Master's degree thesis

LOG950 Logistics

Handling offshore back-load:
from traditional schemes
to modern principles
of information sharing

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Preface

The oil and gas sphere has seen several changes in the recent years. Under the conditions of shrinking oil resources, major companies within the sphere must now cut expenses to make the oil extraction process less costly and risky, smaller companies keeping turning to further developing old and difficult oil fields where the profit is lower, but so are the risks. The development of such fields is easier with the increasing level of technology. Technology also helps to cut costs by making the processes more accurate. Oil and gas companies must now deal with the increased complexity of tax regulations in the oil and gas sphere. They must either spend huge sums of money or learn how to handle the increased complexity. It is natural that they prefer the latter solution, but it requires the overall revision of all the processes.

One very good solution can answer to all the above. Thanks to technology development and the re-engineering of business processes, a company can achieve significant cost reduction by placing the main burden on online process handling. This not only saves time and money, but allows the company to always be in touch with the situation in the field. This solution also significantly reduces the level of bureaucracy, as most paperwork is no longer needed when everything is stored on the computer.

NorSea Group, a supply base proprietor and service company for oil companies along the Norwegian coastline, is trying to show that it is possible to use modern technologies and concepts to perform better in a small aspect of the oil and gas business: the back-loading process. This thesis presents a quite affordable way to re-engineer the back-loading process, providing the theoretical base and practical methodology in which the work-flows are simply and logically organized, the time spent on the whole process is minimal, and the overall cost of the process is significantly reduced.

Two goals were achieved through this thesis:

- a description of different opportunities was given in order to fully understand the solution that can be adopted in the existing situation;
- a concrete description for how to make a system for back-load was given.

Summary

Logistics in oil and gas sphere has always been a very tough thing because of the complicated technologies, huge volumes of products and equipment and different parties who strive for their own benefits involved. Shrinking natural resources and changing big players in the market made smaller companies think about how to cope with these difficulties. In such circumstances the only way out is to optimize the processes in the way that helps to cut costs and use technologies for the benefit of the good result.

NorSea Group, a large logistic operator that owns most supply bases along the Norwegian coastline, also faces some problems in different processes they have. In this thesis we discuss primarily the back-load. Back-loading means the procedure of returning equipment from the offshore installations to the owner onshore, provided the equipment is tax cleared according to the rules accepted in the country regarding the category of the equipment. The main problem of the process carried out at the moment by NorSea Group is that actually it is poorly organized: too much time is wasted on preparing extra documents by too many different people. This leads to creating a disorder in the process and wasting of time and money. In addition to this, NorSea Group has to pay fines if the goods were not tax cleared in time and that is because NorSea Group doesn't the control the process of back-loading.

The task of the thesis is to find a solution to the problem and describe the possibility to make it. So, the idea of the solution is the following: after studying all the drawbacks of the process as it is, the ideal way out seems to be revising and re-engineering of the process and creating a computer system that will become one of the "actors" in the process.

The system must be designed according to the following principles and concepts:

- First of all, the logic of the back-load process should be revised. As the existing workflows work but appear to be unsuccessful in coping with the problems stated above, they should be re-organized and the new ones corresponding to the idea of holding the process should give grounds for the new system.
- It is important that both the newly designed workflows and the system are legal and possible to be made regarding the tax law and other laws of Norway.
- As it is supposed to be a common tool for several "players" involved, the concept of sharing information should be the cornerstone of it.

