes of paper involved (mail, documents, data slips, invoices, tax)
- Large amount of processing (transcription, calculation, punching)
- Many transactions with small or larger amounts of money
- An extremely large number of ways to make errors
- Handling and re handling of huge numbers of small items (communication, mail, to/from the government, departments, etc.)

Ellram, Tate and Billington (2004) states that there have been little done in terms of creating a commendable and comprehensive framework for managing service supply chains. There are clear distinctions between manufacturing and service supply chains. These differences are important to be aware of when using theories traditionally developed for manufacturing companies. Ellram, Tate and Billington (2004, p.24), also emphasises that while the functions and processes may differ between the professional services supply chain and the manufacturing supply chain, the same basic issue exist: there are a host of processes that take place in the supply chain, and they must be effectively coordinated across organisations and functions in order to best meet uncertain demands of the customer.

We have attempted to make use of the concepts of several different theories in order to determine what to look for when we analyse this particular service supply chain. Although many of the theories are developed for manufacturing companies and supply chain, we see many similarities that can be applied, if take into consideration the differences.
A denominator common to manufacturing and any service organization is that mistakes and defects are costly. The further a mistake goes without correction, the greater the cost to correct it is. (Deming, 2000. Ch.7, p.190)

3.3 Lean, Agile and Leagile Supply Chains

There are different characteristics of supply chain strategies that highly depend on the market conditions and type of business, which affects the planning and control of the supply chain.

- Lean thinking is focusing on an effective supply chain, as low costs and as little waste as possible. The strategy is based around the philosophy of eliminating waste by focusing on four areas; specifying value from the customer perspective, identifying the value stream, making the product flow through the supply network and letting the customer pull (Harrison and Van Hoek, 2008).
- Agile supply chains are customer responsive and characterized by a concern with speed and flexible response (Harrison and Van Hoek, 2008). Industries that are characterized by high volatility and uncertainty in demand are forced to focus on achieving high responsiveness to the market through the management of the supply network (Cagliano et.al, 2004). In agile approaches quick deliveries, flexibility and good quality are important objectives for ensuring this.
- Leagile supply chains are characterized by a combination of lean and agile paradigms that shall be determined by whether the company shall be agile or focusing on lean thinking is dependent on where in the supply chain they are located.

The agile supply chain has many of the same characteristics as the supply chain of the case studied. Still there are similarities to a lean supply chain, for example in the way that there are long-term partnerships between the actors. We acknowledge the focus on the agility in the supply chain, but see a possibility for lean thinking in the processes, and have therefore also touched upon the term Leagile.

3.3.1 Agility

Agility is a business-wide capability that embraces organisational structures, information systems, logistics processes and in particular mindsets (Christopher and Towill, 2001). According to Harrison and Van Hoek (2008) agility focuses on customer responsiveness and sensitivity towards the market and demand. It is a network-based approach, where the supply chain should be seen as a network of partners that together shall collaborate towards a common goal, which is to satisfy the end-customers' needs. The network shall further be viewed as a system of business processes that should support the material flow (Process Integration). Processes that do not, and stand alone, will create penalties in terms of time, cost and quality for the while network. Also, a use of information technology shall contribute to a virtual supply chain and to share data between the actors. Virtual supply chains are information based rather than inventory based and electronic data interchange (EDI) has enabled partners to act upon the same data (Harrison and Van Hoek, 2008). Shared information is important, and the visibility of the real demand makes it easier to use the responsive supply chain to exploit profitable opportunities.

3.3.2 Lean thinking

Lean can be characterised as an approach, a principle, a way of thinking, a state of mind, a tool or a concept, that has developed over several years. It has sprung from many different standpoints and understandings, and the definitions are as many as the meanings on if it is effective or not. Toyota Production System has a clear role in the increased interest in lean manufacturing, but the phenomena can be traced further back to both the UK under second world war and the US in the beginning of the 1900 (Christopher and Towill, 2001).

Lean thinking refers to elimination of waste in all aspects of a business (Harrison and Van Hoek, 2008). Another simple definition of Lean, as stated by Bicheno and Holweg (2009), is "Doing More with less". They further point out that lean is not only about cutting back and reducing waste, but just as much emphasising value and growth. Lean is applied to Lean always seeks the ideal way of doing things through a process of continuous learning and improvement. Harrison and Van Hoek (2009) again define Lean Thinking as, *a cyclical route to seeking perfection by eliminating waste and thereby enriching value from the customer perspective* (Ch.6, p.172). Kaizen is a much-used concept in lean that is to strive for continuous improvement. Kaizen emphasises that there is always room for improvement in processes (Bicheno and Holweg, 2009).

After Womack and Jones (2003) there are four principles to be followed in order to achieve the fifth principle, which is "perfection". First one must specify the value from the end-customer perspective. Then the next principle is to identify the value stream, and the processes along the supply network. Further, the next step is to create product flow, which means to minimize defects, downtime, delay and inventory by focusing on simplicity and visibility. The last step is to let customer pull and thereby implementing pull scheduling to only response to signal from the customer. All this is in order to always seek perfection in the supply chain by gradually getting better in everything we do. Eventually it all comes down to eliminating waste.

In Lean thinking there is a distinction between "value adding" and "non-value adding" activities. Value adding activities are something that the customer is willing to pay for. Such as in situations where the customer is not able to perform a task on their own or without spending significant time or costs (Maleyeff, 2006). Organizations should strive for improving the ratio of value adding to non-value adding activities. This can be done by increasing the value, but also through prevention and elimination of "waste"(Bicheno and Holweg, 2009). There are defined seven categories of waste in lean thinking (Harrison and Van Hoek, 2008):Overproduction, waiting, transporting, inappropriate processing, unnecessary inventory, unnecessary motions and defects. These activities create no value for either customers or other stakeholders involved. It might in fact destroy value. The waste principle in Lean is an aid to focus on the goal of obtaining more efficient processes. Elimination of waste is a contributor to increased quality (Bicheno and Holweg, 2009).

These above-mentioned principles and lean thinking in general appear to relate specifically to manufacturing. However, the principles in lean are increasing in use also in the service industry. By a study of 60 service systems Maleyeff (2006) found aspects of the process-system of manufacturing that could be transferred to the service business. He proposed seven categories of waste more fitting to the service sector:

- Delays (time wasted either in a queue or by waiting for information)
- Reviews (activities of inspecting complete or partially complete work in order to detect possible errors or deficiencies)
- Mistakes (errors done internally or by the customer that requires rework)

- Duplication (activities that are performed elsewhere in the system or activities performed more than once)
- Movement (movement of personnel, information or equipment that is unnecessary)
- Processing inefficiencies (ineffective use of a resource)
- Resource inefficiencies (managing the resources in an wasteful manner)

In the internal processes in a service organisation information is often the most important aspect of value provided to customers. A lean approach in an internal service organisation would contribute to provide the customers with the information they need in a fast and effective way. In a service organisation the individual service providers, namely the employees play a significant role in providing service for the customer. As a result, their actions might affect the customer satisfaction. Such as how their tasks are conducted, how they communicate information and how they react to atypical situations. Maleyeff (2006) argue that the service providers are more effective when they have a good understanding of the system as a whole and not just their own tasks. Increased knowledge of the organisation through education might help the employees to better understand the perceptions the customers have with regard to the system.

3.3.3 Leagile

Hybrids of the two strategies Lean and Agility have developed throughout the years as the term *leagile*. This can be considered as a mixed strategy of the two approaches. One version of this can be for an example to differentiate the supply into lean and agile handling based how critical it is and the costs related (Goldsby, 2006).

Characteristic	Lean	Agile
Logistics focus	Eliminate waste	Customers and markets
Partnerships	Long-term, stable	Fluid clusters
Key measures	Output measures like productivity and cost	Measure capabilities, and focus on customer satisfaction
Process focus	Work standardisation, conformance to standards	Focus on operator self-management to maximise autonomy
Logistics planning	Stable, fixed periods	Instantaneous response

Table 3-1: Comparison of characteristics of lean and agile supply (Harrison and Van Hoek, 2008)

Table 3-1 provides simplified characteristic in the comparison on lean towards agile.
In addition there are other characteristics that are different for example that there are often low profit margin for lean supply and high profit margin for agile supply.

Naylor, Naim and Berry (1999) suggest that thinking of the two approaches of lean and agile in isolation, is too simplistic and though they are distinctly different they can be successfully combined. Christopher and Towill (2001) describe that both agility and lean management demands high level of product quality. A require for minimisation of total lead-times is also a common factor. In the agile supply chain the total lead-time has to be minimised to enable agility, because of the difficulties to forecast demand.

The main differentiating and critical factors between lean and agility is that for agility it is the service level that determines the total value provided to the customer, whilst in lean it is the cost or price that is determining (Christopher and Towill, 2001).

According to Harrison and Van Hoek (2008) there is "no reason why there should be an either-or approach to logistics strategy" (Ch.7, p.206). Supply chains can adopt the lean thinking capability up to a certain point in the processes and thereafter go for the more agile approach. Such leagile supply chains can enable for high productivity and a combination of low-cost processes and responsiveness in the different processes.

In our case we acknowledge the need for agility in the supply chain, but we will explore if there are possibilities for applying lean thinking for improving some of the processes. If Bring must be agile and respond to the customers demand, this can possibly affect the company's cost efficiency. Then there might be a point in exploring the term of agility.

3.4 Theory of Constraints

We have applied the philosophy of the Theory of Constraints (TOC) by focusing on the overlying use of the thinking process and the five focusing steps as a way to find out where there are issues in the supply chain and internally in Bring. Our research questions have similarities with the processes in TOC. We have not gone in depth with the tools for discovering them, but rather combined TOC with other approaches to analyse our research.

Goldratt first introduced TOC 1980's. TOC is a tool for on-going improvement of an organization or a supply chain's performance, so that it can reach its goals. The organization needs to improve the parts of its production or service line that prevent them from reaching their goal (Helgheim, 2013). Through the TOC we focus on identifying these bottlenecks or constraints that prevent a company from achieving their goals. According to Bicheno and Holweg (2009) a constraint is a resource with the highest load, while a bottleneck is a resource that is unable to meet current demand. Although the term bottleneck is often used when it in fact is a constraint. The constraints can be physical, logistical, managerial or behavioral (Bicheno and Holweg, 2009). We find constraints to be the most accurate term to use for the challenges in our case study.

Bicheno and Holweg (2009) also states that although TOC has by some been considered as conflicting towards Lean Thinking, they consider there to be little conflict and much to be gained by treating TOC and Lean as compatible. Although TOC traditionally has been a tool for manufacturing companies it has also shown itself useful for businesses in the service industry. We will use some of the tools of TOC as help to detect reasons as to why Bring faces challenges to reach their goals.

There are many tools that can be used in TOC, for example the Thinking Process (TP), The Five Focusing Steps, Conflict Cloud, The Current Reality Tree, The Future Reality Tree, Negative Branch Reservation, the Drum-Buffer-Rope approach and many others.
We will concentrate on the first two, the Thinking Process and the Five Focusing Steps. The reason for this is that we have made the choice not to apply theory of constraint in its whole, but only the overlying philosophy. We feel like these two approaches cover those aspects.

The Thinking Process (TP) is a method that uses the cause-and-effect logic to develop a strategy for problem solving inside an organization or supply chain. The process begins with the symptoms and ends with a detailed action plan.

In the TOC thinking process there are three fundamental questions.

- What do we want to change?
- What do we want to change it in to?
- How do we make the change happen?

These might seem as simple questions, but they might not be as simple to answer. This requires a thorough research of the current situation to identify the core problems, good

understanding of the surrounding environment and a clear focus on the goals and strategy of the company and/or the supply chain.

Another approach in TOC is The Five Focusing Steps, or the TOC Improvement Cycle, which is presented in "The Goal" by Eliyahu M. Goldratt (1984). This is a process for on-going improvement. Although the theory is developed with manufacturing services in mind, we find these steps to be useful also when considering a service supply chain, as our case.

The Five Focusing Steps:

1. Identify the system constraint or the bottleneck
2. Exploit the system constraint
3. Subordinate the system to the constraint
4. Elevate the system constraints
5. Return to step one

All in all it is all about identifying the weakest links and figure out how they can be exploited, allocate the resources thereafter and all in all take action. Our focus is to identify the constraints in the processes related to information flow, and examine how these can be exploited.

3.5 Quality and Productivity

The following discussion represents our understanding of the term quality and will be applied as a basis when we analyse the quality of the information flow in the supply chain in Chapter 7. In order to answer our research problem we need to clarify what is meant by quality.

When discussing quality in a service company like Bring, it is important to remember that the customer determines the total quality experience. This perception can be different among the customers, and is dependent on their different needs, tolerance, expectations and willingness to pay (Dale, 1997). Deming (2000) emphasises that customer satisfaction can be distributed all the way between extreme dissatisfaction to highly pleased. The customers' reaction to the quality of the service might not be easy to measure since it is highly individual, based on expectations and preferences and it can shift based on external conditions.
Quality should be aimed at the needs of the consumer, present and future. Deming states that improvement of quality transfers waste into a better product and service and the result is a chain reaction of lower costs, better competitive position, happier employees and more jobs.

Further, he suggests that when you improve quality you also improve the productivity (Deming, 2000).

There lies a level of quality in the internal processes that might not directly have a noticeable effect on the service provided for the customer but that is crucial for the productivity and profitability of the focal company. In our case, investigating the quality of the internal booking processes in Bring could give us important insight into which areas should be focused on in order to increase the profitability of the company. When focusing on productivity, one must also focus on the quality that is in the processes or the outcome. According to Taylor (2008) it is important to take into account the costly outcomes that can result from poor quality. The concept of quality must be effectively integrated with productivity.

The management of companies in Japan started from the 1950's to focus on the fact that improvement of quality naturally improved productivity, based on literature on quality control (Deming, 2000). They discovered the chain reaction of improved quality leading to costs decrease because of less rework, fewer mistakes, fewer delays and snags that lead to better use of time and materials. This further lead to improvements in productivity, and they were able to capture the market with better quality and lower price.

Quality improvement is highly relevant for the service industry and to Bring. The principles for improvement are the same for service as for manufacturing. Naturally, the application differs from manufacturing and from one service to another. Quality begins with the intent, which is fixed by management. Deming (2000) presents 14 principles for management transformation for improved quality and productivity. In short these principles emphasises that there must be an awakening to the "crisis" followed by action, which is the management's job.

Deming (2000) has an interesting point when he states that best efforts are not sufficient. When he asked the management in a company how they went about to improve quality and productivity their answer was: "By everyone doing his best". His respond was that this is wrong. Best efforts are essential, but without the right guidance, knowledge and consistency it can do a lot of damage. Think of the chaos that would come if everyone did his best, not knowing what to do (Deming, 2000, Ch.2, p.19). In our case it would be helpful to examine

how the employees in Bring perceive their work assignments and see how well this corresponds with the overall goal of Bring, in order to possibly detect areas of potential quality improvements.

Management of quality and productivity are mentioned as incentives to make changes in companies. There are several different methodologies for managing quality in organisations. All of the approaches have a focus on the improvement of organisations, processes or services. Such methodologies can be Total Quality Management, Business Process Reengineering, Lean Six Sigma and so on. We will not make us of such methods, but rather focus on a few aspects that are related to quality, and that are often discussed in conjunction with improvements and changes in organisations: productivity and cost reductions.

According to Gerald Taylor (2008) on Six Sigma, productivity is regarded as the key to economic prosperity. Productivity is determined by how much output you get from the resources put in, or the value produced divided by the factors required to reach that value. Measures of productivity can be an important tool for companies on order to determine how to allocate time, energy, capital and other resources. An interesting aspect to keep in mind though, are that measures of productivity does not lead to improved productivity (Deming, 2000). Just as well as statistics on accidents can tell you were the accidents happen, but it does not provide an answer on how to reduce the frequency of accidents. The issues must be uncovered and improvements need to be set into action.

According to lean thinking a focus on reducing costs of operations is also important, particularly if there is pressure from market conditions that acquires adaption in order to be competitive (George, 2010). Costs and productivity has a clear connection. George (2010) states that the performance of processes and excellence in the execution of them potentially provides agility and the speed that is necessary for supporting improvements in costs.

3.6 Integration

Collaboration between partners within a supply chain opens up for possibilities to better coordinate processes and improve the responsiveness to the end-customer in order to achieve a superior quality of service (Harrison and Van Hoek, 2008). In a supply chain when talking about integration it is a focus on coordination where one must establish the guidelines for the

flow of material and information. According to Harrison and Van Hoek (2008) it has been established by research, that there have often been an improvement of the performance in the supply chain by improving the integration. Frohlich and Westbrook (2001) executed a research of 322 global manufacturers that provide evidence for the fact that coordinated upstream and downstream integration in the supply chain differentiates performance.
We can also differ between the terms internal integration and external integration because there are not only a need for integration between the different actors throughout the supply chain but also "inside the four walls" of the firm. Taking into account both the external and the internal integration in our case could provide us with a better insight of where interruptions in the information flow might occur.

Internal integration focuses on the barriers between different divisions in the firm, like marketing, sales, manufacturing, distribution and so on. Firms that have higher internal integration have a higher logistics performance than less integrated firms (Harrison and Van Hoek, 2008). To examine the level of internal integration in Bring could provide valuable knowledge of how well the company work together towards a common goal. The different divisions in a firm have different wants and needs for the processes and outcomes. The actions of the divisions will affect the possible performance of the firm. Therefore communication and shared strategy are essential for a good productivity.

An important tool in both the internal and external integration is the use of electronic aids for even better possibilities to share information, conduct transactions and in general front a more collaborative planning between the actors. Tools for electronic integration can be EDI-systems and other Internet based solutions for exchanging information.

3.7 Transaction Cost Analysis

Another theory that is worth looking into is the theory of Transaction Cost Analysis (TCA). TCA is one of the main theories within the governance literature. It is an extensive theory that has been studied by many researchers (Joshi and Stump, 1999). We will discuss the aspects of TCA, and the possible extensions to the TCA theory that are most relevant to our case. Bring is dependent on cooperation from the other actors in order to improve the handling of the information flow in the supply chain. It would thus be interesting to apply the TCA

perspective in order to examine how an investment in the relationship with Bring possibly could affect the supply chain actors.

The main purpose of TCA is to handle exchange transactions in a way that minimizes the transaction costs. Transaction costs is the sum of coordination costs and transactions risk. Coordination costs are costs of exchanging information and work that information into decisions. Transaction risks are associated with the risk that the agreeing parties in a relationship do not comply with what was agreed upon (Grover and Malhotra, 2003). Specific assets and the uncertainty surrounding the exchange between the buyer and the seller represent sources of such risk and are core dimensions of the transaction (Buvik and Andersen, 2002). Asset specificity is defined as, *the physical and immaterial assets tailored to a specific relationship that cannot be redeployed for other purposes without the sacrifice of productive value* (Buvik and Andersen, 2002, p. 4). Whereas uncertainty is defined as, *the unanticipated changes in circumstances surrounding a transaction* (Grover and Malhotra, 2003, p. 460).

The TCA perspective states that specific assets and the uncertainty related to transaction exchange between parties give rise to the change of mode of governance from conventional markets toward bilateral governance or vertical integration (Buvik and Andersen, 2002). Grover and Malhotra, (2003) suggest that investments in information systems that is implemented to meet the need of one specific customer can be regarded as an asset-specific investment. TCA theory suggest that substantial asset specificity could lead to opportunistic behavior between the trading partners and thus lead to increased costs of safeguarding inter-firm agreements (Buvik and Andersen, 2002).

According to Buvik and Reve (2002) TCA does not take into account market power and power based on resource-dependence in a significant manner, TCA could therefore be extended with Resource Dependency Theory (RDT). The RDT concerns the resources exchanged and to which degree the parties are able to replace these resources outside their relationship. In that way, the article suggest that although investing in specific assets is a source of bilateral dependence, such dependence might also be affected by the market power and access to alternative exchange partners of the parties involved. Meaning that specific assets does not necessary have to lead to loss of bargaining power for the party investing in such assets.

Joshi and Stump (1999) further suggest another factor that might affect the level of risk associated with investment in specific assets. The authors introduce elements from the Relational exchange theory (RET). RET states that relational norms are an important part of the governance mechanism that could affect the behaviors in an exchange relationship, and as a result increase commitments and reduce the risk of opportunism. Relational norms, trust, and personal relationships are expected to arise as the relationship evolves over time (Buvik and Andersen, 2002). To analyze how possible investments in the relationship between Bring and Statoil might affect the dependency between the two parties could provide important knowledge of consequences this might have on the relationship.

3.8 Information

Our research has focused around the importance of the flow of information. Often when thinking of improvement, one tends to look towards the material flow but an equally, if not more important, area to focus on is the flow of information. Information is an essential aspect in our thesis, thus we have to look at how we can seek areas of improvement both related to the internal information flow in Bring and the information flow with the other supply chain parties. Information about the demand of the end-customer and the supply of the supplier is important to integrate in order to obtain an accurate picture of the situation and the processes. Such integration provides increasing competitive advantage (Harrison and Van Hoek, 2008).

3.8.1 Information and data

Kettinger and Li propose a distinction between information and data. Data is defined as, *the measure or description of objects or events, usually referred to as a set of interrelated data items that measure the attributes of the objects or events* (Kettinger and Li, 2010, p. 414).

Information is defined as, *the meaning produced from data based on a knowledge framework that is associated with the selection of the state of conditional readiness for goal-directed activities* (Kettinger and Li, 2010, p. 415). Two clarifications are further stated to provide a better understanding of what information entails. First, *information must be eventually based on data, which we regard as the primary source of information; it can also come from a secondary source, that is, other people's information* (Kettinger and Li, 2010, p. 415). Second, *the production of information from data needs knowledge, and when knowledge varies, so does information* (Kettinger and Li, 2010, p. 416).

The authors state that information is the meaning of data. The data might be obtained from primary or secondary sources of information. Information processing includes an interpretation of the observations rather than directly observed facts, and because of this "data" from a secondary source might thus actually be information that has been processed before it is communicated further. The data might therefore be influenced by the sender's processing and knowledge, and be regarded as information to the receiver. The receiver on the other hand might re-interpret this information. The two terms might therefore slightly overlap (Kettinger and Li, 2010). The focus on information and data is essential when examining the company and supply chain with regard to the information flow and information systems that are employed.

3.8.2 Information technology and information sharing

As already mentioned, information flow is an important part of supply chain integration. Prajogo and Olhager (2012) suggest that both information technology (IT) and information sharing are forerunners of the flow of goods. Meaning that in addition to the technical aspect of information the supply chain actors have to trust each other and be willing to share information in order to benefit from the supply chain integration. These two aspects will be described further.

Information Technology

There have been massive changes to business practices as a result of available IT the last decade of the 20th century and the development will in all probability continue. IT is defined as, *technology for processing, storing and communication of information* (Bø and Grønland, 2014, p. 237). Historians are increasingly referring to the 20th century as the information or digital age. IT has created options for connectivity between supply chains actors, and is what enables the management of supply chains (Bowersox, Closs and Cooper, 2010). IT allows the information communicated between the supply chain actors to increase in both complexity and volume. Further, IT makes it possible for the actors to bring forth real-time information to the supply chain, such as delivery status and planning scheduling. IT might also increase the coordination between the actors in a supply chain by making it possible to align forecasting and scheduling of operations (Prajogo and Olhager, 2012). IT is regarded as a contributor to knowledge networks, which allow supply chain partners to create, share, and use strategic knowledge in order to achieve increased operational efficiency and effectiveness

(Gunasekaran and Ngai, 2004). IT will in the foreseeable future be important in the development of several logistics processes. Systems that handle warehouse and production planning and orders and invoice processing have contributed to limiting uncertainty and risk in many businesses (Foss and Virum, 2000).

Larger supply chains, due to the fact that many companies choose to outsource their activities to a greater extent, increase the demand for effective data sharing. In our case the information has to go through many links in the supply chain and therefore it could be wise to examine the possibility of increased use of IT solutions to handle this information flow. The development of information and communication technology has made it easier to create clear links between suppliers, producers, customers and third parties. Electronic links have made it possible to transfer more accurate information between the actors in a supply chain with much shorter lead times than before. This creates opportunities to speed up the entire shipping transaction. EDI is a common technology in this regard. However, the cost of implementing has made the investment in EDI solutions difficult for many companies. For those companies, the Internet might be a good substitution. Internet makes electronic business and electronic communication affordable even to the smallest companies (Stefansson, 2002).

Gunasekaran and Ngai (2004) propose several aspects that have to be taken into consideration to achieve successful implementation of IT in SCM. In our case it could be wise to take such aspects into consideration when looking at possibilities for Bring to engage in IT changes. First there has to be made investments in training and education in order to fully utilize and benefit from the IT. IT in itself will not lead to any competitive advantage and is therefore dependent on cooperation from the employees to be successful. The skills and knowledge of the employees and other users is vital in successful IT implementation. Both people and processes affected by the IT have to go through phases of change, learning, adaption and growth. In addition, all the users of the IT/information system (IS) have to be motivated and willing to be a part of a more transparent environment and share information in order for IT implementation to be beneficial. This is an important aspect for Bring to consider when trying to increase the use of IT in the booking process and this will be described further below. Secondly implementation of IT requires support from the management and from the organizational structure in order to enable SCM. Third, it is suggested that before implementing IT, the processes exposed to the changes must be well enough integrated (Gunasekaran and Ngai, 2004).

Information Sharing

Information sharing is another aspect that is vital in building a solid supply chain relationship and can be described as the extent of sharing of critical information between supply chain partners. Some firms might view information disclosure as loss of power and be afraid that other parties in the supply chain might leak sensitive information to competitors. Therefore, factors such as trust, commitment and a shared vision throughout the supply chain might contribute to an increased information sharing (Li and Lin, 2006). In our case the supply chain partners are Bring, Statoil and the suppliers of Statoil. By exploring the level of trust, commitment and shared vision between the actors, one could provide valuable knowledge about this relationship. An example of critical information is strategic information that could help the other actors in the supply chain to make forecasts, which in turn could improve the efficiency and service level in the supply chain as a whole. Although IT is an important aspect of information integration, the benefits of such technology will not be utilized to the fullest unless the frequency, the quantity and the quality of information is good enough (Prajogo and Olhager, 2012). Measures of information quality could be the accuracy, timeliness, adequacy, and credibility of information exchanged. In order to improve the quality of information shared it has to be as precise as possible and preferably flow with minimum delay and distortion (Li and Lin, 2006).

Bowersox, Closs and Cooper (2010) suggest four reasons why accurate and timely information has increased in importance. First, the customers demand real-time information with regard to order status, delivery tracking and invoices. Second, information can be used as a tool to reduce the total use of resources in a supply chain, such as human resources. Third, information increases the flexibility of how, when and where to use the resources. Fourth, more information exchange through Internet solutions will strengthen the collaboration and the relationship between the supply chain members.

Bø and Grønland (2014) lists information exchange as one of the most important elements of delivery service related to logistics. Where information exchange is defined as *information that is shared between customer and transporter relating to the actual delivery, and order status information with possibilities to trace the order* (Bø and Grønland, 2014, p. 233). Exchange of information is a significant aspect of integration in a supply chain, especially in terms of information that flows between a transporter and the user of the transport.

4 The Supply Chain

This chapter contributes to answer to Research question *1: Description of the supply chain*, as defined in Chapter 2.1, and further more specifically Research question *1.1: Who are the actors?* The basis for this chapter is information from the interviews and information obtained from the other sources presented in Chapter 2.2 and 2.3.

The supply chain is a part of the upstream logistics connected to oil and gas production on the Norwegian Continental Shelf. The case addresses the onshore transport between the supply bases. We examine the integration between different actors in this chain, from the viewpoint of the intermediate actor Bring Offshore and Energy. Statoil is the main customer whereas Bring is an intermediary between the oil Company, the transporters, the external suppliers and the supply base operators. The supply chain is illustrated in a simple manner in Figure 4-1 below.

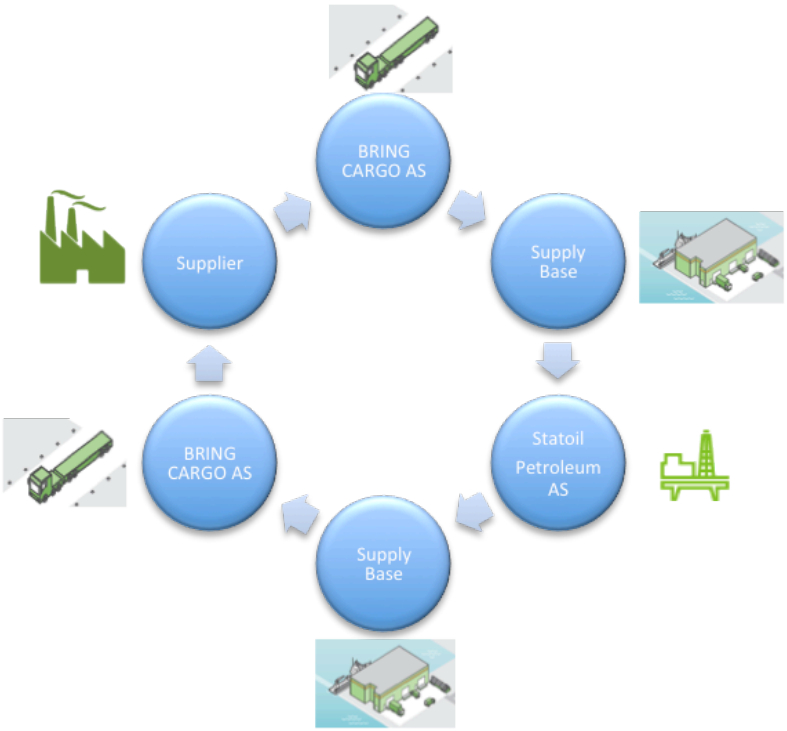

Figure 4-1: The supply chain

4.1 Bring Offshore & Energy

Bring Logistics is a part of Posten Norge AS, and one of the largest providers of postal and logistics services in the Nordic region. Bring offer different services towards business customers such as warehousing, express logistics, tempered freight logistics, mail and parcels, customer relationship management, purchasing, analysis and so on.
Bring Cargo lies under the division of Logistics and is specialized in domestic and international freight transport by road, sea, air and rail. Bring Cargo has three large transport divisions: Offshore and Energy, Domestic groupage and part load and International groupage and part load. This section we will give a description of the division of offshore and energy, as this is our unit of analysis. The main focus of this thesis will be on the oil express (OX), which is a service in the Offshore and Energy segment. We also introduce the division of groupage and part load, as we will slightly compare some of their information solutions towards the offshore divisions flow.

The offshore and energy division in Bring consists of 142 employees all across Norway. They offer transportation and management services, and customized solutions for the offshore- and energy sector.
The services special for this segment are:

- Base-to-base transportation by the oil express
- Project Management
- Marine Management
- Ship Service &Agency

The goods handled in this sector are high cost and specialized goods, often with irregular measures and weights and classified as dangerous goods (ADR transport classes). This will be further described in section 4.1.1.5. The demand for precise and rapid deliveries is high. Many large oil companies and offshore equipment suppliers are customers of the Bring Offshore and Energy Department. Big clients are Statoil, Aker Solutions, Eni, Songa Offshore, Swire, Schlumberger, Weatherford, Baker Hughes and Halliburton, to mention a few.

4.1.1 Oil express (OX)

The oil express (OX) service ranges from project logistics to express deliveries, and transports all kinds of offshore equipment to and between the supply bases along the Norwegian Coast. There were in 2012 about 10 000 departures between the bases. The equipment mainly handled by the oil express is in the category of drilling a well, which we further can refer to as D&W equipment. Many vendors in the oil industry are located in Stavanger, and from here the OX is also managed. At the offices in Tananger bookings are being received and processed, the vehicles get planned and assignments get handed out to the different drivers. There are four charterer assistants and three charterers that handle the booking and planning of the OX. In addition the offices for a local offshore distribution network is located here.

Figure 4-2: The semi-trailers used in the OX with equipment loaded (Bring)

There are several categories under the oil express; it consists of *regular transportation*, *express delivery* and *super-express delivery*:

- When it is regular transportation you have one driver on the vehicle and the trip takes the time necessary, included the drivers resting time. There are scheduled departure times set for each base, and the booking-limit to get goods on these departures are four hours in advance. The numbers of days for regular transportation to the different bases are presented in Table 4-3 in Chapter 4.4.

- Express delivery is when the transport is to be executed outside scheduled departures or transported in less time than regular transportation. When it is express delivery, you typically have two drivers on the same vehicle so that one can drive while the other have a break if it is long distances. This kind of transportation has a small extra charge.
- At super-express deliveries the vehicle should be driven all the time, only stopping for gas, so here you need as many drivers as that take. This is most typically needed for the long distances, like Hammerfest and Sandnessjøen.

The oil express has a 24/7-duty system, so the customer always has the possibility to order a transport. Transports that are requested after office hours are often express deliveries.

In addition to freight by road the oil express also uses transport by sea between the locations along the coast. In 2012 about 2.500 trailer loads were sent by sea. Bring has hired a ship on time charter, the MV Rignator, that has a scheduled departure from Stavanger each Friday afternoon. At times they also use ships from the spot-market, if this is needed and practically possible. The use of a somewhat longer planning horizon is often needed when coming to freight by sea, and the customer must be ok with the transport method.

A challenge in the base-to-base transport is the majority of transports that are not planned in advance. This is characterised as unplanned/unscheduled transports, and in production and operations offshore there is a much larger share of this than in the other segments that Bring Cargo provides service for. Bring estimates that about 80% of the transports in the oil express are unscheduled transports. This stands in contrast to the rest of the transport services internally in Bring, where only 10% of transport is unscheduled.
It is important to notice that Bring also estimates that about 40-50% of the unscheduled transports are express transports. An illustration of this is presented in Figure 4-3.

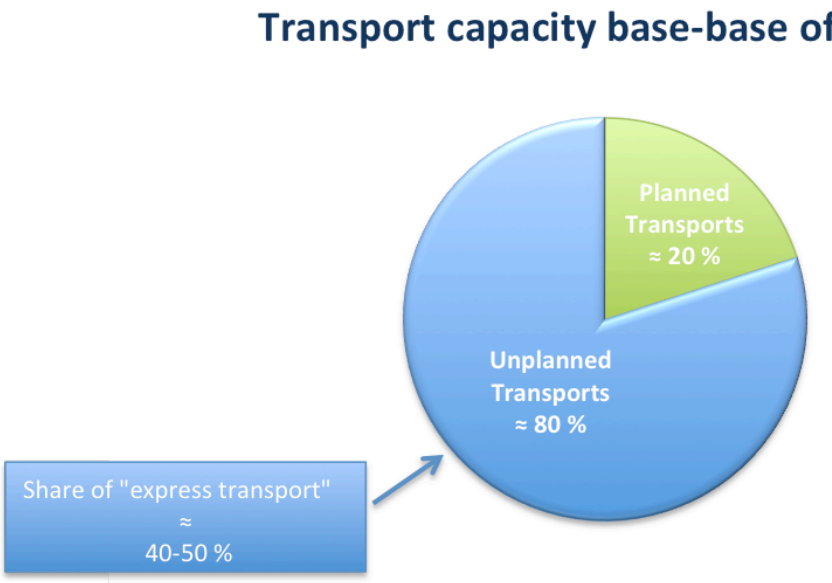

Figure 4-3: Transport capacity base-base offshore (Bring)

4.1.1.1 Booking limits

The oil express has scheduled daily departures from Stavanger to each destination along the coast. The limit for booking regular transport that day is 4 hours in advance of the scheduled departure.

To:	CCB	Mongstad	Florø	Kristiansund	Sandnessjøen	Hammerfest
From Stavanger:	15:30	14:30	11:00	16:00	10:00	16:00

Table 4-1: Daily scheduled departures from Stavanger to the supply bases.

4.1.1.2 The vehicles

It is a total of about 70 semitrailers that are hired to the oil express. These are specially designed and built for the oil-express. Most of these semitrailers have a length of 13,6 meters and a width of 2,4 meters. The terms truck and vehicle will also be used to describe this mean of transport, throughout the thesis. An illustration of such semitrailer is given in Figure 4-4.

Figure 4-4: The semi-trailers used for transportation in the OX (Photo: Rune Grytten, Bring)

When calculating freight, the expression *load meter (lm)* is used. *1 load meter = Length (1 m) * Width (2,4 m)*. This means that one average semitrailer has a capacity of 13,6 load meters. The freight calculation on one load meter is set to 2000 kilograms (kg). The load utilization on a semi hanger will then be as follows: 13,6 lm * 2000 kg = 27 200 kg.

The transports that Bring offer is executed by transport companies or independent drivers hired by Bring. As of today, Bring has contracted with 21 truck owners and approximately 70 trucks that are specially designed for the OX. Bring Offshore and Energy imposes strict requirements on the choice of vehicle material used in association with transportation for the offshore sector.

4.1.1.3 Prices and costs

The customers have individual price agreements in their contracts, which are the basis for the billing of the services provided. These agreements vary based on various things like the level of volumes transported, the types of transportation, distances and so on, and have different discount schemes. Express transport has an additional cost.

It is important to keep in mind that a transport that is registered after the time limit for booking to one destination that day but still makes it in time to follow the regular transport, still gets registered and charged as an express. But in reality it is a late booking fee.

Percentage extra charge for special goods:
Length charge 13,6-23m: +25%
Height charge 3,01-3,7m: +50%
(Height charge >3,7: price for special vehicle is agreed upon in each case)
Width charge 2,55-3,25 m: +25%
Dangerous goods class 1 & 7: +100%
Dangerous goods remaining classes: +25%

Table 4-2: Percentage extra charge for special goods (Bring)

Costs related to vehicles that are at standstill:

Fixed costs 2600 NOK

+ Driver costs 2600 NOK

= Total cost 5200 NOK (per 24h)

4.1.1.4 Health, Safety and Environment

Bring emphasises that there shall be a health, safety and environment (HSE) focus in everything they do. The offshore and energy division has an extra strong focus on the HSE aspects of their logistics operations. The equipment that is transported is often of large dimensions, heavy weights and can be special or dangerous goods. In addition there is always risks related to transport by road, sea and air.

There are several initiatives in motion in the organisation for systematic work on HSE issues. One overall goal is to constantly report potential incidents and work on improvement measures. Every quarter there is an HSE area that gets campaigned, for an example from January to March 2015 the campaign was focused on " Driver behaviour and mobile use". The Bring improvement database is an important initiative in this process. This database will be presented further in Chapter 4.6.

One other initiative is Bring Moment, which is a model developed in cooperation between the management and employees focusing on how to plan, act and evaluate the work in the best way. It is a systematic approach to make sure that Bring Offshore & Energy avoids HSE incidents and deviations, at the same time as there is a focus on continuous improvement in

order to improve performance. The model consists of six steps with two actions in each step that describes the process of plan, act and evaluate. At the different divisions they often "take a Bring Moment" if there are any challenges that they need to work on together on, to come up with a solution to.

Another way they focus on HSE is through the different manuals for driver, charterer, transporters, internal control and collections of procedures, notification plan, emergency plan and other governing documents. In addition they have implemented two routines before loading and transporting of goods, Safe Job Analysis and Before Job Conversation. These are routines with forms to fill out that all the actors involved in an operation, for example loading, should participate in to look at the elements of risk and to plan the work in the best way.

4.1.1.5 The goods in the OX

The goods that are conducted through the OX are mainly drilling and well equipment (D&W). There is a continuous flow from supplier- to the installation offshore and back to the supplier of D&W equipment. This is equipment used for search and production drilling. D&W equipment are often complex with regard to size, weight and shape. Figure 4-5 illustrates an example of such equipment. There are large fluctuations in demand and quantity related to such equipment, which makes it challenging to plan and carry out the transportation.

Statoil either buy or rent the goods/equipment from their suppliers and the costs of rent per day for specific equipment could be extensive. D&W equipment is often urgent to the installations offshore. A large part the goods transported to and from installations as well as between installations are characterized as dangerous goods, and needs to be handled thereafter. We will further describe in more detail about dangerous goods.

Figure 4-5: Equipment and load carriers (Photo: Rune Grytten, Bring)

Dangerous goods

Dangerous goods can be toxic, corrosive, explosive, flammable and hazardous substances. These goods are accepted for carriage on special terms and under the assumption that International Maritime Dangerous Goods (IMO, 2014) codes or the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) rules are met. If dangerous goods are submitted to transportation, the consignor has to vouch for that the goods can be legally sent as groupage.

The consignor is responsible for the following:

- Ensure that the dangerous goods are classified and permitted for transport according to ADR
- Give the carrier information and data, in addition to transport documents and accompanying documents, such as permits, authorizations, certificates, etc. that are required.
- Only use packaging, intermediate bulk containers and tankers that are approved and suitable for transport of the substances in question and labelled as described in ADR.
- Meet the requirements that apply to the mode of shipment and transport restrictions.
- Ensure that also empty tankers that are not cleaned and gas-free, as well as vehicles and different types of bulk containers that are not cleaned, have the proper labelling. Also that empty bulk container are closed and sealed as if they had been fully loaded.
- If the transport also involves transportation by sea, there should in addition be issued documentation and labelling of the goods according to IMDG regulations (Bring Cargo AS, 2014)

Customs

Bring has several responsibilities with regard to customs that they handle on behalf of Statoil. We will not describe these complex routines in detail, but as different aspects of customs is an essential part of the information flow, we have chosen to include a section describing the main tasks handled by Bring. We have obtained relevant information from interviews with management employees in Bring, in addition to the Offshore Logistics Conference we attended in Kristiansund (2015).

Deliveries arriving at a supply base with a customs pass waybill should be processed in accordance with requirements from customs authorities and Statoil. Brings responsibilities with regard to procedures for registration of goods receipt for dutiable deliveries are to:

- Ensure that the vehicle registration number is applied to the customs pass waybill
- Ensure that it appears in the waybill when a delivery is customs cleared by Bring and tax is paid, so that Statoil can register this into SAP goods receipt.

In relation to the exports of goods to an offshore installation, day lists, containing dutiable materials that are sent from Statoil's customs warehouses and to the installations offshore, shall be retrieved and declared. The declaration is sent to the customs authorities' electronic system for exchange and customs declarations. All importers, exporters and forwarders who declare goods for import or export may use the customs authorities' information system designed for the business sector.

Bring prints out a day list showing all deliveries that are not customs cleared and that will be sent to a supply base with a customs pass and further offshore, or put on the customs warehouse of the supply base. Bring reports these deliveries to the customs authorities and declares the deliveries from Statoil's customs warehouse through the system of the customs authorities. The declaration is automatically despatched by the system and assigned a number confirming that the goods are declared and the charges paid. Bring will update Statoil SAP with the correct number and save necessary documents in their own archive.
Before Bring plans transportation of third-party equipment back to the supplier, they have to clarify the customs status of the delivery. The customs status is found on the packing slip that can be printed out from the return document in Statoil SAP. The packing slip shall accompany the delivery as an attachment to the waybill. In addition, a copy shall be placed on the material itself. Bring's responsibilities in customs treatment of return equipment is to:

- Issue customs pass on third-party equipment in return to supplier
- Ensure that declaration number is received and registered in Statoil SAP
- Declare materials when in need for free use at onshore facilities, scraping, disposal, sale or shipments to suppliers without customs warehouse.

Bring is currently in a process of centralising their customs tasks. Some of the customs related work concerns each supply base separately, this work includes declaring the goods going out to the offshore installations and the handling of customs warehouse related issues. The

handling of this customs work is conducted at each supply base, but will within a short time be centralised and located in Bergen as a separate department. The monitoring of customs pass has already been centralised and is performed by a group of 2 to 3 people in Ågotnes, which also will be moved to Bergen.

4.1.2 Domestic groupage and part load

Domestic groupage and part load is one of the other transport divisions internally in Bring in addition to offshore and energy and international groupage and part load. The division of domestic groupage and part load handles general cargo transported all over the country carrying materials typical for the commerce industry. Statoil use their solutions for operating materials/consumables. In this part of Brings logistics there is already a good information system with many automatic solutions, which works very well and reduces the need for manual work on information flow parts significantly.
Domestic groupage and part load has got a well working, automated system to handle the bookings. The management in Bring seems to think that the systems developed inside domestic groupage and part load is worth learning from, since this is in their eyes a vision of good solution. The perception internally in the department is that this solution cannot be directly transferred over to the oil express bookings, but perhaps there are aspects of it to learn from and some of the attributes that can be used. This solution is further addressed in Chapter 5.4.

4.2 Statoil AS

Statoil has for many years had an agreement with Bring for freight both for groupage and part load and for base-to-base transportation along the Norwegian coast. Bring Cargo is per today Statoil's selected freight forwarding agent through the framework agreement entered in February 2013. Bring Cargo has the sole responsibility for all the necessary transportation of goods between Statoil's suppliers and the company's onshore facilities, as well as all the forwarding, customs clearance and return services. This agreement is not purchase obligated from Statoil end, but Bring has the obligation to deliver. Many of Statoil's suppliers must use Bring for transports to Statoil.

Through the Offshore Logistics Conference (2015) it became clear that there is a tremendous focus on reducing cost in the entire chain. Given today's market situation, Statoil stated that they have a goal of a cost reduction of 20% in the course of 2015.

Statoil has an outgoing tonnage of approximately 575 000 tonnes to the Norwegian Continental Shelf (numbers from 2013), this includes D&W equipment as well as equipment and products for subsea, production, maintenance and modification (M&M).
In Figure 4-6 the distribution of the tonnage on the different supply bases per 2013 are illustrated. The distribution will be different after a change in the sailing patterns that leads to a change in areas of responsibility for the supply bases.

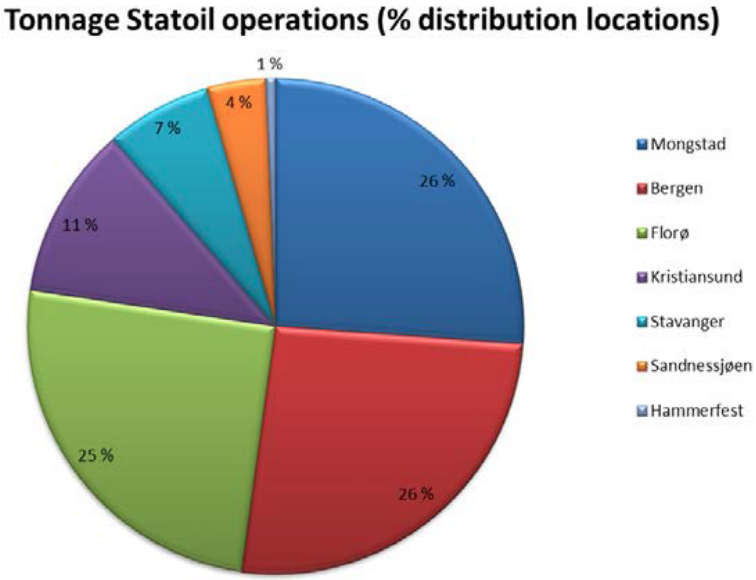

Figure 4-6: Tonnage Statoil operations in % per distribution location (Bring)

Statoil does not just order goods from their suppliers, but often they order a total service, including both human labour and the equipment needed to perform the tasks. Therefore, their purchase order is the order of a total service, not just a list of goods.

Incoterms are a set of standardized rules about the terms of delivery that are used in national and international transactions of trade. They describe who is bearing the costs, responsibility and risks associated with a transaction and the time when the responsibility goes to buyer from seller. For Bring the incoterms are important to know because they give information about who shall pay for the delivery, and thus who should be billed for the transport (Bring, 2015).

4.3 Suppliers

Statoil has roughly said about 1000 suppliers of different materials and equipment. Here the 80/20 rule apply, since roughly said about 20% of the suppliers stands for 80% of the procurement and opposite. Most of the large suppliers are located in the Stavanger area.

The suppliers are an important actor to take into consideration when studying the supply chain, because it is they who book transport directly with Bring on the outgoing material. The many suppliers of Statoil are obliged to use Bring as a transporter, and therefore are also important customers of Bring. The better the service that Bring provide to these suppliers the more likely it is that they will use Bring as a transporter for deliveries to other customers than Statoil as well. The different suppliers have different agreements upon rental, where some receive rent from Statoil as soon as the equipment has gone out the gate, while others do not get paid until the equipment is delivered at the supply base or the offshore installation. As these differ, the wants and needs of the suppliers will naturally differ. Respectively the first supplier will have no rush in transporting the goods, while Statoil might have an interest in speeding up the processes. We will further give a brief presentation of the two suppliers we have interviewed in conjunction with this thesis.

Force Technology

Force Technology is an international technological engineering and consulting company. The company conducts research and technology development, as well as many other products and services (Force Technology, 2015). In the Stavanger office they have an inspection department, which performs non-destructive testing of structures, products and materials. Non-destructive testing makes it possible to examine the condition or the quality of a construction without damaging it. They therefore often transport different isotopes, scanners and other high cost equipment for use offshore. We interviewed the project manager at the Force Technology office in Tananger, Stavanger. This is because this supplier is a large user of Brings services, everything from parcels to the offshore oil express. Just a couple of years ago this department did not have any well-organised solution for shipping of goods. Therefore, the project manager we interviewed, in cooperation with Bring, started a process to streamline their solution. They are now consistently using Bring for shipping. The manager had a lot of views on the chain as a whole, and areas that could need improvement.