- Being one common system for several parties, the system nevertheless shouldn't be very "heavy". The main feature of it is that the system is a "thin" one but having deep roots - all the information that can be extracted from some other places is actually extracted, unique information been kept directly in the system. The technology of mash-ups will help to build this system. In addition to this such "thin" system will be affordable for smaller companies.
- Such "open" system will certainly require special strict rules regarding information security and data protection. These rules will act together with the hash-coding and digital signature technology in order to protect the information from unauthorized access and changing.
- The participants must understand that they are in the same process and therefore should agree on the same goal. This has much in common with the thought of not only sharing but collaboration. The latter is a notion that helps to achieve much better result than when participants are summing their deeds due to the synergy effect.
- The system is so should be a collaborative software, enjoying all the benefits of it: each participant has access to a certain actual information 24/7, he can contribute to the single system and use the information from it with not much effort.
- Yet, sharing always presupposes creating rules of what information should be shared to which party. Authorization and giving access, giving roles and rights to create, change, modify, delete information are also important.
- The above stated is not possible without considering the concept of trust. Not only the user should be trusted (this actually can be regulated by the granted access and permission withdrawal) but the user should also trust the system (and this can be reached by information visibility and keeping logs).
- Motivation of the employees to share the information should be also considered and can be increased by successful using inner and outer controls and benefits.
- The performance of the system will be measured by the specially outlined KPIs.

The supposed results of the system design and implementation will be the following:

1. The revised process of back-loading will take less time and human effort due to the fact that it will be held with the help of computers to the greatest extent possible.

2. The process will be less bureaucratized and require less papers printed as everything will be in the electronic form ready to be printed upon request.
3. The work of several participating parties will be more coordinated that will lead to fewer mistakes and reaching better result due to common goals.

Contents

1.0 Acknowledgements

I would like to express my sincere gratitude to my supervisor Nils Jacob Berland for opening new horizons for me and making me see above and ask right questions. For the two years that he has been guiding me through the captivating world of IT in Norwegian oil and gas logistics he has taught me to collaborate and see farther than it can be vividly seen. And I also wish to thank him for showing me the direction in which I have decided to move in my life.

I also want to thank my contacts in NorSea Group and VestBase - Tommy Buckholm Taknæs, Grete Helgeland and Eivind Lindal - who guided me through the process of backload in the company.

My special thanks goes to Molde University college for having given me the possibility to study in Norway for 3 months in the autumn 2011 and to see this wonderful country and meet wonderful international students.

And last but not least - I wish to thank my closest people: my dear mom who all these years stayed beside me supporting me and encouraging me, taking care of me and believing in me; and also to my group-mate Yuri Nekrashevich who - by serving the example of motivation and persistence - helped me to overcome all the difficulties and moments of despair and complete my thesis.

2.0 Introduction

The oil and gas business has always involved big expenses. This fact can be explained by the huge volumes of the products in this sphere. Taken together, the sphere is very complex in terms of the equipment, schemes, interrelations between the companies involved and general organization of the processes.

This thesis is dedicated to just one small part of the big network of interconnected processes in the logistics of oil and gas – the back-loading process. It can be described as a process in which the parts/equipment are sent back to the supplier from the oil rig. The process is very important as a large sum of money is paid for the "usage" of this or that part/equipment/etc. Besides these charges, there are other financial drawbacks that are comparable in size:

- As it is necessary to coordinate the actions of many participants in the process, the process is usually very time consuming. Every minute wasted in the oil and gas sphere is very costly.
- A lot of paperwork is usually done. Due to the above stated reason – complexity of the process – numerous documents are produced and stored by different participants year after year. Paperwork is also very time-consuming, which further drives up the cost of the process.
- The items being moved from the rig must often be stored in a special area to wait tax clearance. Apart from the money paid for the storage, the great diversity of the items requires difficult and different handling, which increases the total cost of the process.
- Many people are involved in the process. Sometimes they even perform functions that a computer can do, but old traditions are followed and the process is not changed for years. Yet, people's work costs additional money.
- The workforce for the process is often outsourced. On the one hand it removes the headache for the top management, as part of the work is the responsibility of third parties. But at the same time hiring a team of specialists is costly.

So, what can be done to make the process of back-loading less costly and more effective?

The solution that is suggested in this thesis lies in the creation of a system that will serve as a "hub" for all the minor parts of the back-load process. It will be a central repository of data that is constantly updated and is available 24/7. The system would define the work-flows, arranging them so that several tasks are done separately and simultaneously. All the participants must understand the common goals, be ready to share information, and at the same time must agree that they will have access only to the necessary and sufficient information.