Swire Oilfield Services

Swire Oilfield Services, a part of the Swire Group, is one of the largest suppliers of specialist offshore cargo carrying units in the world. They offer a large rental fleet of containers and baskets for every purpose. They have 150 standard designs and hundreds of customer-specific designs (Swire OS, 2015). Almost everything that is transported offshore comes back in return, except some equipment that is on fixed hire and that goes in rotation with the customer. We attended a meeting at Swire's offices where two representatives from the company, two representatives from the department of the MyBring solution and one representative from the sales team at Bring Tananger also took part. Swire has tested a solution in the MyBring system that is under development, and have the possibility to give feedback on the benefits that they experience when testing this, but also most importantly what they find challenging or in fact lacking in the solution. In addition we later interviewed one of the participants from Swire.

4.4 Supply Bases

The supply bases we focus on are ones that support Statoil's operations at the Norwegian Continental Shelf. These supply bases are located in Dusavik in Stavanger, Mongstad and Ågotnes in Bergen, Florø, Kristiansund, Sandnessjøen and Hammerfest. The supply bases are presented in Figure 4-7 below.

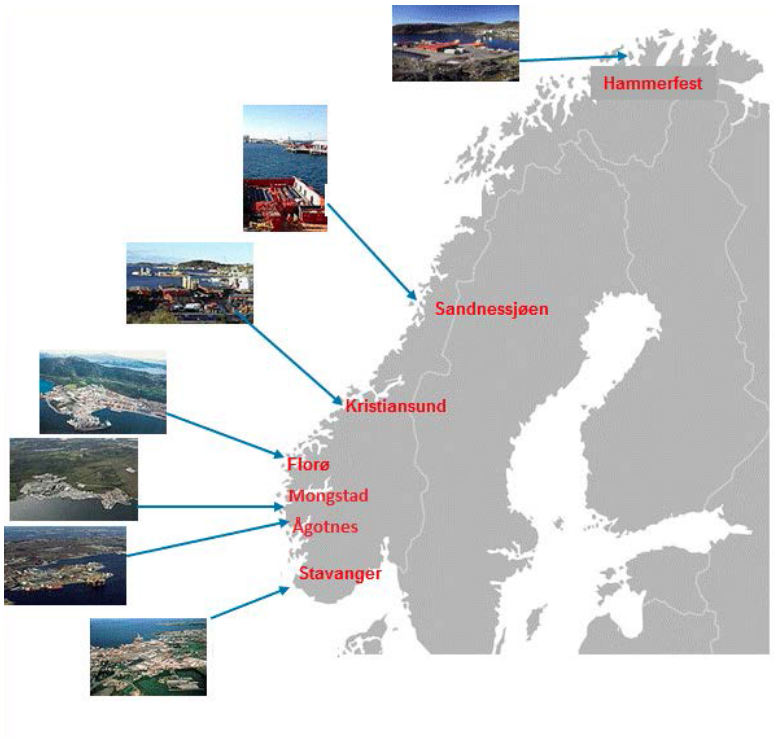

Figure 4-7: Supply bases supporting Statoil operations (Bring)

The offices receive bookings, handle the chartering of the vehicles, conduct custom procedures, take care of air freight and so on. The different bases have its own ways of working, depending on the operator, location and so on, and therefore the "bottlenecks" will also differ.

From July 4th 2015, there will be new operators on some of the supply bases. Statoil has renegotiated their supply base services contract and January 7th 2015 Statoil awarded contracts for services at the 7 coastal bases. A big change resulting from this will be at Mongstad, where Mongstadbase AS earlier were operators, where the contract will in July be taken over by CCB. This handover has resulted in the fact that CCB acquired/bought Mongstadbase AS to make us of the facilities, resources and workforce.

The operators at the other bases, and their area of responsibility, will be as follows:
Nor Sea Group
Dusavik, Kristiansund, Hammerfest → Piping, Warehousing and Terminal
Mongstad, Ågotnes → Warehousing and Terminal
Florø → Piping and Warehousing
Saga Fjordbase:
Florø → Terminal
Asco Norge:
Sandnessjøen → Piping, Terminal and Warehousing

In addition to the changes in supply base service operators, there is also an on-going process of changing the sailing patterns. This process started already in 2010 and will continue throughout 2016. Every offshore installation is connected to an onshore supply base, and it is the structure of which bases are responsible for supplying which installations that is being somewhat altered as shown in Figure 4-8. For Mongstad this will result in a higher level of activity since they are taking over the supply of some of the installations that earlier were supplied by Ågotnes and Florø. In fact Mongstad will now supply all of Statoil's installations in the northern part of the North Sea, except "Snorre" and "Visund". Dusavik will supply the southern part of the North Sea while Ågotnes now will be the base for Subsea and anchor handling.

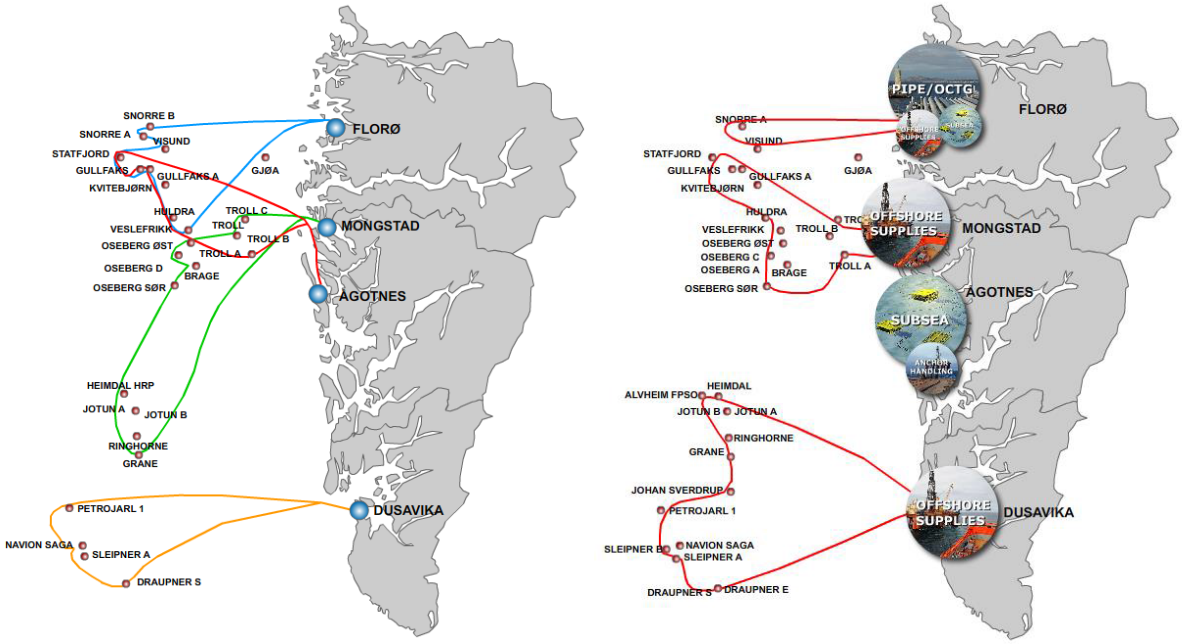

Figure 4-8: The changes in sailing patterns on the west coast of Norway (Bring)

There are deadlines for when goods that shall be sent offshore the same day, must be delivered. On all of the bases this limit is to this date set to 10 o'clock in the morning. This limit is necessary for the supply base, so that they have the time necessary to prepare the goods for further transport, and having it ready before the ship is scheduled for departure.

Mongstad	Ågotnes	Florø	Kristiansund	Sandnessjøen	Hammerfest
1 day	1 day	1 day	2 days	3 days	5 days

Table 4-3: Delivery times from Stavanger with regular transportation

4.4.1 In-house position

Bring has so called in-house personnel located at all the supply bases along the Norwegian cost working side by side with the supply base operators. Statoil pays for this service provided by Bring. The purpose of the in-house position is to be closer to the customer and thus better able to solve their logistics needs. The in-house personnel have a main responsibility to handle the return of goods/backload. In addition, the position is supposed to be somewhat flexible in the way that it is meant to be used to whatever is the need at the specific supply base.

Bring lists some of the functions of the in-house personnel as:

- Receive or extract a manifesto from Statoil SAP
- Collect the return document (RD) and check the incoterms
- Check weight and dimensions of cargo
- Label and assure correct packing of goods
- Issue freight document
- Book transportation and load the trucks
- Handling of customs documents
- Following up the goods

From interviews conducted at Mongstadbase and Vestbase we found that the executions of the in-house positions is quite different at the two supply bases. At Vestbase the in-house personnel have booking and planning of transportation as their main tasks, while the in-house at Mongstadbase constitute a more diverse function. At Mongstadbase the receiving and planning of transport is conducted at the Bring office located by the supply base, which frees up time for the in-house to focus on other logistical issues. Such issues as to solve problems related to outgoing delivery and questions in this matter, paper flow that is not correct, discussions at the supply base worth participating in and so on. Simply be responsible for obtaining an efficient integration between the actors in the supply chain.

One of the reasons why the in-house function is differently executed at the supply bases is that Statoil's needs at the different supply bases as well as the space allocated to the in-house personnel varies from supply base to supply base.

5 Information Systems

We will by this chapter answer Research question *1.4: What information systems are applied?* To do so, we describe the different information systems that the case company makes use of for communication and information exchange. Our bases for these descriptions are documents provided from Bring, and information gained through interviews, business meetings and research through introduction and exploration of the systems, as described in Chapter 2.

First we will present the different information systems related to booking and transport management. Then we will give a short description of a solution that handles information flow related to bookings in the domestic groupage and part load segment. This is done in order to assess whether aspects of this solution might be transferable to the OX.
In the end of the chapter a description of Bring improvement database will be given, and output from this database will further be discussed in Chapter 7.

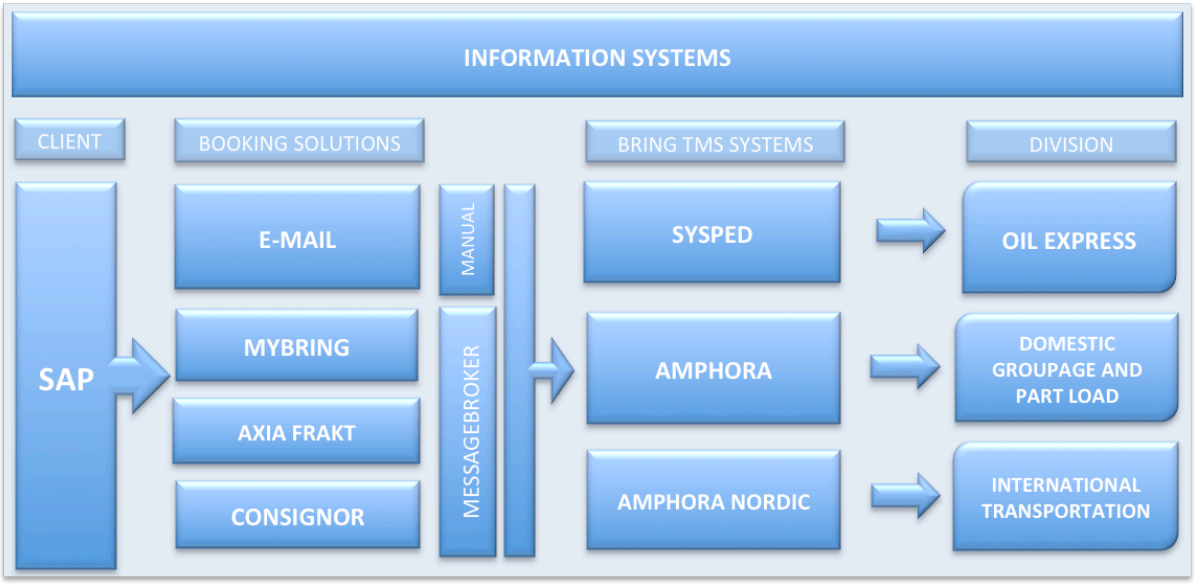

Figure 5-1: Information Systems in Bring Cargo.

For booking transportation in the offshore segment, there are to this day a few different solutions as illustrated in Figure 5-1. The most common way of booking orders, that most of the customers use in the OX (leaders estimate 95%), is in fact *e-mail.* Some may say that this is a somewhat old fashioned solution in today's IT-world, but until now this has been the preferred method. Another solution is an EDI-solution where orders get electronically transferred between the customers ERP/production system in to Brings system and this solution represents the resisting 5% of bookings. Some of the largest customers, as e.g.

Halliburton, use this. Axia Freight and Consignor are EDI software used for booking transportation and are third part solution transport and administration (TA) systems. The last solution that is available is the MyBring system. This is a system that originally has been used in the other parts of Brings logistics, towards the groupage and part load segment. It is new from 2015 that this has been designed and opened up to use for offshore customers. Although there today is only a 5% share of electronic solutions, the management has a goal of reaching 80% electronic bookings over the next years.

As further illustrated in Figure 5-1, the orders received by Axia Freight, Consignor and MyBring are transferred by the help of a message broker into one of the three transportation management systems (TMS) based on the content of the orders. Domestic groupage and part load related orders are transferred to Amphora, international groupage and part load related orders are transferred to Amphora Nordic and orders for the OX are transferred to Sysped. The message broker is a solution for handling of the communication between systems. The module translates all messages from the customers EDI-systems and in to Brings' different transportation management systems based on the content of the order.
The orders received by mail are manually registered into Sysped. We will describe these information systems further in Chapter 5.1 to Chapter 5.3.

5.1 Booking Solutions

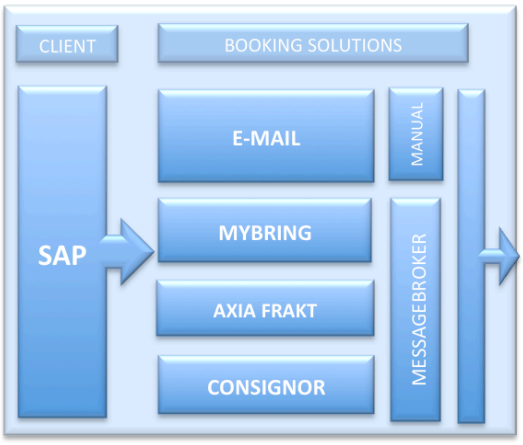

Figure 5-2: Booking solutions

5.1.1 MyBring

MyBring is an online booking solution for all customers of Bring available on the company's official web page. MyBring is a self-service solution to booking where customers log on to a personal account. The features provided by MyBring vary according to the types of services needed and customer agreements with Bring. MyBring mainly offers services as booking of transportation, tracking of shipments, printing of mailing labels and possibilities to gain access to invoices and specifications. Customers also have the opportunity to extract relevant statistics and reports from MyBring. The MyBring solution has earlier only been available for the customers booking transport for groupage and part load, but there is an on-going process of including the offshore and energy shipments to the solution. In Figure 5-3 the layout of the MyBring solution as it is designed for orderings that Statoil does in the Groupage and Part load segment. The layout that per today is designed for the oil express is very similar.

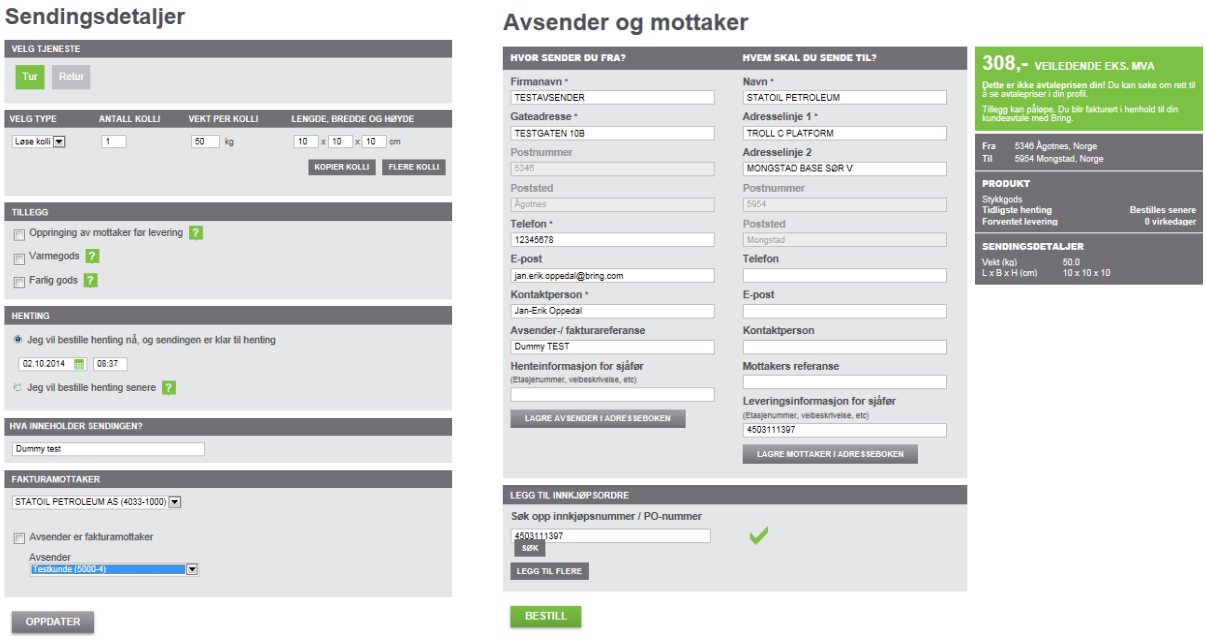

Figure 5-3: Layout of two menus in the MyBring solution (Bring)

5.1.2 Other booking systems

Axia freight

Axia freight is another EDI software for the organisation and administration of transportation. This solution is independent of carrier, and provides the necessary services for booking of transport by electronic transfer.

Consignor by EDI-Soft

Consignor is a transport administration system under EDI-Soft. It is one of the alternatives for booking by EDI, for the customers of Bring. It is a cloud based platform solution that is also independent of carrier.

5.2 MINe

MINe is an electronic business solution that Bring offer their international and offshore customers. Earlier it also included the domestic transport customers but their part was substituted by the MyBring solution in 2013. MINe is a portal that communicates with Sysped, with the purpose to simplify the customers' transport-related activities. It includes features like track and trace, retrieving documents, extraction of statistics and transport cost calculations and many more. This portal will be also gradually be substituted by MyBring and the portal that it offers, for the international and offshore customers. Many offshore customers have used to for the purpose of track and trace.

5.3 Transportation Management Systems

Bring operates with three main transportation management systems (TMS) internally, called Sysped, Amphora and Amphora Nordic. Each of these covers a separated area of services in Bring as illustrated in Figure 5-4. Sysped is a system used in the offshore services, where all goods transported in OX are included. In addition, Sysped covers the transportation of goods by air and sea. Amphora is the system used for cargo of domestic groupage and part load and Amphora Nordic covers international groupage and part load. These systems will be presented in turn with a main focus on Sysped.

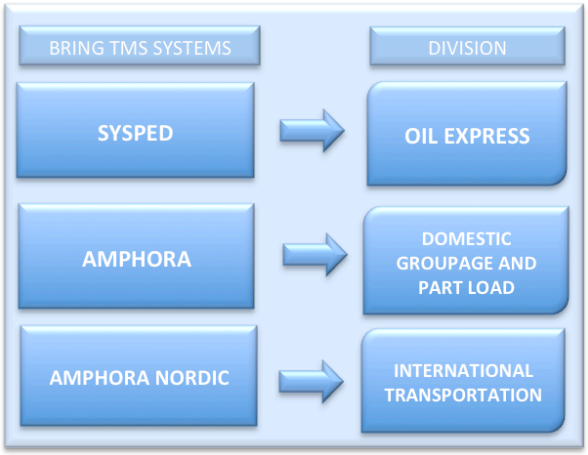

Figure 5-4: Transportation Management Systems

5.3.1 Sysped

Sysped is an information system developed in 1985 by Systema on a platform provided by IBM. It is a transport and forwarding system for all means of transport and consists of several modules with specified functionality. Bring use the system mainly to register booking of transportation and plan the transportation in the offshore segment.

When the charterer assistant, who is the person responsible for collecting the transportation orders, receives this booking by mail, he or she registers this booking manually in Sysped. However, if the customers have EDI modules in their own ERP/production system, the EDI is directly transmitted from their systems into Sysped. After registering the booking, Sysped function as a tool in the planning of transportation and assign the job to an available truck driver. Meaning that the charterer can register the orders on to different trips for the different drivers, into the system.

The system includes PDA modules for all transportation types, where transportation assignments can be transmitted to the PDA's of the truck drivers. All the drivers that have contracted with Bring have a PDA in their truck. This PDA module enable the charterer to send over the assignment to the truck driver consisting of all the relevant information that driver needs to do the assigned job. The truck driver confirms both the assignment and the loading of the truck on the PDA. When the delivery of the goods is completed, the truck drivers can report to the charterer and collect the signature of the person who accepts the goods by the use of the PDA. This link is automatically transferred to Sysped and is a documentation of the delivery of the good. Further, Sysped has a map-based functionality that enables the charterer to track the transportation and have a visual view of the location of the trucks at all times. Sysped also has customs clearance modules, which includes opportunities for customs transfer and handling of customs pass. Sysped provides Bring the possibility to handle documents electronically and archive these documents in the system. Bring employees scan goods that have been send to the customer into Sysped in order to have everything registered. These documents are easy to retrieve from Sysped at a later stage if needed.

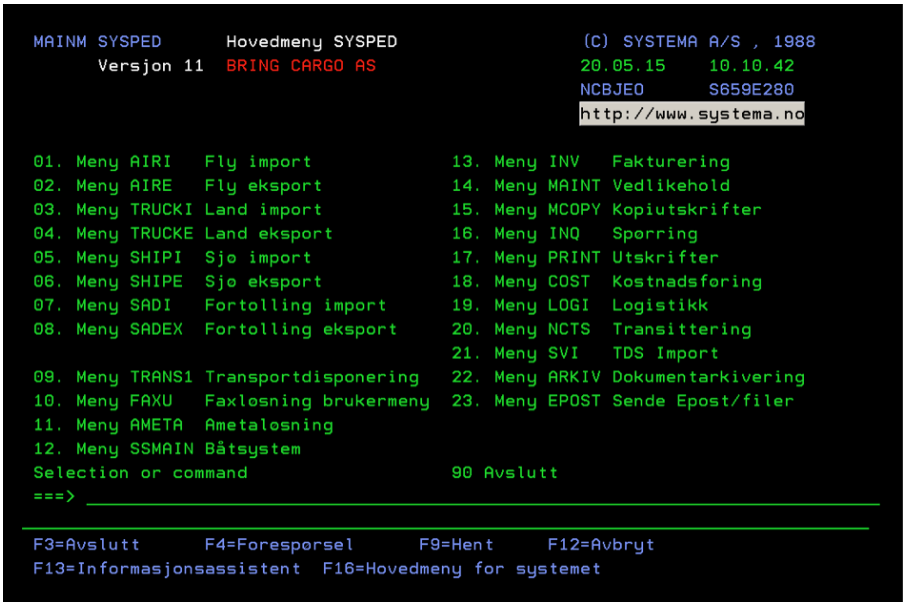

Figure 5-5: Screenshot from the main menu in Sysped (Bring)

Sysped is a somewhat old-fashioned system to the naked eye, which to this day it is not Windows based and does not have a graphical user interface, but a black background in DOS where you by keystrokes and codes navigate through the systems. The main menu inside Sysped is shown in Figure 5-5 and the assignment menu is shown in Figure 5-6. Despite this it is rather well liked by the employees and regarded as a stable and easy system once you have learned all the "tricks". Still, there are missing functionalities that are desirable to have in the everyday work. Because of this there will in May 2015 enter into force an update of this system. More about this will be presented in the analysis, Chapter 7.2.6.

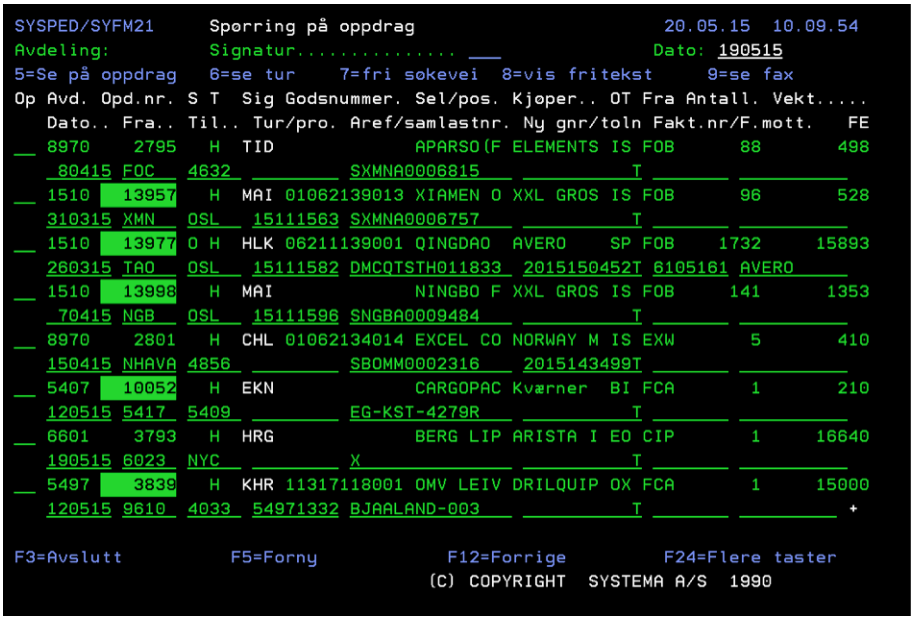

Figure 5-6: Screenshot from the assignment/trip menu (Bring)

5.3.2 Amphora/Amphora Nordic

Amphora and Amphora Nordic are two transport management systems that were developed by the same company, and there is a close integration between these systems. The two systems share among other order agreements and customer registers. A shipment from Germany to Molde for instance will go through both systems. It will shift from Amphora to Amphora Nordic when crossing the border.

Amphora was designed in cooperation between Axia and Bring. This is the system used to cover the services of domestic groupage and part load.

Amphora Nordic is a newer system, developed from Amphora, but this is applied to transport within international groupage and part load.

These systems are not relevant for use in the OX, because Sysped is the best solution for that purpose. Still, we have mentioned them as we present some aspects of the domestic groupage and part load throughout the thesis.

5.4 On Time In Full (OTIF)

Within the services of the domestic groupage and part load Statoil and Bring has engaged in a project called "On Time In Full" (OTIF). Bring considers this project as a virtually ideal solution to booking and information flow for the part of the logistics covering operating materials/consumables. There is a general belief among management employees in Bring that the solutions of OTIF might be applicable if not entirely, at least parts of it, also to the offshore and energy section. We have therefore included a description of OTIF, and we will in the analysis in Chapter 7 assess whether aspects of the project can be transferred to the offshore and energy section.

The OTIF project is one of the initiatives implemented between Statoil and Bring in order to streamline and assure the quality of the information flow between the two actors. The OTIF project is primary a concept enabling Statoil to follow up on their suppliers with regard to precision of delivery, both on time and in full. The solution provides Statoil with the opportunity to gain a complete overview of the location of their ordered items at all times. Functionalities are established to report purchasing order status and item status to Statoil.

Information concerning dates of expected pickup, actual pickup, expected delivery and actual delivery is added to Statoil SAP. Statoil has the possibility to extract this information from their SAP and use it to gain control over their suppliers and achieve a more precise logistics In addition, the solution makes it possible to distribute information in the supply chain with a restriction on who is allowed to see what. Bring has a database for the purchasing orders, called a control tower, based outside all the transportation management systems (TMS) as illustrated in Figure 5-7 below. All the purchasing orders from Statoil, where Statoil pays the transportation, are transmitted automatically to that database. From the control tower, both Bring and the suppliers can use the information lying in the purchasing orders. Each purchasing order might contain several product lines that can vary in number by everything from one to fifty. It is possible to retract a packing slip when creating a transmission by entering the purchasing order number. The packing slip contains all the product lines in the purchasing order.

In addition, with the help of the purchasing number and the systems of Amphora, Bring has the opportunity to make use of the control tower in order to see which installation should receive the invoice. This is done to make sure the invoice will be given the correct customer number at Statoil and be linked to the appropriate installation. When Statoil receives an invoice from Bring, that invoice will clearly state the installation number and what that particular installation is to be charged for. If Statoil wish to undergo an invoice control this might be done through the system portal of Bring. When Statoil log on to this portal information such as shipment number, weight, shipper, receiver, agreement and so on will appear for each shipment. Bring uses Figure 5-7 to illustrate and give an overview of how the different aspects are related.

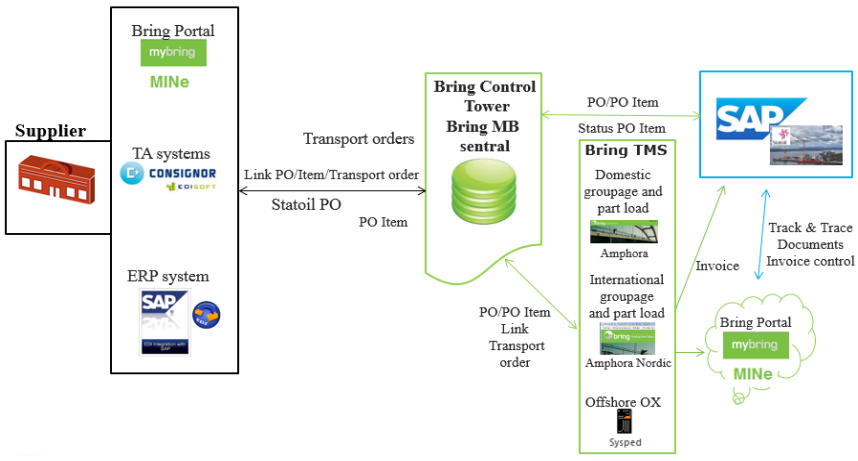

Figure 5-7: Information systems in domestic groupage and part load (Bring)

5.5 Improvement Database

Health, safety, environment and quality (HSEQ) are an important issue in the oil express, especially because of the large dimensioned and heavy material that are handled and all of the transportation by road. This means that there is a continuous focus on avoiding injuries to persons and health, damages to the inner and outer environment and material and material damages and deviations. In addition the important focus on quality in every process.

Bring Offshore and Energy has an improvement database that is an important tool in the process of continuous HSEQ improvement in the organisation. In this database all deviations related to HSE and quality measures should be registered. This includes events that either could have led to, or in fact did lead to an incident, or that have reduced the quality of their operations. The serious consequences of HSE incidents, that one wants to avoid, are for example injuries, material damage, production downtime or shutdown, fire/explosions, leakages/emissions, radiation and so on. The drivers and all other personnel have access to an application on their mobile device where they easily and quickly can register any deviations, in addition to at computers. When a deviation is registered, it will be assigned to an employee responsible. This person will be in charge of following up the deviation in a satisfying manner until it has been implemented measures, and it can be closed. The purpose is to learn from the events, so that similar incidents will not happen again. The improvement database for the offshore division is very useful in the way that the deviations does not only get registered, but are actually dealt with. It is not possible to “close” a deviation before there is registered measures and results to the report, and the person in charge signs it.

We have examined the database in order to discover if there are registered any operational deviations that might be caused by a sub-optimal information flow. The results of our analysis are presented in the Chapter 7.1.

6 Description of the Flow of Goods and Information in the OX

This chapter will give answer to Research question *1.2: How is the supply chain structured?* and *1.3: How is the interaction organised?* In addition it will show where the different information systems described in Chapter 5 are being applied. The descriptions are based on knowledge gained through the data collection of documents, observations and the interviews. This chapter will further be the basis for the analysis in Chapter 7.

An important part of the research has been to understand and structure the processes, activities and the corresponding information and communication between the supply chain actors. As stated by Lambert, Cooper and Pagh (1998) in Chapter 3.1, it is important to understand the structure of the network to be able to manage a supply chain. Through the research on the information and goods flow in the supply chain, we have examined both the outgoing flow and the return flow/backload. The outgoing flow entails goods and information going from suppliers via the supply base and out to the installation offshore, where Bring function as an intermediary responsible for transporting the goods from the supplier to the supply base. The same actors are often involved in the process of backload but in different order and in varying degrees. Upon return of goods, the goods and information flow from the installation via the supply base and back to the owner of the equipment. With Bring, again, as the intermediary responsible for the movement of the goods from supply base back to supplier. About 80% of the goods transported offshore is third-party equipment that have to be transported back to the owner or between installations after use.

The thesis aims to analyse the information flow, but it is natural to include the flow of goods in the description as these flows are closely linked and the handling of goods creates and affect the need for such a flow of information.

6.1 Outgoing Goods

In order to map the processes related to booking of goods in the OX, we visited Brings office in Stavanger. Many of the largest suppliers that book transportation from Bring are located in Stavanger, both suppliers of Statoil and other customers of Bring. The Bring office in Stavanger has the main responsibility to handle booking of transportation of outgoing flow of goods and services. This office therefore differs from the other supply base offices of Bring with a main responsibility to handle backloads. In Stavanger, we talked to charterer assistants

handling tasks of receiving and registering the booking as well as charterers executing the planning of loading and allocation of jobs, and others with more overriding roles. Figure 6-1 gives an illustration of the outgoing flow of goods/services.

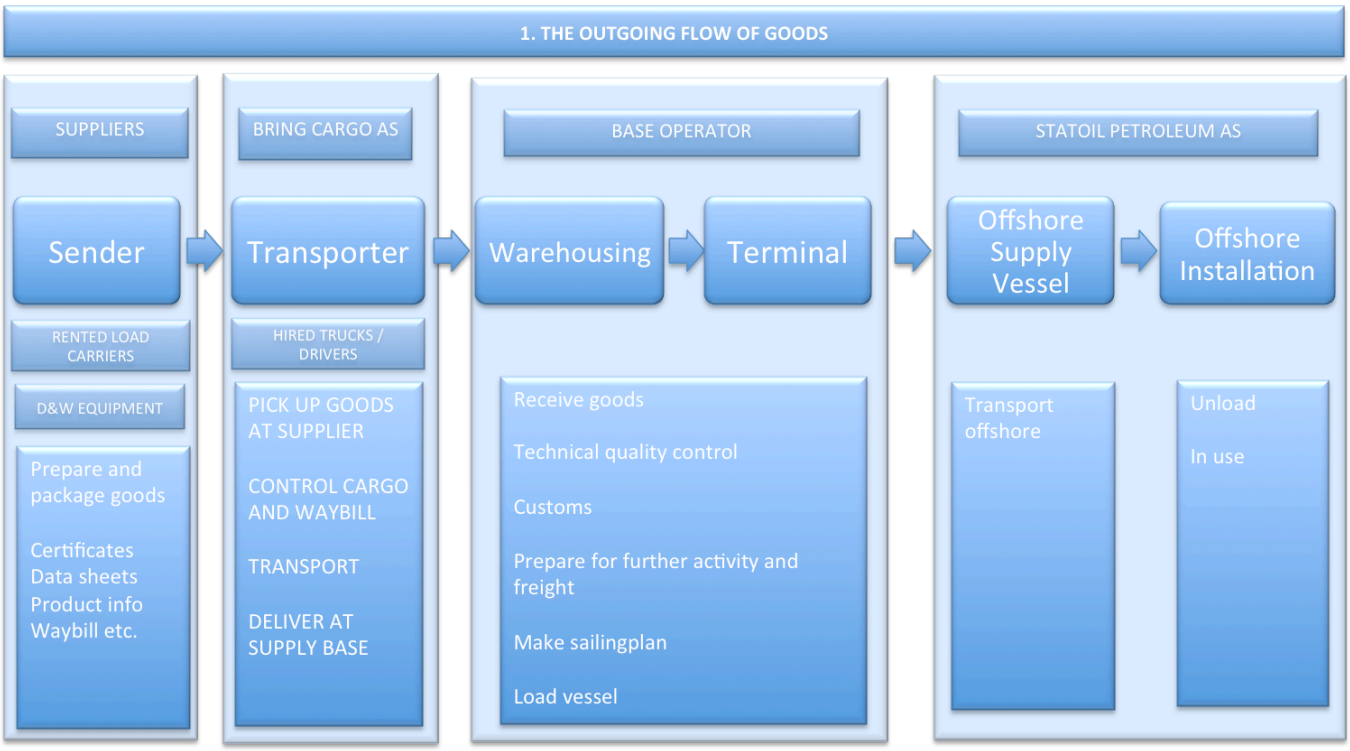

Figure 6-1: The outgoing flow of goods through the supply chain

The demand from the installations offshore initiates the flow of outgoing goods in this particular supply chain. Statoil orders the required goods from one of their suppliers. Some of Statoil's suppliers are obligated to use Bring as transport agent. If that is the case, the supplier will contact Bring to book transportation.

Most often, the suppliers order transportation by mail, and Bring personnel register the booking into Sysped. Charterers plan how to carry out the transportation, by means of finding the most efficient way of loading the goods on the available trucks. The planning is often conducted in cooperation with the respective truck driver that has been assigned the job.

The charterer is also responsible for ensuring that trucks are available for transport. If no trucks are available at the supply base or at other supply bases nearby, Bring have to contact an external transporter and rent a so-called round trip truck. Renting vehicles from competitors is an expense Bring wants to avoid as far as possible. Due to demand uncertainty

and fluctuations, it is challenging to have the right amount of trucks available at all times. The greatest need for renting round trip trucks is during peak times when the demand for D&W equipment is high and holidays where Bring has fewer available contract trucks in their system.

The charterer allocates assignments to the truck drivers according to a waiting list. The truck drivers call the charterer to let him or her know when a job is complete, in order to be placed on the waiting list. Bring transports the requested goods from the location of the supplier and deliver it to the supply base. The delivery of the goods must be carried out within a certain deadline determined by Statoil. If the goods are not delivered in time, the suppliers will not get paid. Bring therefore also has to take into consideration this deadline when planning the transportation. Either the consignor or the recipient will pay for the transport, depending on the delivery terms prevailing in the contract between the supplier and Statoil. Whether Statoil starts to pay rent when the equipment is picked up at the location of the supplier or when it is delivered at the supply base is also stated in the contract.
The operator at the supply base is responsible for the goods once it has been delivered at the supply base by Bring. The operator at the supply base is responsible for storing the goods and for loading the goods on ships when ready for shipment to the installation that requested the equipment.

Statoil describes the activities performed by the supply base with regard to the goods flowing in the supply chain as following (Statoil, 2014):

- **Terminal services-** Terminal operations, Loading and unloading operations and Coordination of activities at the terminal area, Handling of backload (terminal).
- **Logistics/Storage Services-** Warehousing, Management and monitoring of cargo carrier units, Material receipt, Material inspection, Handling of backload, Operational coordination material.
- **Oil Country Tubular Goods (OCTG) storage and distribution-** Management and handling of OCTG centre (mainly Florø), distribution of OCTG to other base locations in Norway.

When the goods are delivered at the supply base Bring has completed their job. The operators at the supply base are, in cooperation with Statoil, in control of the transfer of the goods from the supply base to the installation. The supply base operator is responsible for the

transportation at the base as well as to load the ship. The following sea transportation, loading, unloading and storage at installation are the responsibility of Statoil.

6.2 Returning Goods - Backload

To understand better the return of goods/backload flow we visited Bring personnel at Mongstadbase in Bergen and Vestbase in Kristiansund, where we talked to people in in-house positions. In addition we had a phone interview with two representatives from the supply base in Sandnessjøen.

At Mongstadbase the handling of backloads is shared between employees at Brings own office near the supply base and the in-house located within the supply base, with the main tasks executed at the Bring office. In Kristiansund however, the in-house personnel located at Vestbase is responsible for most of the tasks related to backloads. Either way we received good help in mapping the return of goods/backload flow. In Figure 6-2 the return of goods/backload flow is illustrated.

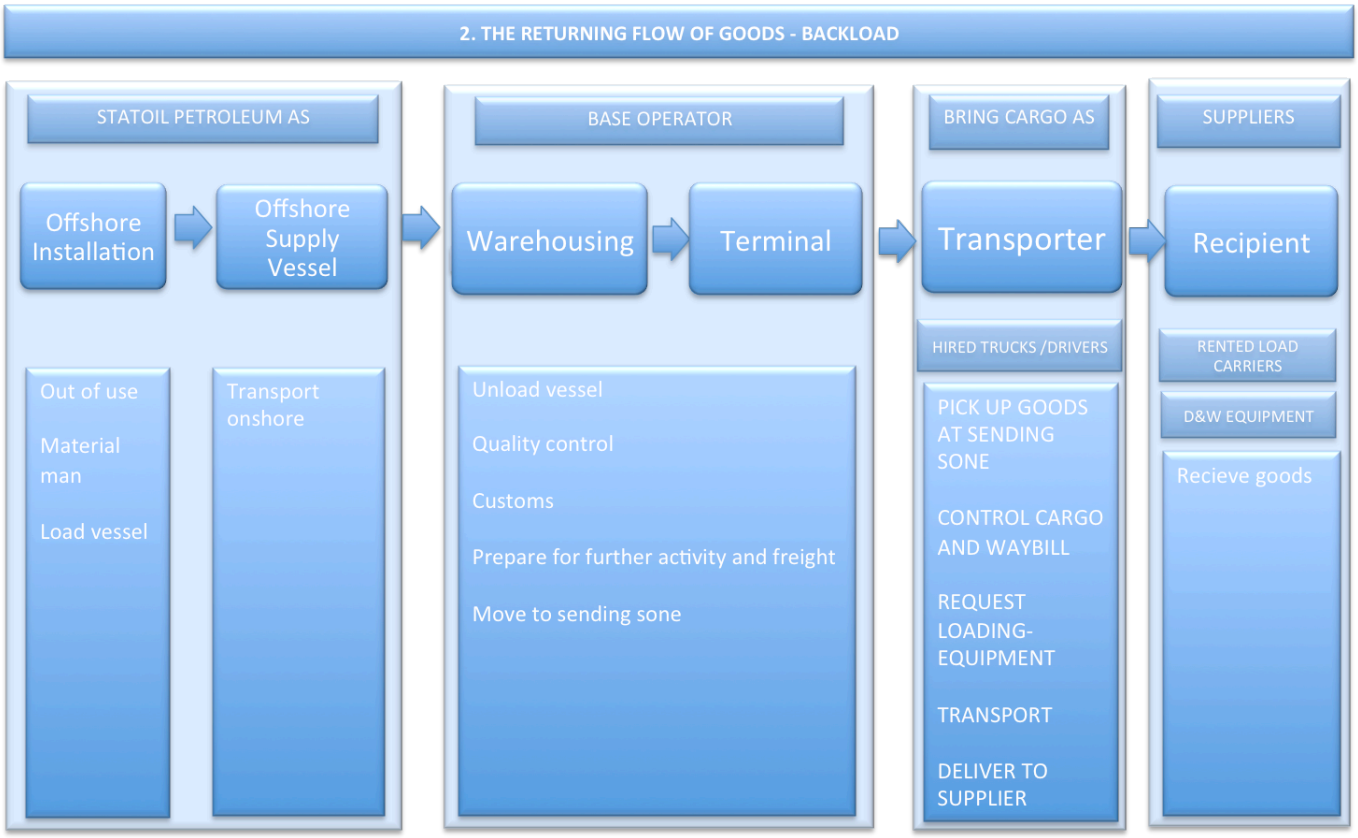

Figure 6-2: The returning flow of goods through the supply chain

When Statoil wants to have goods transported from one of their installations offshore an order for transportation is sent to inform the operator at the supply base. Again, Statoil is responsible for the loading from installation and shipping of the goods to the supply base as illustrated in Figure 6-2. The supply base forwards the order to Bring.

As shown in Figure 6-2 the supply base has the further responsibility to unload the goods coming in from the installation when it arrives at the pier, and move the goods to a sending zone. Occasionally goods have to be repacked or unpacked, but often the goods can be transported further in the same state. The operator also has to perform controls of measures and weights of the goods coming in to the supply base. In addition, the similar responsibilities prevail for the operator at the supply base with regard to the backload flow of goods as already described in the outgoing flow of goods and services.

From the sending zone, transporters hired by Bring will load the goods on trucks based on instructions from the charterer who plans the loading on beforehand. This planning is sometimes done in cooperation with the driver. The content of the goods transported will affect the choice of both truck and driver, for instance when it comes to dangerous goods. Bring has forklifts available at the supply base to help with loading and unloading of the trucks. When the vehicle is loaded as planned, Bring transport the goods to the supplier, or other stated address.

6.3 Outgoing Information

As already mentioned, orders by mail account for about 95% of the total booking of transportation in the offshore and energy division in Bring. The remaining 5% is booking received by through EDI. When orders are transmitted by the use of EDI, today a mail is often sent either automatically or manually to Bring informing about this action. Therefore, the majority of the suppliers of Statoil and other customers of Bring make use of mail in their exchange of information with Bring. MyBring, the third alternative to booking described briefly in Chapter 5.1.1, has currently only been tested by customers in the OX segment, and not yet been applied directly to book transportation. MyBring still lack some essential functionality in order to serve the complex demands of the actors in the OX section, which we will discuss in more detail in Chapter 7.2.2 in the analysis. The outgoing information flow is presented in Figure 6-3 below.

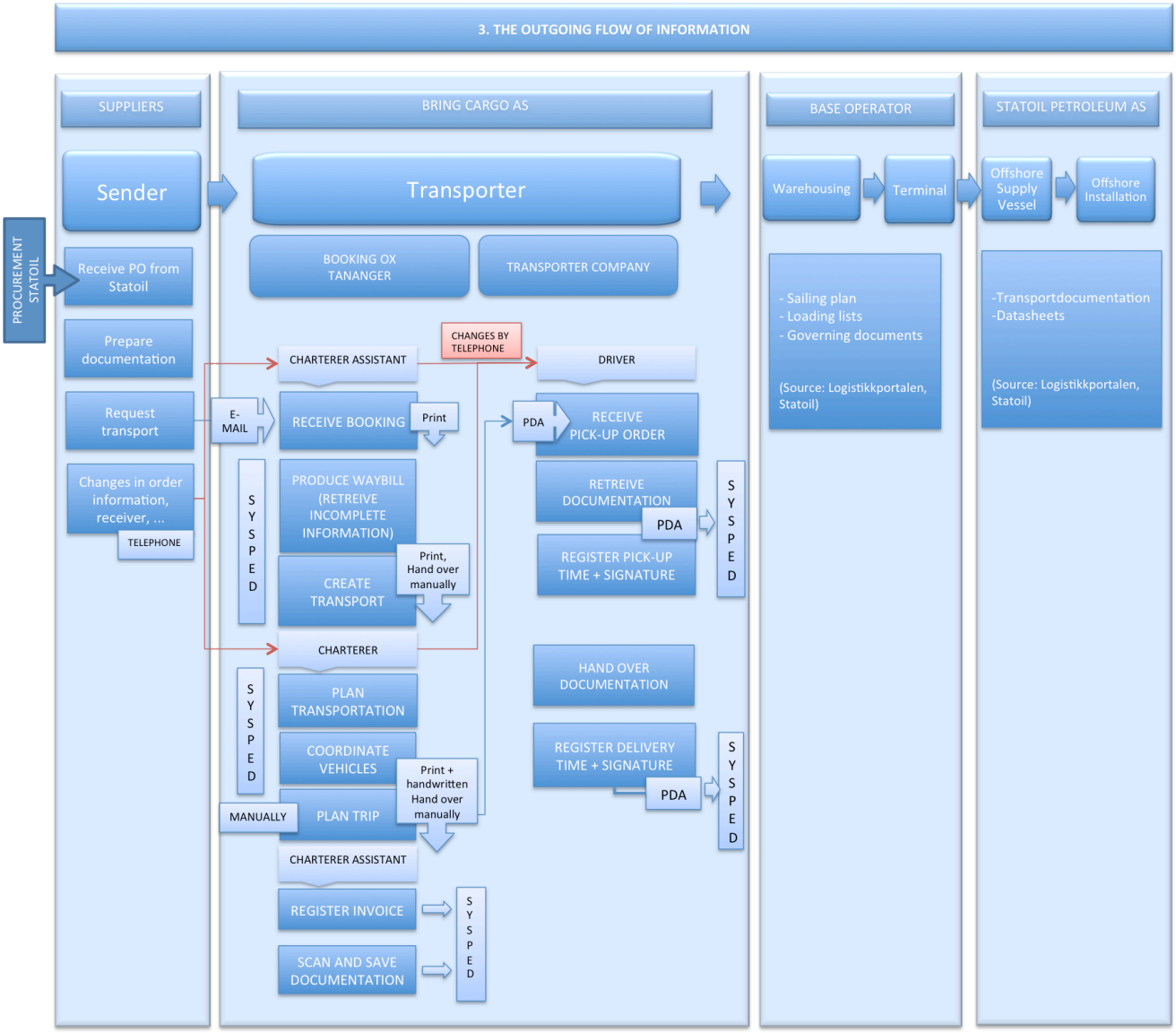

Figure 6-3: The outgoing flow of information through the supply chain

One of the charterer assistants receives the booking and is responsible to retrieve additional information potentially missing. The booking mail should contain pick up address, delivery address, pick up date and time, what goods to pick up (including weight and size), ID on baskets and containers and others, billing information, delivery date and time, etc. If essential information is not included in the mail, the charterer assistants have to respond and ask for the missing information or search for it themselves. Finding this necessary information might be a time consuming process. Of all requests received by mail, the once concerning booking has priority and should be answered as fast as possible. When a charterer assistant opens a booking mail, his or her name is marked with a certain colour to give the others an overview of the read and unread mail. This prevents the case of two employees handling the same

order, as well as reducing the risk of overlooking unread mail. Some suppliers order through the TA system named Axia. However, they often prefer to send a mail in addition to inform about this action.