If the system is launched and fulfills the functions laid upon it, the expected benefits could be the following:

- The system will help to reduce the costs related to the process of back-loading.
    - First, the faster the items are tax cleared, the less time will be required for storing them in the special area. The ideal case will be to complete the tax clearing process before the vessel arrives at the base. To give an idea of the areas involved, see the table below about the supply bases operated by NorSea Group:

Name of the base	**Location**	**Area, m2**	**Major customers**
Vestbase	Kristiansund	550 000	Norske Shell, Statoil
Helgelandbase	Sandessjøen	140 000	Statoil, BP
Tananger	Tananger	400 000	Shell, ConocoPhillips
Dusavik	Stavanger	400 000	Statoil, Total, Exxon Mobil
Stordbase	Stord	60 000	IKM, Aker Solutions
CoastCenterBase	Ågotnes	600 000	Statoil
Norbase	Harstad	40 000	-
Kirkenesbase	Kirkenes	120 000	-
Polarbase	Hammerfest	220 000	Statoil, ENI Norge

Table 1. Supply bases operated by NorSea Group. (Voskoboynikov, 2010)

    - The system will also help to reduce the number of employees: practically all work will be done by pressing several keys on a computer keyboard. The information will be filled in and retrieved automatically, and the reports and documents will be formed automatically within a few seconds. This will naturally result in reducing labor costs.
    - Reduced labor costs will be achieved also by the reduced number of items to be handled.
    - The implementation of the system will also practically eliminate all paperwork, except for the documents that must be printed for accounting reasons. This will

help to move closer to the notion of a ‘paperless office’ – a notion first given in “Newsweek” in 1975 and denoting the working environment when there is no or very little work with paper documents as everything exists in electronic form (Newsweek, 1975). The proponents of the ‘paperless office’ concept claim that it can save space, money, and time, and can make information and documentation sharing and storage more secure, to say nothing of caring for the environment.

- The new way of conducting the back-loading process will make it possible to backtrack through all steps taken and through all documents changes. A very important feature of the system should also be log keeping and the possibility to backtrack which changes were made and who, when and why made these changes.
- The solution will also help manage the cornerstone problem within the back-loading world: speed. It will be possible to carry out the process much faster than it is now.

The aims of the thesis are as follows:

- to analyze the present state of things identifying the present problems,
- to study the concepts that could be of help to solve the problems, and
- to re-engineer the work processes in the way that eliminates the problems.

The objective of the thesis is to find the new way of performing the back-loading process and to give a full description of the new approach.

3.0 Literature review

The main problem of the thesis is to make the process of back-loading in one of the Norwegian companies working in oil and gas sphere - NorSea Group - work better. The idea is to find the answer in the IT sphere. The thesis studies the concepts needed to make a corresponding computer system and possible ways to build it. It is obvious that the problem has more of an applied character due to its specificity. So, it is hard to find the examples of such a system in the world scientific literature. Still, the works of many authors gave food for thoughts about the system to be made within this thesis.

The main source of information about oil and gas sphere is of course www.olf.no - the main web page for this sector of Norwegian economy. The official information and statistics, figures and history of the sphere, documents and guidelines can be available not only for getting the general picture but for thorough study of the topic.

Chima (2007) explains the peculiarities of the supply-chain management in the oil and gas sphere. Still, he doesn't regard the traits characteristic of the Norwegian sector. Harrington (2006), Rogers and Tibben-Lembke (1998) in their works explain the notion of reverse logistics and give reasons why this part of supply-chain management is often neglected. Backload being a separate branch of reverse logistics, wasn't discussed in their works wide enough. However, Rogers and Tibben-Lembke (1998) described a general scheme of backloads and pointed out that one of the problems with the reverse logistics being neglected is absence of appropriate informational system to manage it.

To find and eliminate the problem the Theory of constraints was chosen as the initial tool. The famous Goldratt (2004) introduces five steps to take in order to cope with the constraints. The theory was applied to the backload problem at NorSea Group, too.

As for eliminating the errors in the process it was necessary to study the work-flows, to analyze them and to re-organize them, Weske (200) was useful with his criteria for analyzing the work-flows.

Two of the basic concepts of the thesis - information sharing and collaboration - were also studied by many authors. Great attention was paid by Simatupang and Sridharan (2001) to the informational sharing in supply-chain management. They revealed the importance of informational sharing in this sphere by introducing 4 benefits of sharing. Schonfeld (1998) proved the efficiency of informational sharing on Dell example. Collaboration was thoroughly studied by Gray (1989). She described the essence of collaboration, gave numerous examples and distinguished between collaboration and interaction and contracting. Grosz (1996) studied collaborative systems and gave an example from healthcare sphere. However, oil and gas

collaboration survey (2009) showed that though companies admit this to be very important, still most of their employees use old means of communication. Handfield (2002) in his article explained the notion of information visibility in the supply chain, enumerated modern ways that logistic companies use to achieve it and again remembered Dell as a good example of the company that achieved great success in its logistics due to the information sharing and information visibility.

Motivation for information sharing also causes great interest at many authors. Hendriks (1999) names main barriers for information sharing; Chidambaram and Tung (2005) consider work through Internet/Intranet an additional barrier. Andriessen (2006) gives several example of successful information sharing within Chevron and Siemens companies and how employees are motivated there. Ryan and Deci (2000) resulted their studies in 2 kinds of motivation to share - intrinsically and extrinsically motivated. Maslow (1968) with his pyramid of needs can also be cited here as one of the founder of the studies in the sphere of human motivation and behavior. Trust in the sphere of information sharing is also an important category. Seidman (2009) gives several good examples of how trust can increase trust in return and help build good and partnership relations in business.

To start developing the logic of the would-be system, it is necessary to address not only to psychological aspects of working with such a system, but of course to the technologies and IT things that will be used during the work. So, some articles about system design were looked through. For example, Pataki, Dillon and McCormack (2009) gave a good and step-by-step scheme explaining the peculiarities of any system design. Among the technologies that are necessary to be used in the system under discussion mash-up no doubt takes one of the leading places. This technology helps not to overload a system with many types of information but suggests to pick this information when it's needed from the database where such information exists. Peenikal (2009) studied mash-ups and their role in the modern technology. Checklists as a good way to organize the processes and avoid mistakes especially at the initial stages of the system's implementation were described by Gawande (2009).

Another important part of the system is security and legal issues. Olson and Abrams (1994) described different aspects of information security policy and draw the readers' attention to the moments which an organization should clarify while creating its own information security policy. Hashing and hash functions can be also used for the security reasons. Holmes (2011) explains what the hashing is and helps to understand the benefits of using it in systems. Hashing is often used also in digital signatures. Electronic signature act (2001) outlines the rules of usage of electronic signature in Norway. As regards legal issues of the system under discussion, the

official documents such as Customs Act (2007), Guide to a Value Added Tax in Norway help to keep to the law and not to violate the rules for doing business in Norway.

After studying all these articles, documents, books and publications it can be possible to apply the knowledge to settling of the problem of the thesis.

4.0 General oil and gas and the back-load problem

4.1 Peculiarities of supply chain management in oil and gas

Logistics and the supply network existing in the oil and gas sphere differ much from those in other fields. The whole supply chain in this industry concerning several processes from exploration through to the production, refining, and marketing to consumers is so complicated that it almost always requires the involvement of several companies and even several states. It can therefore be called "a global supply network". Beyond that, traditionally the oil and gas industry is known as being filled with commercial secrets. Under these conditions, information sharing becomes crucial if the companies want to have a successful business that will distinguish them from others in customers' eyes.

Oil and gas activities on the Norwegian Continental Shelf have been the driving force of Norway's economy for more than 40 years. According to official data, more than 60 per cent of Norwegian petroleum resources remain to be extracted, 25 per cent of which waiting to be discovered. When Norway began oil and gas operations over 40 years ago, it was soon decided that the assets beneath the seabed belong to the nation. As a result, about 90 per cent of all revenues from the Norwegian Continental Shelf benefit the community and every fourth krone in the government budget comes from the petroleum industry. (OLF, 2011) So, the industry's role in the Norwegian economy cannot be overestimated.