6.3.1.1 Internally in Bring

When the information is completely gathered, the charterer assistants print out the booking, create an order in Sysped, print out the waybill and documents, and manually hand over all the papers to the charterer as illustrated in Figure 6-3. In the Stavanger office where the OX is run, the charterer assistants and the charterers sit across from each other and communicate verbally when necessary. The charterer needs to be sure that the information received from the charterer assistant is correct otherwise the loading might be wrong or even dangerously executed.

The charterer reads the print outs given and starts to plan the transport. The transport order is also now visible in Sysped, but one can see that it has not been distributed to a driver. Each transport order shall be placed on a "trip", and the goal is to plan each trip as cost efficient as possible and that it is consolidated in the best possible way. This means that the vehicle is loaded in an optimal manner with regard to size and weight, and that transports are sorted based on the area they shall be picked up and delivered to. It is preferable to utilize the full capacity of the vehicle, to combine different orders on one vehicle, to make every process related to this as efficient as possible to get the best possible earning on each trip.

In order to plan the transportation the charterer use the information gained from the documents and Sysped and combines this with the stack of trips that he has started to plan in addition to a list over all the drivers that are in queue. With his competence and knowledge as a key tool, she/he then manually plans the transports. This distribution is done with regard to the different routes, the drivers' competence, the vehicles capacity, the applicable regulations and a focus on the economy of the transport. In Sysped there is a map solution that by GPS tracks all the trucks that Bring has on contract. Meaning that this can be used to see which truck is the closest one to the pick-up point, and to somewhat predict when a returning vehicle will be at the base and ready for new assignments. This is an important tool in the planning process. In addition to this, an Excel document with an overview of the trucks available and the trucks that are in queue is used to assign transport assignments to the drivers in a righteous manner. The charterers distribute the assignment to the driver that first was available for

transport and then follows the queue, at the same time as they try to avoid that the same drivers always get the trip with the best profits. Though sometimes they do have to make decisions based on the experience of the driver and not the queue, if for instance very complicated tasks that shall be carried out.
Sysped has a limitation in the way that it does not provide the charterers with an overall picture of the vehicles and trips and what are loaded on them, inside the system. The charterer has to look manually into each order separately in Sysped to get an overview, and therefore often prefer to use the printed documents when planning. It is less time consuming to look in the pile of paper than to enter into every order in Sysped to see the specifications.

When the transport is manually planned and the charterer registers it into the system on a specific truck and a specific "trip", the system automatically transfers the pick-up order to the drivers' PDA, along with the waybill. The charterer sometimes also has some correspondence by telephone with the drivers in cases where questions or concerns might arise concerning the planned transport. The need for this can be a result of the fact that the driver has not used the PDA good enough or simply that the drivers have some opinions they would like to share with the charterer. The construction of the load is also determining the profit for the driver, and therefore they would very much like to utilize the vehicle and the trip in the best possible way. Often if it is complicated requests or special goods, the charterer and the driver might discuss how they can address the planning and loading in the best manner. They combine their knowledge and expertise and can by that solve an issue together. The charterer has numerous aspects to take into account when planning the loading of the truck, such as financial aspects, environmental aspects, the drivers' capabilities and certificates, transportation rules and so on. The possibility to consolidate with experienced drivers is therefore a huge advantage. Sometimes one party can see a solution that the other one at the moment didn't even consider, and they can both learn from the discussion. The fact that the charterer does not visually see the truck when planning makes it an even bigger advantage to be able to confer with the drivers.

When the orders have been planned and distributed and the trip is complete, the stack of documents is returned to the charterer assistant. Further the charterer assistant uses the printed order document to create invoices to the customer. The process of invoicing is performed every day, but a consolidated invoice is sent to the customers once a month. As shown in Figure 6-3 the charterer assistant also applies the printed document to scan manually all the

items delivered to the customer. They scan all items in order to have documentation that is easy to extract from Sysped if needed. In case of changes to the order, the charterer assistant verbally informs the charterer, which in turn notify the truck driver. The charterers inform the truck drivers either through the PDA or by phone.

As mentioned, when an order has been distributed an assignment is sent directly from Sysped to the PDA of the chosen transporter. The assignment includes all the information that the driver needs to do the transportation job and must contain at least one waybill. The truck drivers might be Norwegian, German or Danish, or another nationality. The charterer needs to tailor the information given to each driver with respect to both content and means of communication in order to avoid misunderstandings. If the driver has questions related to the job, he or she call one of the charterers. If everything is clear, the drivers confirm the job through the PDA and no personal contact is required. The driver has the PDA in the truck and activated during the whole trip, and uses it to collect a signature when he or she delivers the goods at the address specified as seen in Figure 6-3. If the supplier request their goods, Bring has the possibility to send a link referring to the delivery time and the signature of the person present when the goods where received. If Bring has delivered the goods at the correct address, the person who accepted the goods is responsible for the whole shipment from the moment he or she signed the PDA.

The flow of information further in the supply chain, after the goods have been delivered at the supply base, is something that we have not investigated. We have not mapped the information flow here, but in the model there is listed some documents that are used in the further processes (Logistikkportalen, 2015). What we do know is that Bring do not have any form of sharing information with the supply base, other than the necessary documentation that is handed over from the driver at delivery. This is sadly an ending point in Brings part of the information flow, and all the information that Bring potentially could have about the goods/order would then not be transferred further out in the supply chain.

6.4 Return Information – Backload

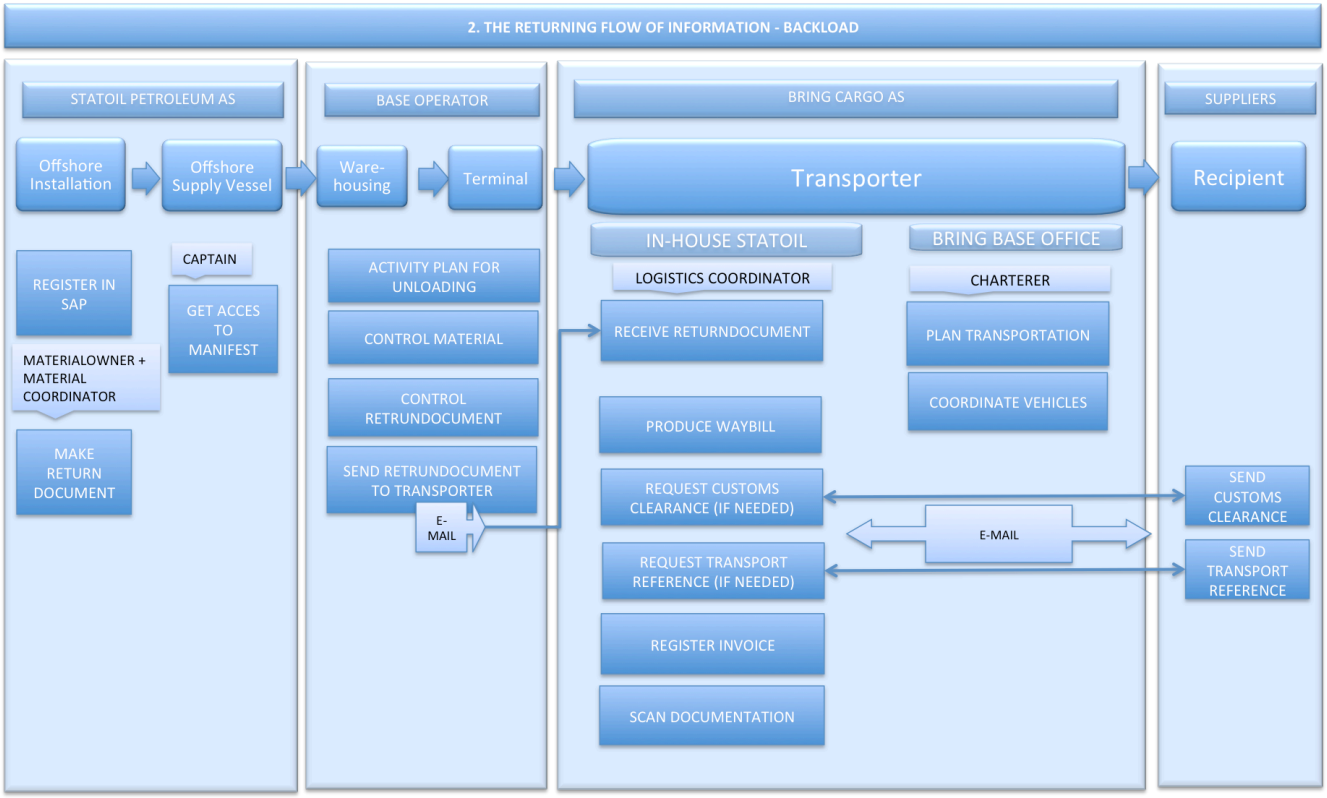

Figure 6-4: The returning flow of information through the supply chain

Offshore Statoil employees fill out a return document (RD) and send this to the operator at the corresponding supply base when they want to have something transported back from the installation offshore. An example of a complete return document is available in Appendix 2. The RD will be discussed in more detail in Chapter 7.2.4 in the analysis. In-house personnel located at Mongstadbase described and illustrated to us that in most cases the RD cannot be applied as a complete transportation order without the supply base operator or in-house personnel filling in additional information. The operator at the supply base measure and weighs the goods, and forward this information to Bring. The delivery terms, including information as to who should pay for the transportation, the consignor or the recipient is also included in the document.

A RD consisting of the added information is sent to Bring by mail or delivered manually when the goods are ready to be picked up. The means of which the RD is handed over to Bring varies by supply base. This RD should include what goods to be transported, if the goods are classified as dangerous, the size and weight, the delivery name/company and address and who is billable/responsible for the transportation. When Bring receives the RD a logistics coordinator punches the information in the RD into Sysped manually. There is a

minimum of automated transmissions of information between the actors when it comes to backloads. Similar to the conditions of outgoing flow of information a significantly amount of manually performed processes and paper flow prevail for the backload information flow. One of the employees we talked to at Mongstadbase referred to the paper flow and transport booking as, *we are at a Stone Age level*. This was due to the processes of scanning and mailing of single papers and that all information received through the RD document Bring personnel have to register all over again. Based on the RD the logistics coordinator creates a waybill in Sysped, or some places in Axia freight and thereafter transferred to Sysped. The logistics coordinators also use Sysped to register invoices and scan documentation.

Bring will in some cases have to collect a transport reference and/or a customs clearance from the owner of the equipment before the transportation can be executed. This must then be done before the goods can be transported. Without a transport reference, Bring might risk that the supplier did not expect or want the goods delivered at that specific time, or claim that they are not billable and thus refuse to pay the invoice. This correspondence is generally conducted by mail. The tasks executed by Bring with regard to customs clearances were described in more detail in Chapter 4.1.1

Both the in-house personnel at Vestbase and Mongstadbase have to a limited extent access to Statoil SAP. From Statoil SAP they have the possibility to extract manifests that serves as an aid in the planning of transportation. This information provides the in-house and the charterer with an overview of the goods coming in from the installations offshore. The manifest shows what and how much goods are being shipped from the offshore installation to the supply base onshore and gives Bring an indication of how many trucks might be needed to handle further transportation. However, the in-house/charterer does not know when the goods arrive at the pier, when it is unloaded or when it is ready to be picked up. This is information that the operator at the supply base is in control of and which is not available to Bring. Therefore, the information is not sufficiently accurate to plan an actual transportation. A detailed planning will not be possible because the charterer is dependent on having goods physically ready for pickup in order to assign the transport to a driver. The charterer plans the transportations and allocates them to the drivers. Much of the same procedures prevail here as for the outgoing flow of goods. The main difference between the two is that there is not the same extent of urgency related to planning the transportation for backloads as it is for the outgoing flow of goods.

7 Analysis of the Information Flow in the Oil Express (OX) – Discussion of Issues and Potential Improvements

Now that we have described the supply chain, the information systems applied in it and described the flow of goods and information, we will further present what we have perceived as issues and potentially improvement. This is based on an analysis of our research material, and a respond to Research Question *2: Are there any issues concerning the handling of information?* We focus on the flow of information and how this affects the performance of Bring, but also the supply chain performance as a whole.

With a basis in Research Question *2.1: How do the issues occur?* and *2.2: What is the cause?* The issue will be explained, and what might be the cause will be enlightened. Further, through Research Question *2.3: What are the consequences?* We reflect upon what effect the issue has. Eventually some potential improvements are suggested, as a respond to research question *2.4: How can the issue potentially be improved?*
The findings presented in the chapter are structured into five sections, still many of them will to some extent overlap and blend into each other.

7.1 Analysis of the Deviation and Improvement Database

The improvement database, as presented in chapter 5.5, provides insight in the deviations that have been registered concerning operations in the Offshore and Energy department of Bring. An analysis of our findings from the database gave an initial picture of where there are processes that might need improvement. We focused on extracting the deviations that could be related to or caused by the information flow. This was in order to see if there was sufficient evidence of the perception of a sub-optimal information flow, and in that case what deviations this led to. In this section we present some of our findings in the database presented through numbers, figures and examples.

In 2014 there were registered 788 deviations in the database. These are both internal and external events and they vary both in severity and likeliness of occurring. The number of deviations includes events related to the whole division of Offshore and Energy, and not only

the oil express. In the examples we present, we have focused our attention to the ones we found that were directly relevant to the OX.

As Figure 7-1 shows, 70% of the deviations are related to either internal or external quality. The remaining 30% are incidents, HSE almost-accidents and HSE accidents. The last-mentioned represent only about 1% of the deviations.

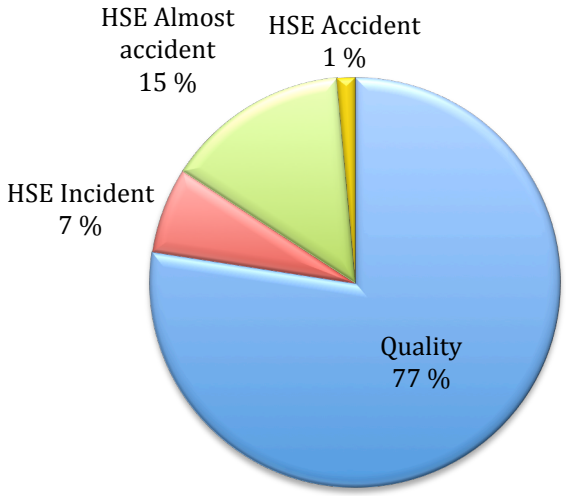

Figure 7-1: Total of internal and external deviations registered in 2014

This shows that there is a huge potential in the quality of the conducting of processes and activities. In the worst cases the deviations related to quality can also become HSE issues. 15% of the deviations are HSE almost accidents, these could possibly have caused for severe consequences.

214 out of 788 deviations in 2014 were directly related to Statoil as the registered customer, which is in fact about 27% of the total registered deviations. In addition there might be several deviations concerning material from Statoil that are registered on their suppliers. This is not unnatural since Statoil is such a large customer of Bring in the Oil Express, but it shows that there might be a large potential for improvement in the processes between these two parties.

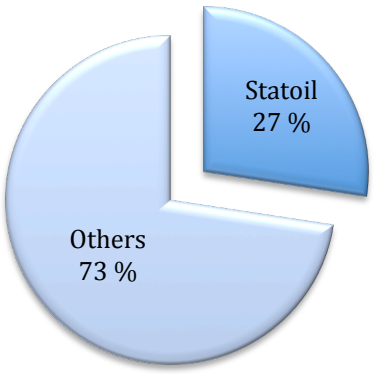

Figure 7-2: Share of deviations directly connected to Statoil

In the type of processes that Bring work with each day there are naturally a large part of the deviations related to practical issues like damage to goods, maintenance, securing of cargo, delays, traffic incidents and so on. Still, a quit large part of the deviations registered in 2014 were directly related to the information flow and specifically deviations from the booking. As shown in Figure 7-3 at least 23% of the deviations are directly concerning the exchange of information, and these categories are the ones we have focused our attention.

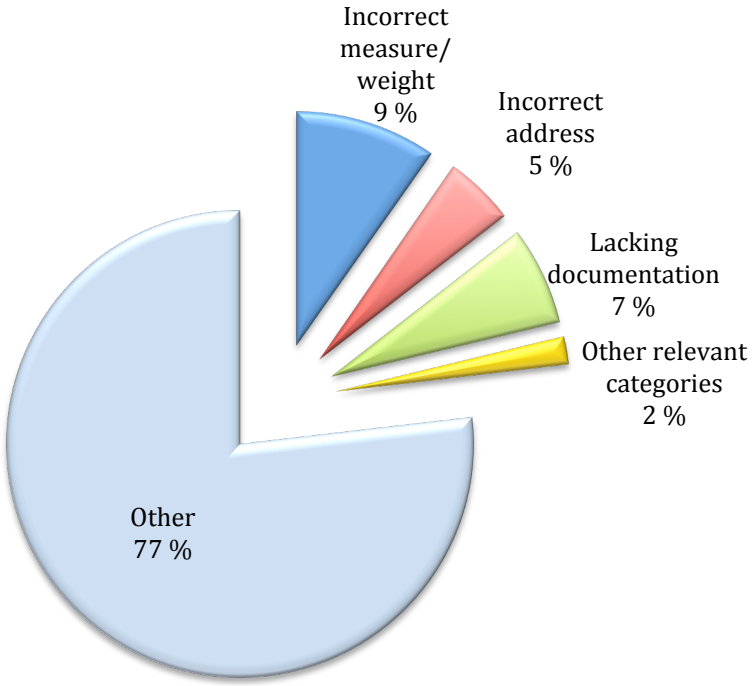

Figure 7-3: Share of the deviation categories directly concerning the booking - 23%

A large part of the deviations are related to “Incorrect measures and weights”, “Incorrect delivery addresses” and “Lacking documentation”. These types of deviations are highly relevant for our research problem. Other relevant types of deviations, which occurred in a smaller scale, were “Breach in ADR”, “Incorrect invoice-receiver” and “Incorrect terms of delivery”. These are categorised as other relevant categories in Figure 7-3.
There were some other highly represented categories that, when closer examined, we found not to be relevant for our research. These were “Breach in process”, “Improvement suggestions for quality”, “Breach in cargo securing” and “Delays”.
Further, some examples of deviations in the most relevant categories will be presented.

7.1.1 Incorrect measures, weights and location

The deviations in this category are mainly lacking or incorrect measures and lacking or incorrect weights. Either from the return document or the booking directly from the customer related to “outgoing goods”. In addition there are several incidents where the location of the cargo to pick up is not on the given location or the delivery address is incorrect. Mistakes in this area are a great HSE issue.

Examples of deviations:

- A shipment from Statoil to a customer was booked without any measures on a tank. Bring did not have any prerequisites to know this and it is not possible to look it up online based on container-ID.
  The immediate action was that the driver had to check the size on the unit.
  The corrective action were suggested to be to address the issue with Statoil at a operating meeting, and that it has to be set routines for how shipments shall be booked with Bring.

- A transport order from Statoil of about 35 joints/pipes, were specified to weigh about 7.500 kg. The order was to be picked up at one of their suppliers. When the driver came to load it, it became clear that the cargo had a total weight of 14.300 kg, which means that there was a difference of 6.800 kg to the registered weight.
  If this had not been discovered, it could have caused for severe accidents. Statoil were notified about the incident.

- A backload shipment had incorrect measures on the load in the Return Document (four different return documents). This led to the fact that the driver could not transport the cargo on the vehicle, and had it not been discovered than it could have led to an accident since the vehicle would have been too heavy loaded. Wrong measures and weights will also lead to delays in the processes since the vehicles cannot transport the booked cargo.
  The immediate action was that the goods were not transported as agreed upon.
  The corrective action was to visit the customer, in cooperation with Statoil, to focus attention measures/weights when loading vehicles.
  Further, the result is documented as a Statoil-meeting with the customers on specific dates. In addition a campaign internal in Bring was started to focus on measure/weight and securing of load.

- An order was booked from a supplier in Stavanger for transportation to the supply base in Florø. In the booking the weight was listed as 13,5 tonnes, but in the waybill provided at the pick up point, the weight was listed as 10,8 tonnes. The driver then placed the cargo according to this.
  Just outside Stavanger Statens Vegvesen controlled the vehicle and the vehicle had exceeded the allowed bogie weight and the total weight of the vehicle.
  The immediate action was to reload, try not to delay the delivery anymore than necessary and the cargo was control weighed at the supply base. There it turned out that the cargo had in fact a weight of 14,8 tonnes.
  The corrective actions were to discuss this on an operating meeting between Bring and the supplier.
  The consequences of this were extra costs because of a fine from Statens Vegvesen, equipment for reloading of the cargo and overtime for driver.

- A transport order from the supplier to Statoil had several cases of incorrect and lacking information on the customs waybill.
  Incorrect measures on the cargo, was listed as 1 m^3 but was in fact 9 m x 0.8 m, incorrect location of the placement of the cargo and incorrect name on the load carrier.
  The incorrect naming was a mistake from the in-house office and are therefore further registered in its own deviation.

The consequences were that they had to spend time on searching for the cargo, and the initial truck could not transport the cargo because of the new measures. The driver had to leave the cargo behind for loading at a later point. In addition there was ordered a crane for loading that had to be cancelled, and could have been used in another place.
The corrective action was to bring this up with Statoil so that they could remind their suppliers on the importance of following Statoil's package and label instructions and of correct information so that transport can be planned in a proper and secure manner.

7.1.2 Incorrect address

There are several cases where the wrong addresses are listed on return documents and bookings and waybills, that have led to goods being delivered at the wrong location or that goods could not be sent as planned. We will not present any detailed example in this category. There are several cases where the address is not even given, but this will usually not be registered as deviations, but it is rather fixed immediately by the personnel.

7.1.3 Lacking documentation

With regards to the category of lacking documentation recurring deviations are for example deficiencies in in the information given in booking, incorrect type waybill, lacking data sheets, incorrect PO, double waybills and lacking ADR-documentation.

Examples of deviations:

- A booking from a supplier in Stavanger for transport to the supply base at Ågotnes did not include any information on the fact that the goods contained ADR. It was listed that it was under the ADR level, and when no documentation were sent and it was not listed which class it belonged to, Bring concluded that it did not contain ADR goods. When the vehicle arrived at the supplier to load the cargo the driver received the ADR-papers, and it appeared that the load did in fact contain explosives. This could not be consolidated with the existing cargo loaded on the vehicle, which were gas racks.
  The immediate action was to require an own vehicle for transport.
  The corrective actions were to inform the supplier about the importance of informing as early as possible about the class, UN-number and the amount and send the ADR-documentation. This is so that the charterer can plan what goods can be consolidated

and which restrictions that applies. The supplier further informed the responsible division about this.

- The scheduled truck from Stavanger has sometimes no with it waybills on all of the assignments. This leads to a hold up at delivery because Statoil do not want to unload cargo without the right waybills or it can lead to goods being sent in return.
  The immediate action is to inform the division, that if there is not time to make the waybill before the vehicle leaves, then it must be done before it arrives at the destination and sent by e-mail.

7.1.4 Potential areas for improvement

Based on the deviations mentioned above, it comes to light that there are in fact activities that would most definitely benefit from having some adjustments to the practices. It becomes clear that there is a source of errors in registrations of the bookings. In addition, some of the deviations that occur are probably neither acceptable to Statoil nor in accordance with the HSEQ requirements. Such deviation should thus be dealt with in a thorough manner. Taking this into consideration, there should be a shared desire of both parties to find a solution to prevent such deviations from happening. It is important to keep in mind that this is deviations that at some point are discovered, and if not the consequences could be much more severe.

7.2 Analysis of Today's Information Systems in the OX

Before we started this project, the management in Bring was aware that they might have some issues regarding the information systems used in the supply chain. This was the reason that they wanted us to map the situation, look for bottlenecks and figure out where things potentially could be improved. They had already started with some processes focusing on improving some of the existing systems, mainly updating Sysped. In addition they had slightly started the process of developing the MyBring solution that already existed in the domestic groupage and part load segment, in to fitting to the offshore sector's needs. Though, this is still in a somewhat early stage.

Although Bring clearly state that they may have a large potential for improvements, it is also important to remember that they have a good logistics and is a highly acknowledged organisation in the sector. Nevertheless, as when the times are changing so will the need to keep up to speed, if they are going to be a part of the race.

In this section we present issues related to the booking solutions and the internal transportation management systems. With regard to booking solutions we will analyse both the bookings related to outgoing equipment from supplier to installations, and the bookings associated with returning goods from offshore installation and back to the supplier.

7.2.1 E-Mail

When we began with our research of Bring Offshore and Energy, the first thing that became clear was that the communication was based upon a massive amount of *e-mails*. Both internally in the company and in all interactions with the customers. As mentioned, 95% of the bookings are per e-mail. There are often several mails concerning one single booking. The charterer assistants are responding to all of these. In addition the bookings are often lacking necessary information to conduct the transport, which leads to the need for additional mail to be sent back and forth between Bring and the customers. In addition, the information given might possibly also be incorrect. One of the charterer assistants at the Stavanger office believed that about 20% of the bookings received included incorrect or inaccurate information or lacked essential information. From observing the improvement database, which we analysed in Chapter 7.1, we discovered that it was a significant amount of deviations related to incorrect or missing information in the bookings of transportation.

In order to get a clearer picture of the magnitude of the use of mail related to booking we asked both Bring personnel responsible for outgoing flow of goods and the ones responsible for backloads how much mail they received and sent on average during a day. The results are illustrated in Table 7-1 below and describe the average amount per person.

	Outgoing goods	Returning goods/Backload
Number of e-mail received	60	30
Number of e-mail sent	100	25

Table 7-1: Amount of e-mails exchanged on an average day

Also, not all customers check their e-mail very often, so occasionally Bring personnel even have to call the customer to be able to get the information. It might be difficult to get hold of the right person, and things suddenly take a lot of time.

When using e-mail as the form of booking one would expect that there would be some form to be filled out and sent, or a template that the order should follow. Especially considering the complex cargos that are transported. This is not the case. In fact the information that the order provides can vary from complete, to just a sentence or two saying e.g. that there is an order to be sent and the number of containers and the delivery supply base.

The reason for this is that there have been routines from the beginning using e-mail, and these have not been challenged to a large enough extent. This is an issue that has consequences for the charterer assistants receiving the bookings, in the way that they must use extra time and resources to recover this information to be able to make an order.

In addition, the use of e-mail also creates extra work in itself. When receiving a booking the charterer assistant must print out all the correspondence and information attached, create a transport and scan all of it into the system manually. Not only does this create a whole lot of paper/documents that can easily be cause for mistakes, but it also takes a lot of time for the employees to manage. A consequence of this is that the supply chain demands a lot of human resources related to these activities.

7.2.1.1 Potential improvements:

There should not be any reason for the bookings to continue to be conducted like this. Initially we got the impression that the excuse for the somewhat old-fashioned solution is that the deliveries in the offshore sector are too complex to be handled by a system. Our perception throughout the process was different. Although some orders might be complex, these could have been handled further over e-mail or telephone if necessary. There are many orders that contain goods that the personnel in Bring are familiar with, and if the necessary information about measures/weights/ADR and so on initially were provided it would probably not be an issue.

What we discovered through our many interviews with Bring employees is that orders coming in are carried out with few requirements as to what have to be included in an order. A template that clearly states what the order must contain of information should ease the booking process and time spent obtaining and correcting information.

If Bring succeeds with their goal to increase the percentage of customers using electronic booking solutions the number of incomplete bookings would probably decrease. This is consistent with what Stefansson (2002) stated about IT in Chapter 3.8.2 namely that electronic links have made it possible to transfer more accurate information between the actors in a supply chain. The human resources used in relation to the handling of mail could be reduced if there were a higher degree of automation of the booking routines. In addition fewer mistakes could occur, and although it usually becomes detected in reasonably time, it could have in fact been avoided.

The booking procedure could have been more automated if the electronic solutions of MyBring or EDI were better exploited. It can also be discussed if the extensive amount of booking through mail may be because of lack of knowledge about other solutions or resistance towards change among employees and clients. These issues will further be elaborated.

7.2.2 MyBring

The MyBring solution did not earlier include transports in the offshore sector, other than regular transport of consumables like clothes, food, toilet paper and so on. Now there is an on-going process of developing the solution to include the transport bookings in this sector. The feedback from the customers that have been testing this system for deliveries for D&W equipment is that they experience the solution to be useful, but incomplete. A lack of possibilities for tailoring of the order is prominent. Meaning that they do not have the possibility to write additional text that can be of great importance, for an example special instruction to the driver or additional information essential for the handling of the goods. Also, there are very limited possibilities for linking company specific information to the order, so that it can be used again in relationship with billing. This leads to questions regarding what services or goods the invoice received from Bring is for. Such information could for an example be customer references, task numbers, customer ID, internal number and

so on. The MyBring solution has only been tested by some clients, and not actually on real life bookings because it has been under development. Though, the customer we asked would definitely be interested in using the MyBring solution if these features were improved.

In the development of the system, the different managers in the oil express divisions have had some clear ideas of how the solution should be tailored and what specifications that are necessary to include. It has shown itself that not all of the attributes that have been ordered are fulfilled in the developments. This is probably because of misunderstandings between the different parties. At the meeting we attended between the MyBring domain owner and developer and the OX management, it became clear that there were different perceptions on how the solution should be designed. The representatives from MyBring wanted to maintain the streamlined solution that only contains the most necessary information and features. The OX managers on the other hand wanted to add several features in order to make the solution more useful. It seems as the process of trying to design a joint system is compromising the progress and resulting in the continuous use of mail.

We got the impression that there were a somewhat limited awareness of the solutions available for bookings and the other attributes they offer, among the employees and the customers. It became apparent when one of the managers attended a meeting with a supplier along with the seller from Bring. When he introduced the MyBring solution and how it could be used as a portal for retrieving reports and so on, the customer was very interested in using that solution. The seller on the other hand had not thought of the solution, and to inform the customer about it. This shows a lack of awareness internally.

7.2.2.1 Potential improvements

A challenge is to coordinate the desires from both parts to work out a functioning and complete service. As described in Chapter 3.6 a shared strategy and increased internal integration will contribute to better performance for Bring. This demands a focus on the internal communication between the divisions. There is no point in spending time and money on developing systems that are “almost good enough”. That will only be a waste of resources. If the system shall be used, it must be complete based on the references of Bring and the customers. If not, the customers will only choose other alternatives for booking. The solution should be designed in a way that provides a clear incentive for the customers to choose this

booking alternative rather than mail. Therefore, in order for Bring to achieve the goal of increased use of electronic booking, the needs of the customers have to be considered carefully. The booking solution is a part of the service provided by Bring and as pointed out in Chapter 3.5 thus has an impact on the total quality that the customer experiences.
The OX managers have good insight in the preferences of the customers, the complexity of the orders and the magnitude of the information demand. It is important that their voice is heard at the same time as the people with competence in development of such solutions have the liberty to design this in the most client friendly manner.

As described in Chapter 3.8.2 to fully utilize the benefit of an information systems, it is important that the whole organisation is aware of the solution, that they get training in how it works, what the purpose is, how it can help the clients and what the company's goal is by implementing it. If not, it will not work optimally. Training and education is crucial when it comes to using information systems. Therefore, Bring should be willing to make investments in education of both their employees and their customers in order to increase the knowledge of the MyBring solution. At the same time, increasing the customer awareness with regard to what booking solutions that actually exist will increase the likelihood of the customers using these solutions.

Bring has to make sure that all employees know about their strategies and goals, and the measures and solutions that they want to exploit to reach them. Bring employees will then be better fitted to communicate correct and accurate information about the booking solution to the customers. This is important with consideration to Chapter 3.8.1 where it is said that the data might be influenced by the sender's processing and knowledge.

MyBring is an internet solution, which as shown in Chapter 3.8.2 should make it possible for all customers of Bring to use regardless of size and turnover.

7.2.2.2 Track and trace information

Concerning the MyBring solution that is under development, some of the suppliers seem to be missing a more live update through the system on where their materials are at all times. To this day many of the customers have made use of the MINe solution to track their good. This

solution is now being phased out. The existing track and trace information that are available in MyBring is limited to the points where the goods have been delivered and signed, but not anything beyond that. A better tracing of the equipment would for example help them in planning the further use of the equipment. For an example if their equipment is to be used again somewhere else and they do not know where it is or when it is coming they might have to get hold of new or alternative equipment, which can be very costly. This need is differing between the suppliers, where for example Swire does not see any large benefit for them in a solution like that. Force Technology on the other hand would very much get an advantage in such an ability of tracing. They specified that there were no need for sending a mail all the time informing of when the goods are arriving at the different places and so on, but rather the possibility of going in to a system and get exact information when needed. While some don't have the need for a detailed tracing, there might be some customers that would like to know the exact position of their goods. This may differ based on the incoterms, in other words whether the suppliers receive rent only when the equipment is at the offshore installation or the supply base, or from the equipment leaves the supplier until it is back again. There are customers that have experienced that the equipment has been standing for a long while on the supply base and not been sent in return. This is not Brings responsibility, but the responsibility of the supply base operator. In those cases where the suppliers do not get paid for this time it causes for large costs. In the cases where they get paid it can cause for large costs for Statoil. Therefore, Statoil might also be interested in a more accurate source of information with regard to the location of the goods. Another aspect that might reinforce this desire for Statoil's part is the requirements from the customs authorities saying that Statoil is responsible for the goods when it is transported offshore. In addition Statoil would most probably want to know how far along the equipment has come in the transport as this equipment might be both expensive and of great importance to the production on the offshore installation.

7.2.2.3 Potential improvements

The condition for such a track and trace solution to be implemented is dependent on a RFID or GPS marking of the load carrier or equipment. If the purpose shall be to track the equipment on item level, it might be necessary with a mark on the equipment and not just the load carriers. The EPIM Logistics Hub can provide such RFID marking. More information with regard to this solution can be found on their webpages (EPIM, 2014). Bring is unsure

what benefits they can gain from this solution. However an increased transparency as to where the goods are located at all times should contribute to better planning abilities for the actors in the supply chain. This possible outcome is supported by information technology theory presented in Chapter 3.8.2 stating that information and communication technology has created opportunities to speed up the entire shipping transaction. Therefore, information sharing is believed to result in a more efficient supply chain for all the participating actors. If the project is successfully implemented Bring should thus be willing to share information regardless of what outcomes are directly profitable to Bring.

A solution to enable an increased overview of the location of the equipment could prevent the information flow from being interrupted when the equipment is delivered at the supply base by Bring. If information were shared also at the time it was transported offshore and at the supply base this could contribute to better planning conditions for the employees responsible for the return shipments. Bring employees would then have the possibility to see the movement of the goods also when it has arrived the supply base. This could in turn enable Bring to have the right amount of trucks ready at the right moment.

However, considering the period that the oil sector is going through at the time it may be questionable if the project will see the light of day anytime soon. Projects with high development costs for several of the actors are not likely to be carried out in times when the focus on cost reduction is highly prioritized. We do not know completely what remains for the solution to be useable.

The OTIF solution described in Chapter 5.4 is creating a good overview of the goods flow and information flow for Bring and their customers in the domestic groupage and part load segment. The control tower mentioned in the description of OTIF is a database that function as a mean to increase the information sharing in the supply chain. A similar solution for the OX could increase accuracy and information shared with the actors, if Statoil could provide a PO on item level. The location of the goods could be transmitted to Statoil SAP and provide Statoil with the same possibilities to control the deliveries and the performance of the other actors similar to the OTIF solution. A discussion of the possibilities of transferring aspects of the OTIF solution into fitting the OX is presented in Chapter 7.5.4.

7.2.3 Electronic Data Interchange (EDI)

A few of Statoil's largest clients are using EDI to request their bookings with Bring. This is done through an automatic transfer between their systems and Brings system. There is therefore no need for interaction through mail unless there are any deviations. Still, it occurs that in addition to the electronic transfer there is a mail sent to Bring to alert the booking already done through EDI. Bring believes this is because of the fact that this method is not widely used and may not be quite incorporated, so the customer feels like they must be sure that the order is brought to Brings attention. Otherwise, the resulting consequences could be to forget something, not pick something up that was supposed to be transported, not deliver in time so that the installation offshore have to wait for the goods that have not shown up and so on.

Through our interviews it were brought to our attention that cases resulting in such consequences had occurred. There had been incidents where the customer suddenly called and wondered if Bring were coming to pick up the goods anytime soon, because for some reason the order had not gone correctly through the system. It has happened that the customer also believed that the system was purely for making waybills and was not aware of the fact that the order automatically had been sent directly to Bring.
From this we can see that there have been some challenges related to this solution, which again might just be a product of lacking information or training of the personnel and the customers of Bring.

7.2.3.1 Potential Improvements

As mentioned earlier it became clear through our interviews that it is about only 5% of bookings that are booked through EDI systems. Bring has a goal to lift the share of electronic bookings up to 80% in the OX, which then also includes the MyBring solution.
The use of EDI has been a well working solution for many of the customers, and it should be no reason not to engage more clients to make use of this solution. Though, it might be preferable to get them to use the MyBring solution when it will be available. Other than that, we had no perception of that there were any objections from Bring's side for customers to make use of EDI-systems. Bring must inform their customers about the possibilities, and help them find the best solution for their activities. Especially if Bring wants to reach their goal of a higher share of electronic bookings, this must be communicated to the clients. No matter what means of booking the customers choose to apply, Bring has to make sure that the

customers have the sufficient knowledge to use the solution as it was intended by Bring. This corresponds to what was said in Chapter 3.8.2, that the skills and knowledge of the employees and other users is vital in successful IT implementation.

In addition to many large suppliers, Statoil are also supplied by a large part of small companies. Some might be companies with fewer resources to use on information systems like EDI solutions. According to Chapter 3.8.2 the fact that MyBring is an Internet based solution, and also free of charge, should increase the possibility that also the smaller suppliers could change to an electronic means of booking.

7.2.4 Return Document (RD)

7.2.4.1 Manual transfers

In the backload flow, the return document (RD) is the first official request for transportation. This is being sent from the base operator to the in-house logistic coordinators at Statoil by e-mail or handed over on paper. The information on this document is then again manually punched into the system to create a waybill, which is the official booking in to Bring's systems. The challenge here is again the number of manual operations that we to a certain extent considers unnecessary.

7.2.4.2 Lacking or incorrect information

Another issue that were discovered regarding the RD is that it is often lacking essential information regarding weight, measures, delivery address and marking. One of the in-house employees estimated that this could occur about two to three times a day and on average take half an hour to correct. The time spent obtaining or correcting such deficiencies most often affect their ability to manage other work tasks. In one single case the time spent would not be an issue, but when this is more the rule then the exception, then it becomes a huge problem.

These issues are something that the logistics coordinator or the base operators have to correct or obtain, because it is lacking from the installation offshore. Sometimes the base operator adds some of the information missing, but it is not always this is complete either. In most cases this regards addresses or marking of ADR goods. If the information about ADR is lacking the cargo will be treated as normal goods unless the base operator, in-house personnel or the driver that loads the goods discover it. This is a serious HSE issue that should be totally unacceptable according to the company's guidelines. The interviews pointed out that in most

cases this is uncovered before the shipment is sent, but it depends on the alertness of the people handling the goods, and if not detected it can cause for severe consequences.

There is in fact too much resources used in recovering information that Statoil does not provide. In addition to that, it is also an important matter of HSE. If the weights and measures are wrong, there is a risk that goods are handled in a wrong manner or equipment that is not suitable is used in the loading and transport activities

In this case it would be a relevant question to ask why Statoil does not provide this information. A perception by some employees in Bring is that Statoil do not wish to use unnecessary time on equipment that is not theirs (just rented) and that no longer affects their production. Another perception is that because of limitations in space and time at the installation, Statoil might prefer for these tasks to be executed by the in-house personnel from Bring or by the supply base operator. It is unknown if Statoil has the same impression, that they provide poor information in the RD. We do not know in fact the reason why this might be so, and we do not know if this is something that they have the opportunity or willingness to improve. Still, it is reasonable to assume that it will be an advantage to have this information precise from the installation, regarding that there is activities related to the loading of the vessels that possibly could benefit from the right information when it comes to HSE. What we do know is that this is information that Statoil probably have available or to some degree easily can obtain. It might just be a small priority to spend time and space on performing such measures. In addition, it is also reasonable to believe that it is important to have the right weights and measures from when the goods are shipped from the installation, because of the fact that this transportation probably also has strict demands related to HSE.

7.2.4.3 Unclear incoterms

There is also a problem related to the invoices, because in many cases it is not clear which party should pay for the transport. Statoil has in the many different contracts a variety of delivery agreements/incoterms that states if it is Statoil or the supplier that shall pay for the transportation. In the return document it is not clearly stated which incoterms that are valid, and if the incoterm is stated it can be for the outgoing transportation and not the return. In some cases the base operator stamps the RD with a text saying if it is the consignor or consignee that are billable. This is a human operation were mistakes easily can occur. Such

mistakes can lead to errors in the invoices from Bring, which again can cause a higher transportation cost for Statoil.

The issue with the RD is therefore in general caused by the fact that Statoil does not provide good enough information about the backload, so that the processes further internally in Bring and at the supply base get more complicated than necessary.

7.2.4.4 Potential improvements

Template

With regard to the lacking or incorrect information in the RD it does not seem unreasonable that the basic, but necessary information like measures/weights, addresses and ADR labelling are correct and complete all the way from the offshore installation. We have not researched how the routines are at the offshore installation per today, but it should be possible that they could follow a template. A template that specifies exactly what has to be included in the order will probably make the ordering process easier for both Statoil and Bring. Correct information from the initiation of the order should increase the quality of the information and in turn reduce the need for resources. This effect is supported by what is stated in Chapter 3.8.2 that a result of a more accurate information sharing could be a reduced need for human resources. Bring personnel do not have to use a lot of time searching for this information other places. To increase the level of quality of the information and reduce the wasteful activities of collecting incomplete information the focus, as seen from Chapter 3.8, should be on getting the information precise from the very start and prevent the information from being destroyed along its way. The sooner the required information related to the order is in place, the less people at later stages in the supply chain have to spend time correcting the information. As pointed out in Chapter 3.3.2 in accordance with lean thinking such activities are regarded as wasteful and should be eliminated as far as possible.

This places a demand on Statoil employees located at the installations to fill out an order more accurately and actively do a job to obtain this information. If for instance weight and size should be filled in at the installation this means that Statoil employees have to weigh and measure the equipment before shipping it. The question is whether Statoil wants to use resources to collect this information for the greater good of the supply chain as a whole. As

described in chapter 3.1 and 3.6 addressing SCM and integration Statoil will probably be rewarded with better performance if more focus is granted to streamlining and integrating the supply chain. At the Offshore Logistics Conference in Kristiansund we got the impression that Statoil wanted themselves and the collaborating partners to focus on improvements internally but at the same time try to see these improvement in a holistic manner. In this regard, the efficiency of the goods flow was also mentioned, referring to both getting the equipment shipped fast out to the installations, but also fast shipments back to the storage and supply bases. This gives an indication that Statoil wishes to give the flow of goods to and from the installations more attention and thus as stated in chapter 3.6 should be interested in focusing on improving the just as important information flow as well.

Electronic transfer

An optimal improvement with regard to the return document would be to have an electronic transfer between the actors to reduce the number of manual operations and achieve a smoother interchange. If an automated solution to booking and information flow were established, there could be blockages in the software so that the document could not be sent before all the required fields were filled in. Such a solution should according to Chapter 3.8.2 prevent missing and incorrect information to be shared in the supply chain. In addition it could allow for the actors to share more accurate and complex information.

If the document were electronically issued offshore at the installation and included all required information it could instantly be sent to the supply base where the base operator could just unload and inspect the goods toward the document and electronically confirm. If there were missing or incorrect information they should fix this, but if not they could just "press the green button" after the unloading and inspection and the RD would be sent to Bring. This could reduce unnecessary work related to completing the RD and thus increase the performance in the supply chain. This is supported by the findings in Chapter 3.3.2 where Harrison and Van Hoek (2009) define Lean Thinking as *a cyclical route to seeking perfection by eliminating waste and thereby enriching value from the customer perspective* (Ch.6, p.172).

It could possibly be considered to use a mutual solution for the outgoing and returning bookings, where there would be different graphical user interface for the onshore and offshore

booking. An electronic transmission of the RD would most likely ease the processes, reduce the need for manual labour in many links and potentially reduce errors and incidents.

Regarding the unclear incoterms it could be useful if the PO was in some way connected to the backload, so that one could reuse the information about the incoterms. Thereby it would be easier to see who were responsible to be billed for the transportation. Even if the incoterms were intended for the outgoing transport there could be some kind of sign in the PO that indicated how the incoterms could be applied on the backload. For example a letter or sign that indicated that the incoterms should just be reversed when the goods were returning.

Other information could also possibly be reused. A reuse of the outgoing information on the return, were you do the necessary adjustments, could ease the processes. Then it is important that the necessary changes in the information are done. For an example, an isotope that has been on the installation for two months do not have the same radiation when it is sent in return as when it arrived at the offshore installation. The possibility to reuse the outgoing information in the case of backloads is discussed in more detail in chapter 7.5.

7.2.5 Electronic Transport Reference

Sometimes a reference for transport needs to be signed by the party responsible for the transport before Bring can send it back to the owner. This can either be the oil company or the supplier. When examining the routines of the employees at the in-house position it became clear that this process in itself is not so time consuming. However, when they have busy days and many goods coming in, this can lead to some delays in the process of getting the goods transported back to the suppliers.

The reference is sent by e-mail to the supplier. Receiving a response can sometimes take some time depending on the supplier. Some of the suppliers have stated that they would be ok with the goods just being sent back to them without any reference. If Bring were to do this, it needs to be properly organised and clearly stated in their documents.

7.2.5.1 Potential Improvements

A possible approach could be to make arrangements clearly stated in the return documents stating whether the party wish to have the goods transported with or without a transport

reference in advance. This will again depend on the incoterms, and the agreements between the oil company and the supplier. An agreement will have to be properly implemented so that there will be no uncertainties as to what deal has been made.

Another approach that could be very useful is an automation of the process. The way it is done today is by manual operations, where the request for reference cannot be sent until the goods are ready to be shipped from the supply base and back to the supplier. As mentioned this can cause for issues when the workload is extensive, and it may lead to goods using a lot more time on transport than necessary. One may argue that the amount of time to wait may not be so long, but it is important to remember that there are small margins on time in the business of transportation. Although the time pressure is highest in the outgoing flow because of the pull effect from Statoil it is not necessary to use more time and resources than necessary.

An approach could therefore be to implement an electronic interaction with regard to the transport reference. This would require a higher level of integration, but again might be more efficient and adaptive to changes in the terms of delivery. An electronic alert could be sent to the recipient already when the goods are on its way back from the installation. The recipient could in turn confirm the transport electronically and for example cross out if they need the goods to be sent by express. In that way the in-house coordinator would be able to send the goods as soon as he/she received the RD and the goods had returned to the supply base and been handled by the supply base operator. An automation of the process would preferably lead to spared resources in terms of time spent on getting the reference and time wasted by waiting. The personnel would spend less time e-mailing for references. There could be an increase in the speed of the processes in terms of less waiting since the reference would then be ready and the goods could be transported immediately. Thus eliminating waste could spare resources. According to Chapter 3.3 and Lean Thinking, such waiting and time spent on non-value adding activities is considered to be waste and should be focused on to eliminate.

7.2.6 Sysped

Through our interviews it became clear that about 60% of all orders in the base-to-base transportation has a need for manual handling in some way, and assignments can often be controlled up to five times before it goes to invoicing. This is both caused by complex

agreements and the TMS system. When researching the use of the internal transportation management system (TMS), Sysped, we discovered various issues regarding these manual operations.

These issues were mainly considering limitations in the possibilities to insert certain information or the automatic appearance of information. For an example one issue has been that one must always manually fill in the different measures on standard containers and baskets, for each order into Sysped. The consequence of this is that the employee must either have the knowledge of the sizes on the carrier, or the person concerned must search in the load carrier owners' webpage. This will hopefully be linked to a database and appear automatically when for an example entering the baskets id-number, in the updated system.

Another issue has been that not all information inserted follows through the processes. There are areas were if you type in specifications, it may not necessarily continue to follow in the next level. As stated by one of the employees the systems works well with regular assignments, but not so well if you have to do anything out of the ordinary.

When planning a transport the charterer has not got the full overview in Sysped and the system does not assist very much in the process of planning transports. The ones that have been working with this kind of planning for many years might prefer to have the orders on paper and do all of the planning manually. Still, this might not be the optimal solution for this process.

7.2.6.1 Potential Improvements

As a respond to the issue of limitations for insertions, that one of the employees highlighted some of the managers thought that the person just didn't not know the system well enough, and that there should be enough possibilities to add what's necessary. Whether this is true or not, in the case that the employee had in mind brings another more foundational issue to the surface. The question that arises is whether there are an adequate training and education of the systems in the organisation. Training and education is as stated in Chapter 3.8.2 crucial part of implementing information systems, and a large prerequisite for the systems to serve their purpose.