Given these circumstances, the importance of the supply bases supporting the oil platforms and rigs is obvious. There not many industries that can benefit from maximizing supply-chain efficiencies more than the oil and gas companies. (Chima, 2007) In this industry, the types of shipments made vary widely. In addition, very few industries require such an immense array of supplies to be moved in large quantities and on a daily basis onshore, offshore, domestically and globally. There is a need to ensure that each company or operator along the supply chain can respond quickly to the exact material needs of its customers, protect itself from problems with suppliers, and buffer its operations from the demand and supply uncertainty it faces.

4.2 Reverse logistics as a part of supply chain management

Reverse logistics is the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal (Harrington, 2006). This term is usually

applied to describe the process of returning goods for various reasons, including returning merchandise due to damage, seasonal inventory, restock, salvage, recalls, and excess inventory. Other reasons include recycling programs, hazardous material programs, obsolete equipment disposition, asset recovery, and remanufacturing and refurbishing activities (Rogers and Tibben-Lembke, 1998). Finally, returning equipment from oil rigs to the proprietors onshore is also an activity described by the term 'reverse logistics'.

At the moment, little attention is being paid to reverse logistics but little by little managers begin to realize how important it is and how costly when it is not properly organized. Following a survey of 300 respondents, it became known that problems companies face include the following:

Barriers to Reverse Logistics	**Barrier Percentage**
Importance of reverse logistics relative to other issues	39.2%
Company policies	35.0%
Lack of systems	34.3%
Competitive issues	33.7%
Management inattention	26.8%
Financial resources	19.0%
Personnel resources	19.0%
Legal issues	14.1%

Table 2. Barriers to reverse logistics. (Rogers and Tibben-Lembke, 1998)

These survey results demonstrate that the perceived lack of importance of reverse logistics – and likely, a lack of understanding of it – together with inadequate computer systems results in undeveloped or little-developed methods for organizing the reverse flows.

4.3 Back-loading issues as part of reverse logistics

Back-loading, as an aspect of reverse logistics, also presents a challenge for logistic managers. Usually the common scheme for back-loading can be shown like this:

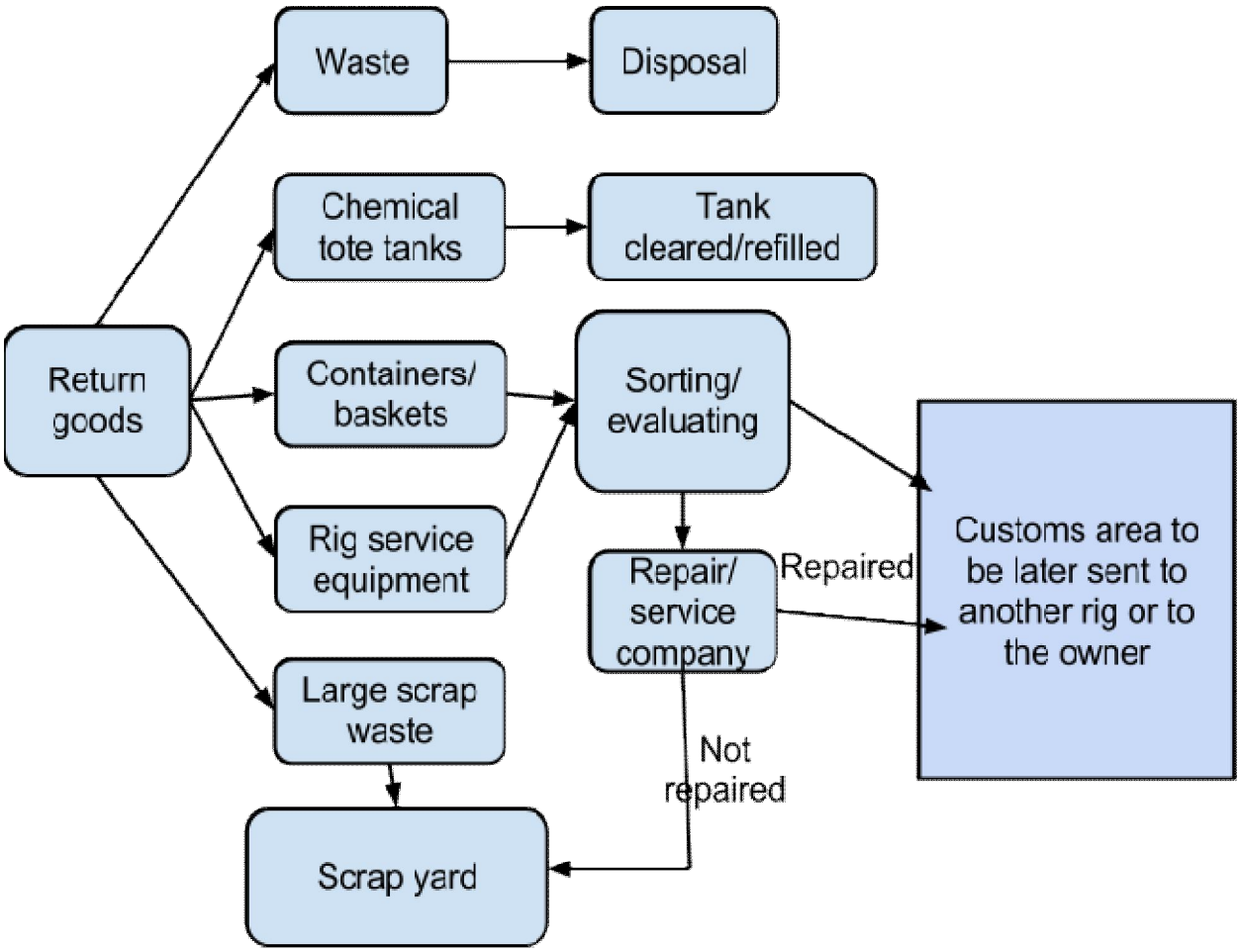


Fig.1 Typical scheme for back-loading.

The above stated problems, such as lack of understanding of the reverse logistic flows and inadequacies of the computer systems to manage the flows, are also characteristic of back-loading. The following two key management elements in reverse logistics are noted by (Rogers and Tibben-Lembke, 1998), and they seem to be applicable to back-loading as well:

- Compacting Disposition Cycle Time, and
- Reverse Logistics Information Systems.

Concerning the first element, managers point out that time is crucial in managing returns. *"Stuff isn't like fine wine. It doesn't get any better with age"* (Rogers and Tibben-Lembke, 1998). In many companies the process of returns is exception-driven, which is why decision making about returns takes quite a long time. Similarly, back-loading time is very important as the items to be returned are kept within special areas resulting in mounting charges with every day of delay.

Concerning the second element, the problem is the lack of information systems to manage the return flows. The system must be flexible because of the numerous exceptions. In the case of back-loading, exceptions arise from the different taxes and country customs laws that the company must obey in sending an item back onshore to the proprietor. The system must also be able to work across the boundaries between a company's departments and between companies themselves. This causes additional difficulties in defining the item in different systems and aligning all the documentary processes together.

4.4 NorSea Group: background of the company and back-loading process

NorSea Group is a logistic operator and a reliable and trustworthy partner that is well known in Norway. The company is a leading company in Norway on establishing supply bases along the coastline. The company owns territories, buildings and infrastructure and provides service to the onshore and offshore industries. The history of NorSea Group dates back to 1965 when the company was founded. Now it has 10 strategically-located supply and support bases that enable it with the flexibility to cover all the offshore network of Norway. *"Such an approach requires great investments but enables providing a functional control over territory and infrastructure"* (Voskoboynikov, 2010).

Among the services the company provides are supply base operations, commercial terminal and stevedore services, supply chain management, marine logistics, project and infrastructure management. Some additional services include third party ones, tubular and waste management, transport, containers and more. Conveniently, the customer can get a vast range of services under one contract (NorSea Group, 2012).