Many of the issues regarding manual operations will probably be eliminated after the updated system, which they plan to implement in late May 2015. The update will have a purpose of improving the existing system, which had some limitations and a somewhat old-fashioned graphic user interface. This new version will update both the layout and functionality. The changes are supposed to improve two areas. One is related to automation and the other is with regard to planning. This will lead to some changes of the work processes. The changes in the planning is focused on having a much more transparent systems where the charterers can have a better visualisation over the different vehicles, orders ready to be picked up and so on. Also, across the different geographical locations so that there can be a better coordination between the departments on the different supply bases. This is done with regard to getting a better utilization of the vehicles.

Bring has a goal to get an 80%-90% rate of order assignments that goes automatically through the system, without any need for manual interference. This is dependent on that the information is correctly entered the first time. The update of the system is a measure for a step towards this goal, and hopefully it will lead to better quality and better income.

7.3 Analysis of Resources in the OX

7.3.1 Utility of human resources

7.3.1.1 Coordinators

Something that stands out throughout the interviews is that the employees in the different divisions, as somewhat mentioned earlier, must carry out tasks that are not creating direct value for the customers. This is tasks related to document handling like punching information from one document to another, printing out and then scanning of documents, manual delivery of documents between different coordinators, and so on. Because of a lack of integration in the processes with having electronic transfers, these tasks are often done several times in the different parts of the supply chain. This causes a poor utilization of the workforce. As stated by one of our interview objects: *We don't want smart people performing stupid tasks*. But unfortunately this might be the case in the reality. As explained in Chapter 3.3.2 non-value adding activities or waste should always be focused on to eliminate, such unnecessary operations can be considered as waste. Also, according to Deming (2000) in Chapter 3.5, less rework may lead to better quality and cost savings through increased productivity.

7.3.1.2 In-house

As described in chapter 4.4.1, through our research we discovered that the in-house personnel located at the different supply bases execute quite different set of tasks. As stated by the management in Bring the in-house positions should work as "*greasing in the machinery*", which means that they should fill the needs prevailing at the different bases.

In general, the in-house function can be a symptom that there are operations in the supply chain not working optimally. The challenges related to the information in the bookings and the extent of manual operations executed in this context addressed in Chapter 7.2 increase the risk of errors. In turn, this causes the need for an intermediary to detect and correct issues that might arise. However, the in-house personnel with main responsibility to handle transportation orders and planning do not seem to take on such a flexible role as their time is tied up in its entirety to handle backloads.

Either way, the activities performed by the in-house personnel do not seem to create any value for any of the supply chain parties. Based on what is stated in chapter 3.3.2 some of the tasks performed by the in-house personnel can be regarded as wasteful activities that do not add value to the supply chain. Meaning that the management should try to find ways in which these resources can be better utilized.

At the same supply base there were concerns regarding to the role of the position when the workload will be increasing. The fear was that there would become an increased need for spending time on "punching in orders"; in the way that every booking of backload is manually handled and with larger volumes, the time spent on these operations will also increase.

7.3.1.3 Possible improvements

If Bring were to succeed in increasing the use of electronic booking solutions the need for people involved in this process would probably decrease. As of today, Bring personnel that are responsible for handling booking execute daily tasks that could be substituted by a more encompassing system. An automated system would decrease the need for manually operations of information exchange and registration related to booking described earlier. In accordance with lean thinking described in chapter 3.3 this reduction of wasteful resources will lead to increased value in the supply chain.

This elimination of waste applies to both in-house personnel located at the supply bases and other personnel located at Bring's own offices that handle booking. Initially this would be the case for the people in charterer assistant and logistics coordinator positions that have the main responsibility to register bookings and not the charterers that handle planning and allocation of transports. In addition to register bookings, much of their daily work consists of discovering and correcting lack of relevant information and errors resulting from incomplete information in the transport orders. An integrated and automated system is hoped to minimize the need to search for information and correct errors, and thus a decreased need for manual labor. A reduction of the workforce will lead to cost reductions for Bring. Less people in in-house positions will lead to cost savings for Statoil.

In contrast to letting employees go because of the need to eliminate the employees' position, Bring might transfer people to other positions. The in-house responsible mainly for punching transport orders and creating waybills might for instance take on a more flexible role. A more automated system will free up time for those in-house personnel to execute a more various set of assignments. Although the need for people in in-house positions and others that handle bookings will decrease, there will probably still be wise to have some remaining in-house personnel functioning as a tool to achieve better integration between the actors. The in-house personnel located at the supply bases will have inside information of what needs Statoil and the supply base operators have. Such information might increase Bring's abilities to create better integration, which according to chapter 3.6 will contribute to better performance in the supply chain and increased quality of service to the end customer.

7.4 Analysis of The Integration in The Supply Chain

When interviewing representatives both from the suppliers and the managers in Bring Offshore and Energy, we early discovered some lack of integration between the actors. Bring as an intermediate, which by transport does not have as much impact on the added value of the processes, also have a somewhat limited power of persuasion when it comes to gaining insight in and share information. This is supported by what Buvik and Reve (2002) says in Chapter 3.7, namely that dependence might also be affected by the market power and access to alternative exchange partners of the parties involved.

7.4.1 Time pressure

By talking to the management in Bring we got a better understanding of the great time pressure prevailing in the supply chain. Some of the main reasons for this are of course the many uncertainties and fluctuations in demand related to the offshore and energy sector. When demand for equipment arise at one of the installations offshore, Statoil needs and expects the equipment to be delivered within a short time. If necessary, Statoil or the suppliers of Statoil are often willing to pay an additional charge to have the equipment delivered quickly. The cost of having to stop the production of oil for instance is much higher than the cost of an express delivery. As a result Bring has to apply an agile approach, which as described by Harrison and Van Hoek (2008) in Chapter 3.3.1 focuses on customer responsiveness and sensitivity towards the market and demand.

Bring constantly experiences challenges related to urgency in the outgoing flow of goods and services, but in terms of the return flow of goods/backloads this is not an appreciable problem to the same extent. There is more urgency related to getting the equipment transported to the installation offshore than it is to have the same equipment shipped back onshore. Statoil regards other parts of their business more critical, such as production. Where the handling of equipment essential for productivity is regarded as a priority. However, according to Bring employees Statoil is more concerned about this part of the goods flow now than before. Bring suggest that this is partly due to requirements from the customs authorities saying that Statoil is responsible for the exports from the installations and the import to the installations, and the fact that in times of recession Statoil is more concerned with lowering costs where possible.

The challenges concerning time pressure is thus most relevant to discuss with regard to outgoing flow of goods and information.

7.4.1.1 *Deadline at the supply base*

One of the factors contributing to the time pressure and the subsequent lack of time to plan transportation for Bring is the strict deadline for delivery that apply at the supply base. Statoil has set a deadline of ten o'clock in the morning for their suppliers to deliver the goods requested at the supply base. If the suppliers do not meet this deadline, they will not get paid for that same day. The deadline does not vary in line with the time the goods are needed at the installation offshore. As a result, several of the transportations that seemingly was urgent was in reality not. The deadline applies regardless of when the goods shall be transported from the

supply base to the offshore installation. The deadline exists to give the supply base operator enough time to handle the goods before the supply base closes. Although Statoil most likely tries to order the equipment close to when they need it at the installation offshore due to the expenses related to lease, the deadline still cause for unnecessary amount of urgency in the supply chain.

7.4.1.2 *Express delivery*

The transportation can be executed either by regular transportation or by express delivery. In order for a trip to result in economic gain the loading of the truck must be well planned and preferably result in minimal empty space. The desired outcome is to have several different deliveries on one vehicle. Bring management states that in the case of express deliveries there is a great chance of an economic loss. In that case, they refer to express deliveries occurred because of urgency and which the charterers do not succeed loading on regular transportation. If the charterer is able to allocate two or more express deliveries on one truck it could result in an economic gain. The likelihood of accomplishing such a combination decreases as the evening approaches as there are fewer orders received. The charterer will try to hold back goods to enable mixed loads.

The challenges of combining several orders onto one truck/trip is reinforced by the fact that many suppliers are more aware of and concerned about how to best utilize the space of the trucks themselves. If the suppliers for instance have goods ready for transportation that could be sent and charged as regular transport, but the shipment is not filling up an entire truck, they often rather wait for more goods to be ready in order to utilize an entire truck. By waiting for more goods to be ready the need for an express delivery might arise. The cost of splitting the goods onto one regular delivery and one express delivery is higher than the cost of having all the goods gathered onto one vehicle and one express delivery. This increases the incentive to wait for more goods in order to load the truck to its limit, even though this might lead to the need for express delivery of all the goods instead of just parts of the goods.
In addition, in the evenings a customer has to pay for a whole car regardless of how much of the filling ratio that customer utilizes. This reinforces the incentive to hold back goods.

The reason why express deliveries often result in an economic loss is, as explained by the management, that the price difference between express delivery and regular transportation

stated in the contract is too small. If they knew at the time the contract was negotiated, how the service would be utilized today, they probably would have adjusted the price accordingly.

In addition, Statoil often postpones the order of equipment to the last minute due to the high lease expenses. Thus, the suppliers have a haste to put together the order and book transportation by Bring in order to be able to deliver the goods before ten o'clock the following day. The charge of express delivery is a small cost for the suppliers compared with the loss of income from delivering too late at the supply base.

Due to these conditions, Bring is left with more express deliveries than what is ideal. In a way Bring is the party that takes the cost of short deadlines and poor planning, although they have nothing to do with the cause of neither. In addition, the short time window between receiving the order and the transport has to be conducted affects the possibility of Bring to plan a cost efficient loading. The result is vehicles with a filling ratio too small to make any profit. Although the trips resulting in loss and the trips resulting in a gain generally will even out during an amount of time, Bring still want to minimize the trips with a low filling ratio.

These challenges can be seen in context with the market trends in the transportation sector presented in Chapter 1.3.1, where Bø and Grønland (2014) stated that, the delivery service to customers might often influence the transportation cost for the carrier in the sense that fulfilling the demands could make it difficult to utilize the transport materials as desired. Providing the customers with the possibility of urgent and flexible delivery service might be costly to the carrier and such costs need to be carefully considered.

7.4.1.3 Potential improvements

Increased information exchange

The challenges related to the time pressure that both Bring and the suppliers experience in this regard is a clear sign that the integration in the supply chain is not as good as it potentially could be. As stated in chapter 3.6 there must be cooperation related to the flow of information and materials in order to exploit the advantages of a supply chain. Further, as described in chapter 3.6 information flow is a necessity to achieve integration. Instead of Statoil setting a deadline that prevails for all deliveries, Bring and the suppliers could instead have been given

the opportunity to get better insight into the demand of the equipment. Answers to questions such as when the goods are needed, how fast it has to be delivered, when the ship is leaving the pier of the supply base, how far in advance the goods have to be ready at the supply base and so on could enable both Bring and the suppliers to plan a more cost efficient transportation. As pointed out in chapter 3.8.2 sharing such information gives Bring the opportunity to create forecasts and thus more time to plan the actual transportation which in turn could increase the efficiency of the supply chain as a whole.

Extended deadline at the supply base

For Statoil to think in more holistic terms and see how their choices might affect the whole supply chain is important because, according to chapter 3.1, competing as a network is vital for success in today's competitive market. If Statoil in this case were to see how the deadline at the supply base affects the supply chain as a whole, they might have wanted to change the terms surrounding the deliveries of the equipment. If the deadline were to be changed or made into a time frame instead of a strict point of time this would ease the pressure Bring is exposed to and lead to more time to plan transportation. Such changes require a great commitment between the actors and for Statoil to trust that the goods will be delivered within acceptable time. As described in chapter 3.8, increased information exchange between Bring, Statoil and the suppliers will help control the flow of goods and is necessary to achieve the integration needed to apply such changes. However, such information sharing requires trust and commitment between the actors.

The actor responsible for paying the transport might also experience a benefit from a more cost efficient loading of the cars, this being Statoil or the supplier. Therefore, such a solution could give rise to profitable outcomes also for the supply chain partners of Bring.

The deadline gives the supply base operator a certain amount of time to handle all of the incoming goods before the closing time at the supply base. Therefore, in order to possibly extend the deadline the opening hours at the supply base may also have to be changed. According to Bring management the opening hours probably will be extended after the restructuring of the supply bases. This could ease the suggestions of changing the terms of the deadline.

Increased integration and customized services

If Bring was given the opportunity to change the framework surrounding pricing of express deliveries this could solve the challenges related to obtaining a profit when conducting express deliveries. In addition this could result in a behaviour change among the suppliers and the amount of express deliveries they order from Bring. If the price difference between regular and express deliveries were increased, the suppliers would probably be more cautious to send the shipment as express.

However, what speaks against the possibility of such a price adjustment in the contract with Statoil is the current situation the oil market and Statoil is in, and the great need for all the actors in the supply chain to save costs. The speaker at the Offshore Logistics Conference we attended in Kristiansund representing Statoil announced that for Statoil's targeted cost reduction to be a reality, Statoil is dependent on cooperation from the other actors in the supply chain. Meaning among others, that a clear management driven improvement focus is expected of the suppliers, the supply base operators, and other actors. Statoil might have to renegotiate contracts with collaborators to try to lower the prices and follow up the contracts more strictly. The goal of Statoil is to reduce costs in order to become sustainable, and not perform a quick fix (Offshore Logistics Conference, 2015).

Therefore, instead of suggesting raising the prices related to express deliveries Bring should rather take advantage of the fact that Statoil wish to create a better integration in the supply chain as a whole, and initiate a dialogue with the supply chain actors. This might give Bring a better understanding of what needs their customers have. This might also create an opportunity to find integrated solutions that benefit the whole supply chain. Through conversations, the actors might see opportunities as to how they can align their processes in order to achieve a more cost efficient supply chain. This corresponds to what Harrison and Van Hoek (2008) describe as agility presented in Chapter 3.3.1, namely that it is a network-based approach, where the supply chain should be seen as a network of partners that together shall collaborate towards a common goal. In order to increase the integration the components suggested by Lambert, Cooper and Pagh (1998) in Chapter 3.1 should be granted attention. The most relevant components in this regard are joint planning, the type of information flow and how often the information flow is updated, the philosophy of the management and culture and attitude. These are aspects that should be focused on in order to achieve increased integration in the supply chain. If for instance one could try to get the culture and attitudes

compatible between actors in the supply chain this might lead to better integration and collaboration.

7.4.1.4 Resting time versus opening hours

This is an issue that is not directly affected by the information flow, but is quite relevant in relation to the integration between the actors. The drivers have statutory resting times, and this in itself is not an issue. This is a necessary measure for safety and wellbeing of the drivers and the surroundings. Still, if you see it in conjunction with the deadlines at the supply bases some issues might arise. The deadline for delivering at the supply base is ten o'clock and the driver often arrives at the location the night before and rests there until the morning. If he then starts up the truck at 7 o'clock in the morning to deliver the goods at the base, his driving time for the day will then start. Therefore the drivers tend to wait till the last moment, before 10, to deliver their goods. In addition it becomes a problem that either way if he starts up at 7 or more close to 10, the goods that comes in return and he can transport as backload, is not ready in several hours. This is because of unloading of the vessels, inspection and internal transport and so on. This means that several hours of the drivers driving time is spent waiting.

7.4.1.5 Potential improvements

The opening hours at the bases, at least at Mongstad, will most likely be expanded after the restructuring of the bases. This might lead to a better flow if the vehicle or the vessels can be unloaded in the evening before the driver parks for the night. In that case the driver can wait until backload is ready for transportation to start up the vehicle and his driving time. By this he could much further until he have to rest again. This might lead to more "trips" on a few days than what is possible today.

Another potential improvement could be to have personnel on the base handling the loading and unloading of the vehicles, so that the drivers do not spend his "driving time" on those processes.

7.4.2 Limitations in area of responsibility

Throughout our interviews with the managers we discovered that there was a desire from Brings part to take responsibility over a larger part of the logistics services for Statoil and their suppliers. Bring has at one point taken part in the tendering process regarding the supply base services including terminal, logistics and storage service at the supply bases. They did see the possibility that control of a larger part of the supply chain would give them an advantage because of better possibilities for information integration, and open up the possibilities for better planning.
They did not win this tender, and therefore the information sharing in some ways stops when they deliver the goods at the base. The challenges related to this will be discussed further below.

7.4.2.1 Potential improvements

Although Bring did not win the tendering in this round, it can be argued that a reduction of actors in the supply chain, that would come of Bring taking over supply base operations, could lead to a more efficient chain. Fewer interfaces between the actors could as stated in Chapter 3.1 ease the management of the supply chain. Meaning that more resources can be granted to the links that are most critical in obtaining an efficient information flow. This will result in better opportunities to increase the integration in the supply chain. Especially since it has showed that there are a breakage of the information flow in the link between Bring and the supply base operator (see chapter 6.3). This means that none of the information that could have been available with Bring from when the goods were delivered can be linked to the returning goods.

7.5 Analysis of the Information Exchange

It became clear through our research that the information exchange in the supply chain is lacking essential aspects to execute the ordered transportation. A challenge in this regard is that the initial information exchange, namely the booking, is often lacking essential information. This means that in order to obtain good quality information throughout the rest of the supply chain someone along the way has to detect what information is missing or is

incorrect and add it/correct it in the existing order. The statement by Li and Lin (2006) in Chapter 3.8.2 saying that in order to improve the quality of information shared it has to be as precise as possible and preferably flow with minimum delay and distortion should be considered in this regard.

In addition to the issues related to the lacking of information in the bookings we also detected that the information flow ends for Bring's part when the goods are delivered at the supply base. As a result much of the information that Bring has used time and resources in obtaining for the outgoing flow are not reused when the same goods are transported as backload. This finding will be the focus of this chapter.

7.5.1 Ending point in the information flow

The information flow concerning the order of transportation for outgoing flow of goods is not available to Bring after the goods have been delivered at the supply base, as described in chapter 6.4. At the point of delivery at the supply base the flow of information from Bring is ending. This means that all additional information Bring might have about the goods, is not transferred any further. This makes it difficult to remain control of the supply chain.

When Statoil sends an order for transportation to the supply base operator at the time the goods are ready for return, challenges related to lack of important information applies again. An in-house employee stated that about 10% of bookings received regarding backloads needs to be corrected in some way and further that this process could take up to one and a half hour a day. Examples of such missing information in the RD are described in more detail in Chapter 7.2.4.2. If the information from the installation concerning backload is incomplete this increases the chance that the information from the supply base operator given to Bring is also incomplete. Bring management refer to this "situation" as "*shit in shit out*", because if the personnel at the installation forget to include something in the order, the likelihood that this information stays overlooked by the other actors in the supply chain increases. Such challenges might arise as a consequence to large supply chains. As stated in Chapter 3.8.2 larger supply chains increase the demand for effective data sharing.

7.5.2 Loss of information

From mapping both the outgoing flow of information and the return/backload flow of information we detected that there is a loss of information from when the goods are shipped

from the supply base to the installation to when the goods are shipped from the installation back onshore. The information that is provided and obtained in relation to the ordering and executing of transportation of outgoing goods does not seem to be reused to a notable extent when the same goods are planned to be transferred back onshore. Much of the same information seems to be missing in the RD as was missing in the initial booking of outgoing goods. There is no continuous flow of information throughout the whole supply chain. As a result Bring and the other supply chain parties use unnecessary amount of resources in completing and correcting information. Bring employees responsible for booking of outgoing flow and the ones responsible for backload do much of the same work and it can therefore be argued that the same tasks are performed twice internally in Bring. This can be regarded as yet another example of a source of waste. This is supported by the suggestions related to lean made by Maleyeff (2006) in Chapter 3.3.2 stating that activities that are performed elsewhere in the system or activities performed more than once can be regarded as waste.

The above mentioned issues with relation to the information exchange corresponds to what Lambert, Cooper and Pagh (1998) suggest in Chapter 3.1, namely that failure to integrate, streamline and manage the supply chain will lead to more friction and thus waste of resources.

7.5.2.1 Potential Improvements

Information "loop"

We discovered that there might be a potential for reusing the suppliers' information from when the goods are sent to the supply bases, to when they are being sent back in return. Meaning that if there were a total "loop" of information that followed the goods throughout the supply chain, the information flow would not end in one interface. An illustration of such an information "loop" is given in Figure 7-4. As about 80% of the equipment going offshore is shipped back after some time, it should be possible to control this equipment through a system and reuse the information on the return. An explanation of what an information "loop" is thought to entail will be discussed next. This discussion corresponds with Figure 7-4.

A solution to the challenges related to loss of information could be that when Bring handles a booking of outgoing goods, a waybill number is allocated to the order. In turn, this number should automatically be transferred back to the RD, so that it would be possible to look into the RD and see what kind of waybill these goods belong to. All the information attached to

the order for the outgoing flow of goods should be linked to a number that it is possible to enter in to a system to make it possible to look at the order when necessary. In that way Bring will be given the possibility to follow the order and the goods the whole way through the supply chain and thus be better able to foresee the backloads in a greater detail.

If an integrated and automated system was to be established between the supply chain parties the flow of information could be visible to all the relevant actors. All the exchange of information between the actors would then have been executed electronically. The information flow is initiated by a purchasing order sent to the supplier by Statoil. The supplier will further order transportation from Bring. All the information and documents needed to perform the transportation should be included and sent electronically to Bring. Bring would then use this information and create a waybill in the system. In addition, Bring would apply the information to perform needed tasks related to customs and invoicing. After Bring has delivered the goods at the supply base they will contribute with information on date and time for delivery to the system, which increases the overview of the goods for the supply chain as a whole. The supply base operator would do the same, and in addition continue to update the system with the location of the goods as soon as they change the position of these goods. The information flow will thus still be visible to Bring after delivery at the supply base and enable them to see what time the goods are shipped offshore. At the time the goods are transported offshore Statoil will update the system with date and time on when the goods arrive at the installation and again when the goods are transported back onshore.

When the Statoil employees order transportation of backload they will be able to make use of the information related to the goods from when the goods were booked for outgoing transportation. As described above, a waybill number allocated to the initial order should automatically be transferred to the RD. Statoil will check the information and make sure that it can be applied in the transportation order for the goods also for the backload. If not the Statoil employees do the necessary changes. As pointed out earlier, the properties of the equipment might have been altered during its time at the installation. Next, the supply base operator will update the system when the goods are back on the pier and again when the goods change position. The supply base operator will look through the RD received from Statoil and if necessary perform corrections, otherwise they just press a button and forward the RD electronically to Bring. Along the way Bring will have a good overview of the equipment and as a result could be fully prepared when the RD is transferred from the base

operator to the systems of Bring. A request for transport reference, referred to as TR in the figure, will be electronically transmitted to the supplier owning the goods and this can be done before the actual transportation of the goods are ready to be executed. In turn, the supplier responds to the electronic transport reference. As a result, time could be saved by not having to wait for a transport reference.

Either Statoil or the suppliers receive an invoice from Bring of the transport. Whether it is sent to Statoil or the supplier depends on the incoterms. Regardless of who is the billable party, the solution of an information loop will make the invoicing process easier and more accurate for Bring to execute. Increased information sharing through an integrated and automated system would give Bring a better overview of both the goods flow and the agreements between the different suppliers and Statoil.

As already mentioned Bring is currently in a process trying to customize the MyBring solution in to fitting the requirements in the OX services. The MyBring solution, if developed to optimally fit the offshore segment, would be an important step in the automation of the procedures related to information exchange.

For Bring there will be several positive effects from reuse of information and increased integration between the actors. The issue concerning time spent retrieving lacking information is an important focus area. As according to Maleyeff (2006) and lean thinking in service supply chains presented in Chapter 3.3.2, activities related to detecting errors, rework and waiting for information are to be regarded as waste. Better information exchange about the goods going in and out, will lead to a release of resources with regard to time. These resources can be utilised in a better manner in terms of having more time to plan cost efficient transports. As further stated by Maleyeff (2006) ineffective use of resources is also characterised as waste. It can possibly lead to release of resources, in the way that less human labour is needed, and thus less employees might be necessary. In addition, fewer deviations with regard to incorrect information may lead to less incidents that can be both costly and dangerous.

For the suppliers, access to such a " loop" of information would mean increased control of their equipment. This solution would to the greatest extent benefit the suppliers that get paid for renting out their equipment from the time the equipment is delivered at the supply base

and until it is back on the supply base. To these suppliers it is crucial to be able to obtain information with regard to the location of their equipment and be able to see when it is expected to be shipped back onshore. This information could prevent equipment from ending up waiting for transportation somewhere in which the equipment does not give rise to any income. Such information would also make it easier to plan further utilization of the equipment.

To Statoil, such a "loop" of information will ease the booking routines, under the condition that they have succeeded in implementing a booking template. I addition, a "loop" would increase the overview of where the goods are located and make it possible execute a more efficient return of goods/backload flow. Such an overview might ease the requirements set by the customs authorities to always know the location of the goods once it is offshore. As pointed out earlier, Statoil seems to be more concerned with increasing the efficiency of the backload flow and decrease the costs related to the rent of the equipment and therefore should be willing to discuss such a suggestion of an information "loop". To the supply base operator, this reuse of information would also be beneficial, as they too seem to spend unnecessary amount of time searching for missing information in the transportation order received from Statoil in terms of backloads.

Such a "loop" would result in a more quality assured and controllable supply chain and could be advantageous for all the participating actors. The main benefits for the supply chain as a whole would probably be the increased efficiency resulting from the reduction of wasteful activities.

Such a solution however requires great willingness by the supply chain actors to cooperate and share strategic information. As shown in Chapter 3.8.2 Li and Lin (2006) state that factors such as trust, commitment and a shared vision throughout the supply chain might contribute to an increased information sharing.

Figure 7-4: A loop of information following through the entire supply chain

7.5.3 Customs

Bring performs much of the customs related work on behalf of Statoil as described in chapter 4.1.1 and this is an essential part of the information flowing in this supply chain. It is a demanding customs regime with a large number of transactions. All loads must be accounted for either by having exemption invoked, a customs passed issued or through customs clearance. About 50.000 customs passes are issued annually which require extensive administrative work (Offshore Logistics Conference, 2015).

The same challenges exist for the information flow related to customs documentation as with information concerning the booking, which we described earlier. Several instances have occurred where goods “lose” their customs related data after arriving the installation and become customs goods in the return shipment. A reason for this shortcoming could be lack of familiarity with the requirements from the customs authorities and the possibilities of getting exemption from customs declaration (Offshore Logistics Conference, 2015).

7.5.3.1 Potential improvements

Information loop

There is also in this case a great potential for reusing the information obtained when the goods were outgoing on the return of goods/backload. According to management in Bring as much as 60-80% of goods shipped offshore are Norwegian goods. If these goods remain traceable they can be accounted for as Norwegian goods also on the way back from the installation onshore and a customs pass waybill does not have to be issued. An information "loop" consisting of an automated and integrated system creates a possibility to reuse the customs documentation in the return of goods/backload and reduce the need for administrative work. Avoid having to check all the backloads will decrease the work related to issuing customs pass waybills performed by Bring employees and thus lower the administrative costs. An electronic storing of customs related documents will eliminate the need for attachments and can be reused as documentation that the goods in question are in fact Norwegian goods.

7.5.4 Can we learn something from the OTIF solution?

In the domestic groupage and part loads segment and OTIF which was described in Chapter 5.4 there is a well working solution to booking of transportation that could be wise to take into consideration when looking for ways to industrialize the booking procedures and related information flow in the OX segment. Such a solution could be a helpful mean also for realising the suggestion of a "loop" of information.

In the domestic groupage and part load segment and OTIF described in chapter 5.4 the booking is executed in a fully automated manner with the need for a minimum of manual operations. The amount of resources needed to get an order through the supply chain is much smaller than what is the case in the OX segment. Adapting this solution in to being suitable for the OX segment could result in a more efficient and coherent supply chain.

One of the reasons suggested by the Bring management as to why Statoil has not engaged in initiating the same solutions also for the D&W equipment is that this is not theirs. Statoil does not own the equipment and therefor does not want to have responsibility for the database covering this equipment. There is much data related to such a solution, and IT resources are expensive.

Another challenge related to the possibilities to apply the OTIF solutions in the OX is that currently there is not the same level of detail included in each PO in the OX shipments, as is the case in the domestic groupage and part loads segment. In the OX the PO does not consists of several product lines but rather a description of a service or job that needs to be performed, meaning that there is often not a specific item that is ordered. The orders are more complex in OX and it is therefore difficult to transmit the PO data directly to a database and update each product line similar to what is done in the OTIF solution.

Implementing a somewhat similar solution to the OX would however give all the actors in the supply chain a better overview of the logistics of the shipments. As mentioned in the description of OTIF in chapter 5.4 Statoil has the possibility to use SAP to see four dates that has been registered related to updates on the shipments, as well as a description of which items each shipment consists of. In addition, in retrospect Statoil will have the opportunity for following up on the execution of the shipments and extract statistical data. In the OX a date and time is also registered, both when the goods are pick up at the location of the supplier and again when the goods are delivered at the supply base, through the PDAs of the drivers. This information might be extracted from Bring's web portal. However, these registrations are not transmitted directly to Statoil SAP because the order itself is not to be found in SAP.

Investments in such IT changes for the transportation of D&W equipment would provide Statoil with the same benefits related to control the efficiency and accuracy of the deliveries as is possible for the groupage and part load shipments. Such changes in SAP would provide Statoil employees located at the installation offshore to know how far along the demanded equipment has come.

At the same time, an automated solution to booking would ease the process of creating an order for the suppliers and Statoil as much relevant information could be integrated in the system and reused for similar orders. It would be possible to have a customer database stored in the system, such as final delivery addresses and firms that could easily be looked up when needed to complete an order.

The improvement changes suggested in relation to the information and/or the OTIF solution requires time and resources, but most important cooperation from the most critical customers of Bring including Statoil. Therefore it is vital for Bring to find ways in which a renewal of

the booking routines and the subsequent information sharing might be beneficial to the whole supply chain. Also, it took about 3 years to fully implement the OTIF project in the services of the domestic groupage and part load segment. This gives an indication of the amount of time that needs to be invested in to accomplish a somewhat similar solution also for the OX.

Investment by Statoil in such solutions of the handling of D&W equipment can be regarded as a specific-asset investment and can as described in Chapter 3.7 contribute to closer inter-firm dependency and integration between the actors in the supply chain. Statoil cannot easily redeploy this investment in other business relationships. However, as discussed in Chapter 3.7 concerning the RDT, taken into consideration the market power of Statoil and their possibilities to find other alternative freight forwarding operators this investment would not result in loss of bargaining power for Statoil. I addition, the commitment and wishes of Bring to maintain this relationship reinforces this belief. Increased integration will as pointed out in Chapter 3.6 likely have a positive impact on the competitiveness and performance of the entire supply chain. These investments require IT changes related to SAP in addition to fully implement the MyBring solution. As listed in Chapter 3.8.2 there are several positive effects of IT on the information flow, such as increased complexity and volume of information, real-time information and increased coordination between the actors in the supply chain. These improvements are critical in achieving a more efficient supply chain.

8 Summary and Conclusion

8.1 Is there a need for Change?

Chapter 8 is a summary of some of our findings, were we will attempt to respond to the total of Research Question *3: Is there a need for change?* The chapter seeks to summarize parts of our research, and describe our reasoning towards the final conclusion.
The challenges that we presented in Chapter 7 serves as evidence for the fact that we found a clear potential for improvement of the information flow.

8.2 In what Areas is there a need for Change?

This section answers to research question *3.1: In what areas is there a need for change?*
Our research has led us to focus on two areas that we consider requiring changes. These are quality of information exchanged and integration between the actors in the supply chain. The main issues will be summarized with regard to these two categories, and thereby references will continuously be made to Chapter 7.

8.2.1 Quality of information

The quality of the information exchanged between the different activities and actors in the supply chain highly affects the quality of the separate processes, and the productivity of the supply chain as a whole. With reference to section 7.1 and the general perception through the interviews, we have established that there are several deviations related to the quality of the information exchanged in the supply chain. Further it became clear through section 7.1 and 7.2 that these deviations were particularly concerning entered information about measure, weight, ADR, address and invoicing, from the customers booking through e-mail and the return document. In Chapter 7.2 it becomes obvious that the manner of exchanging information is one of the direct causes for the inadequate quality of information. There is no consistency in the level of information provided, neither in the outgoing flow nor the backload. The number of manual operations related to the exchange of information through bookings, as mentioned in section 7.2.4.1, can easily increase the probability for human mistakes. Also, as discussed in section 7.2.4.2 the routines with Statoil related to issuing the RD might contribute to an insufficient specification of information. In Chapter 7.3 we can see that the issues in 7.2, leads to an inefficient utilization of the human resources. This does not only affect Bring internally, but also the customer as they are paying for the services of the in-house position.

As stated in Chapter 3.5 the quality of the processes that Bring internally conduct may not be directly observable to their customers, but it is an important factor in the company's level of productivity and cost efficiency. The processes related to the booking and information flow presented in this thesis have great potential of increased quality, which in turn could lead to fewer interfaces, less need for rework and higher productivity. Quality at every stage in the supply chain is especially important in this particular industry, considering the equipment transported (see 4.1.1.5) and the strict HSE requirements prevailing for transporting such goods (see 4.1.1.4). The low profit margins are also an incentive for aiming for high quality, productivity and cost efficiency.

8.2.2 Integration

The other aspect that we found to be critical for Bring was the level of integration between the partners in the supply chain. These issues with regard to integration are outlined in Chapter 7.4, but it also became clear through chapter 7.2 and 7.3 that there is limited information sharing as further described in Chapter 7.5. As presented in Chapter 7.4, a lack of integration could be a result of the differences in market power of the actors involved. We present a few issues that, through our perception, are decreasing the potential for a fully cost efficient chain. The time pressure discussed in section 7.4.1 is such a factor, which can lead to bad utilization of material and high cost for several of the actors. Through our research it seems that Bring, as the intermediate, often is the suffering actor from such lacking integration.

8.3 How can the Information Flow be Improved?

Further we suggest some solutions to research question *3.2: How can the overall handling of information potentially be improved?* We base our discussion on what we have found to be the issues, how they affect the supply chain, and what we have proposed as potential improvements.

We find it beneficial to separate our suggestions in a short-term and a long-term perspective. In an improvement process it can be useful to take one step at the time, and focus on a few constraints in order to optimise the processes bit by bit. A focus on fixing everything at once may backfire in the way that none of the measures are carried out in the best manner. Implementing systems that are not fully functional towards the customers' needs is such a thing, and a direct waste of resources. At the same time there must be an overlying strategy controlling the choices that are made, and a long-term goal of what is considered an optimal supply chain.

8.3.1 Short Term: The First Steps

Electronic booking solutions

In line with what is suggested in TOC presented in Chapter 3.4, Bring should focus their attention to their core issues first. One of the main constraints to Bring in our areas of research seems to be the handling of bookings, which is a process that requires a great load of resources. It became clear in section 7.2 that the customer has to provide better information in the bookings, which again leads to a need for better booking routines and arenas for information exchange. The goal of having 80% of the bookings received electronically is an improvement that should be possible to accomplish within a short-term perspective, but in order to do so there are clear measures of improvement that need to be done.

The issues with regard to bookings, is relevant both with regard to outgoing and returning goods. A first step with regard to backload could be to improve the routines related to the making of the return documents. The minimum requirement here should be, as presented in Chapter 7.2.4.4, that there were a template that the personnel on the offshore installation follows, so that it is not acceptable to leave out any of the required information. Another measure that was suggested in Chapter 7.2.4.4 was to add restrictions in software so that it is not possible to complete the return document without adding all the information necessary.

With regard to the outgoing flow of goods and information, there must be set clear goals of what Bring would prefer as the optimal way of booking. As mentioned in Chapter 7.2 we find the solution for booking by e-mail as to be inefficient and that there must be a focus on optimizing the electronic solutions, based on the users preferences. If the solution does not satisfy the customers' needs, then it as said in 7.2.2.1 useless to spend resources on development. Therefore it is important that all functions are included so that the information needed gets through. Further it is important to implement the solutions properly. A critical factor for implementation and use of information systems is as stated in Chapter 3.8.2, and mentioned several times through Chapter 7, is awareness and training of employees and customers. This requires that the Bring employees and the sales force themselves have the needed knowledge to share this information.

Integration and cooperation

A higher level of integration between the actors can, as described in Chapter 3.6, be an important change in terms of easing the possibility to coordinate the processes between the parties. The need for cooperation and integration from the other actors in the supply chain is necessary to succeed in reaching the goal of increased use of electronic booking solutions. Even if we acknowledge that the interest of integration might be most obvious from Brings' part, we still strongly argument for the fact that this will be beneficial for the other actors. Theory describing TOC presented in Chapter 3.4 emphasises the need for continuous improvement in order for Bring to achieve their goals. It is important that all the employees in Bring are aware of what the organisation strive to accomplish. The above-mentioned initiatives would be the first steps in the direction towards a more long term and optimal solution.

8.3.2 Long Term: The optimal solution

Loop of information

From analysing the issues and potential improvements through Chapter 7, we see that a loop of information as presented in Chapter 7.5.1.1 could be a large contributor to solving the main issues related to the information flow in the supply chain. We acknowledge that the solution of a loop of information require a more long-term perspective to be implemented.
Such solutions of information handling do also have a need for a great level of cooperation from the other actors in the supply chain.
In Chapter 7.5.4 we discuss whether some aspects of the OTIF solution could be transferred to the OX. We recognised that it could be beneficial with a somewhat similar solution, and in addition if all actors were involved it would probably be much to gain for all parties.
Although such an integrated and automated solution of information exchange and booking requires big changes and a great willingness to cooperate, it should be a solution to strive for. A gradual implementation can be beneficial and again a focus on optimising one link at the time may be useful. As mentioned in Chapter 1.4, presented at the Offshore Logistics Conference (2015), there is now a growing need and desire among the actors to think holistically and streamline the supply chain. This is a good thing for Bring in order to realize their wish to improve the logistics in the interaction with their supply chain collaborators.

8.4 What are Potential Consequences of the Improvements?

We will here present some thoughts around research question *3.3: What will the consequences be for the supply chain?* Although we cannot say anything certain based on the fact that none of the changes have been implemented and tested, it is possible to make some assumptions. These are based on what we through our findings, perceive as the consequences of inadequate information handling, and we can therefore say something about what will hopefully be improved.

8.4.1 How will it affect the company?

Both the short-term changes and the long-term changes we have presented above will likely contribute to increased quality of information in the supply chain. For Bring this entails several possible consequences.

With reference to Chapter 7.5, electronic information sharing can lead to higher level of quality of the information. Such quality enhancement will according to Chapter 3.5 contribute to reduce the time spent handling the bookings received. As a result the need for people in these positions could potentially decrease.

A loop of information and the accompanying possibilities to reuse information will as stated in Chapter 7.5.2 reduce the resources needed to correct and obtain information. As a result, time saved might be used on more critical activities such as planning the transportation. This means increased utilization of the workforce and a more cost efficient execution of the transportation.

8.4.2 How will it affect the supply chain?

Increased integration and quality of information sharing as a result of increased use of electronic means of communication will have positive consequences for the supply chain in its entirety. As a result of the changes proposed above, the links in the supply chain will be able to reduce the resources spent in obtaining, correcting and sharing information. The need for in-house personnel involved in the booking procedure will as stated in 7.3.1.3 most likely decrease and result in cost savings for Statoil.

In addition, there will be easier for all the parties to get an overview of the goods flowing in the supply chain. Statoil will in a better way meet the requirements from the customs authorities saying that they are responsible for the goods shipped to and from their

installations offshore. In addition, if the perception of Bring is correct with regard to Statoil being more concerned with streamlining the return flow of these goods, the improvement suggestions will increase this possibility. If Statoil pay rent for the equipment up until it is delivered at the supplier they could benefit from a more efficient execution of the return flow. The daily rent of such equipment could be extensive and reducing the number of days Statoil pay rent could be a significant source of cost savings.

If the rent terminates when the equipment is delivered at the supply base however, the suppliers would be the party most concerned with getting an overview. As described in Chapter 7.5.2, an overview might increase the suppliers' ability to better utilize their equipment and at the same time reduce the time where the equipment does not generate any income. Figure 7-5 illustrates a summary of our main findings described above.

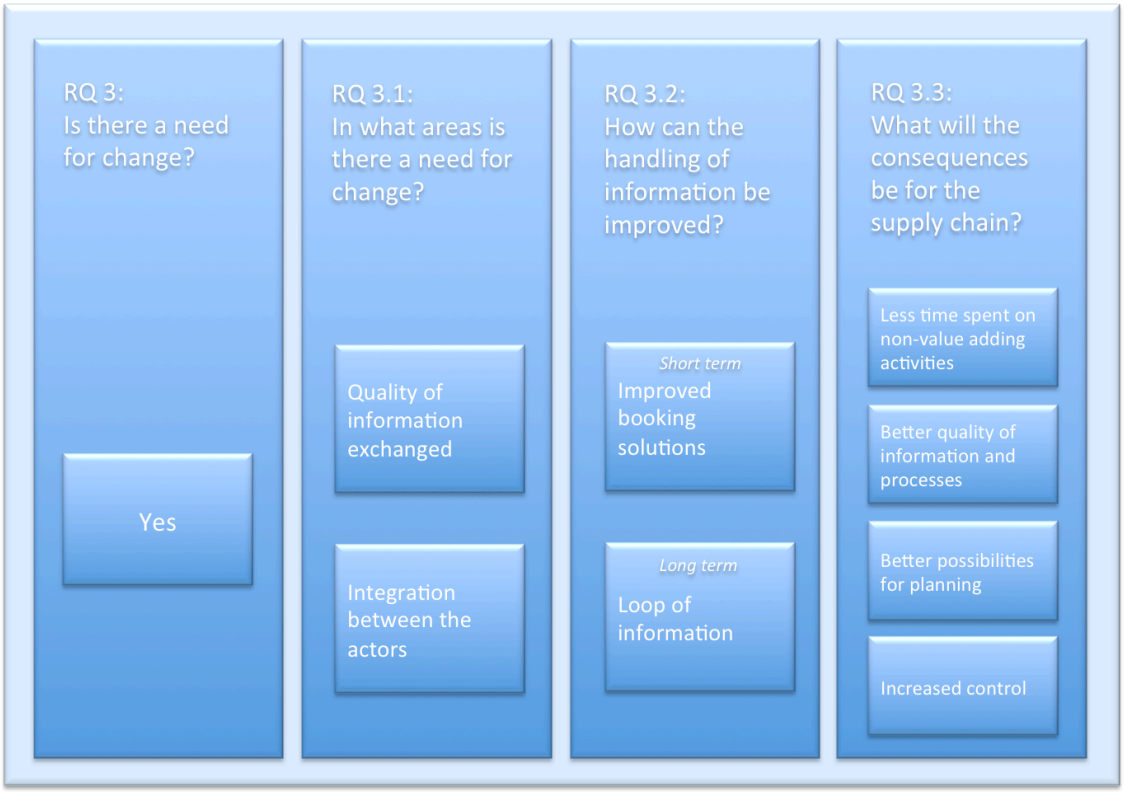

Figure 7-5: Improvement of information flow

8.5 Conclusion

Based on our analysis and discussion, we can keep our hypothesis and conclude that there is potential for improvement in the information flow. We have put forth potential improvements that we consider to be beneficial based on our studies. Nevertheless, it could be useful for the case company to further assess these improvements and elaborate before making any changes.

9 Strengths, Weaknesses and Further Research

Strengths

The thesis is strengthened by the solid foundation of information from the case company, where we have had easy access to interview objects and other source throughout the whole study. We have had conversations with a lot of people inside the company, and thereby been able to gain an extensive knowledge of the case. The case company have been supportive all the way, and provided us with a lot of the information we needed. In addition they have been very interested in our findings and the progress of the research, and there have been an open dialogue through every step of the study.

The research is a comprehensive study that we feel provides good insight in very large parts of the case company's operations. Our perception is that there is a good basis for our assertions with regard to their procedures and integration with the supply chain.
Although we have not interviewed representatives from all of the supply bases, we feel like we have covered all the parts of the supply chain in a good manner.

Weaknesses

A weakness with regard to the research might be that the perceptions of the other parties have not been examined. It has not been fully studied whether the customer share the same view of the information flow as the case company. Still, we have reason to believe that the issues are noticeable for the other actors in the supply chain.

One can question if the research methodology has affected the data collection in a bad manner. The method of depth interviews is reasonable to consider since the interviewer, interview object, time and space and other circumstantial factors can affect the results. Nevertheless, with regard to our research problem, we cannot say that we think any other method would have provided us with the same extensive insight as the one we have chosen.

Areas for further research

We won't characterise the extensively qualitative research as a weakness. Although, we can see that a further analysis into the discovered aspects will be beneficial. Our suggestions for potential improvements would be useful to assess further with regard to costs of today's situation, cost of implementation, potential savings from implementation and so on.

It would be interesting to study what consequences the changes in Sysped, that were to be implemented around the submission of the thesis, would affect the processes that we have examined.

Another interesting angel would be to examine the research problem from Statoil's point of view. And to see how they perceive the information flow, and potentially what would be the areas where they would want and be willing to make adjustments.

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11 Appendices

11.1 Appendix 1: List of Interview Objects

(Nina Gudmundseth	HSEQ Responsible Bring Offshore and Energy)
Bjarte Holstad	Key Account Manager, Bring Bergen
Atle Solheim	Senior Consultant, Bring Bergen
Jan Erik Oppedal	Coordinator/ Drifts-KAM, Bring Bergen
Charles Lien	Manager Offshore Department, Bring Sandnessjøen and Verdal
Richard Dagsvik	Team leader, Bring Sandnessjøen
Harald Settem	Logistics coordinator, In-house Statoil, Bring Kristiansund
Lill Anita Lervåg	Charterer Oil Express, Bring Kristiansund
Silje Steinsund Rød	Customs/In-house Statoil, Bring Mongstad
Laila Seim Rød	Logistics Assistant In-house Statoil, Bring Mongstad
Terje Rangen	Key Account Manager, Bring Tananger
Mary Lature	Charterer assistant, Bring Tananger
Henrieta Brenkhus Vester	Team leader Bring Tananger
John Terje Handeland	Charterer, Bring Tananger
Håvard Berakvam	Charterer, Bring Tananger
Hugo Bergsaker	Project Manager, Force Technology Stavanger
May Helen Lønningdal	Procurement, Swire Oilfield Services, Tananger

11.2 Appendix 2: Example of Complete Return Document

STATOIL

Return Document 500648977 Print Date 16.03.2015

Document Item:	0002 Status: CL closed	Return Date:	10.03.2015
Sending Plant:	**1110 Gullfaks A Platform**		
Reciving Plant:	**1007 Ågotnes - Gullfaks O050C**		
Ship-to-External:			
Rec. Action:	**Y3 3.PART- Equipment**		
Step:	**12 COMP - Complete**		
Responsibility:		Reference:	AKER INSPEKSJON
User:	**835633 Tore Wigum**		
Material:	Lyskasse for filmbetrakning		
Temp loc.:			
Misc info.:			
Return Delivery:	139312208 000010	Transp.Ord:	00000
Return Shipment:	507721	Voyage:	00000000000000082012
Ret. Handling Unit:	AMD3248	PO/Item:	00000
WBS:		PM Order:	23269585
		Customs ref:	201508232069002
Final ship-to-party:		Vendor:	
Return Header text:	**2015: Forbruksmateriell ifm. inspeksjon**		
Item text:	**Lyskasse for filmbetrakning**		
Quantity/Unit:	**1 PC**		

PLAT:

Lyskasse for filmbetraktning sendes i retur til

Sendes til:
Aker Solutions MMO
Utstyr, lager og logistikk, Hinna
Jåttaflåten 11, Bygg 23
4020 Stavanger

Avsender:
Gullfaks A
Aker Solutions Inspeksjon
telefon 55145715
v/Tore Wigum 10.03.2015

Bring
Transitt nr. 201501523
Fraktbrev nr. 70713750109438722
Rakel Teisbo 16.3.2015

11.3 Appendix 3: Example of one of the interview guides

This interview guide was applied as a guideline for the initial interviews of Bring employees in the link between Bring and the customer. The interviews were conducted in order to get a clearer picture of the supply chain and detect possible issues. The interview guide were altered between some of the interviews, as our knowledge increased, and never followed in a strict manner. In addition we had some questions added that were specific to persons, place, role, etc. We always started by introducing our self and the topic of the master thesis. We explained the purpose of the research and that they should feel free to talk as pleased.

Introductory questions

- How would you describe your work tasks?
- What are your initial thoughts when we mention "information flow"?
- How do you communicate with others?
- Who do you communicate with?

The supply chain

- Can you describe the supply chain?
  - Actors? Collaboration?
- Who do you interact with?
  - How? By what means?
- What processes are conducted?
- Does any delays occur? Where? Why?

The information flow

- How would you describe the information flow between the actors?
- What kind of information do you need to do your job?
  - When? How? What if not?
- Can you describe processes and activities related to booking? What tools are used?
- Can anything be done better? Where? How?

- If you could propose a change in the supply chain/your company/your daily tasks etc., what would that be? Why?