Fig.2. Supply bases of NorSea Group (http://www.norseagroup.com/)

NorSea Group is now trying to concentrate all accompanying services in their hands so that the customer could receive more service in one company, and NorSea Group could earn more and retain the customer. One of the services the company has decided to pay attention to is back-loading of the equipment returning from offshore territories. The service seems rather easy at first glance, but indeed it is very complicated due to the issues NorSea Group has faced, which are as follows:

- offshore installations have different taxes;
- parts that are no longer used on the platforms must be returned onshore and taxed properly as “onshore equipment”;
- the goal of the company is to remove the barriers that slow down the process.

For the time being the process of back-loading is divided among several organizations requiring time and effort, which in turn increases costs and decreases operations’ smoothness and speed. An additional problem is that the majority of the data is located within other sources and getting this information is not always easy. The solution that will be proposed in this project will ideally make the process easier, clearer, faster, more up-to-date and less bureaucratized. The key point will be the possibility of getting all work done with the help of a single software acting as a unique system for the data, processes and transactions.

5.0 Concepts

In what follows, we will expand and develop some concepts that will be useful for solving the problem described above.

5.1 Theory of constraints

In order to do the whole work easily and quickly, a certain methodology should be implemented. To our minds one of the most suitable methodologies is the Theory of Constraints. The theory was first introduced by Dr. Eliyahu M. Goldratt in his 1984 book titled *The Goal* and is a system of views that is designed to help organizations achieve their goals. The theory is based on the assumption that all companies must overcome a number of constraints on their way to success. The main goal of the theory is to identify the constraints and then reorganize the work of the entire organization in a way that diminishes the problem. There are "Five Focusing Steps" that help to eliminate the problem:

1. Identify the constraint (the resource or policy that prevents the organization from obtaining more of the goal)
2. Decide how to exploit the constraint (get the most capacity out of the constrained process)
3. Subordinate all other processes to above decision (align the whole system or organization to support the decision made above)
4. Elevate the constraint (make other major changes needed to break the constraint)
5. If, as a result of these steps, the constraint has moved, return to Step 1. Don't let inertia become the constraint. (Goldratt, 2004)

In regard to back-loading process, the above steps can be interpreted as follows:

1. From the interview with the contact in NorSea Group it became clear that there are several bottlenecks in the process of back-loading. Namely, too much time is wasted during the process (due to the absence of information visibility and concordance of deeds of different participants), which leads to extra charges and fees that render the procedure very costly. As such, the cornerstone of the problem is poor organization of the process in terms of data management.
2. A decision should be taken to align all the smaller tasks in the process of back-loading in a way that minimizes time and effort. The solution that is suggested in this work is to organize a system with a central repository of data which will be accessed

by users (i.e. participants of the process) in performing their functions. The system functions on the principles of information sharing, and this information is real-time (i.e. constantly updating). This will allow the participants to perform their tasks simultaneously.

3. The necessary conditions for the success of the action is that all participants understand the importance of the action, have the same goal (completing their work in less time and in a simpler fashion), and are ready to share the necessary information while at the same time agreeing to have access only to what that is necessary and sufficient for performing their functions.
4. When the system is activated, it gives the possibility for the users to retrieve the real-time information, to perform their tasks simultaneously and to finish the joint project (i.e. back-loading process) in the shortest period of time. However, as this requires great preliminary work on everything from the re-organization of workflows to system design, the implementation of such a system must be tested on only a couple supply bases so that if mistakes occur, work will not be too affected. If the system demonstrates the results we are counting on, it can be launched across all NorSea Group bases.

As things can always be improved, the possibility of further development should be presupposed. Therefore, the system should be flexible and adaptable to change in order to avoid future bottlenecks.

5.2 Work-flows

Generally speaking, work-flows can be described as a certain sequence of processes that are necessary to perform to complete in order the person, group of persons, department, company, etc fulfill their work. Sometimes it can really be a part of real work. Work-flows gather separate operations into a connected chain, combining material flows and information flows together to present a whole transparent view of the work being done. In our case the work-flow will combine all the operations needed for completing a back-load process.

5.2.1 Material flows

The movement of material stuff in the process of back-loading is not overly complex. In fact, it is simply the way the item is moved from the rig to the owner.

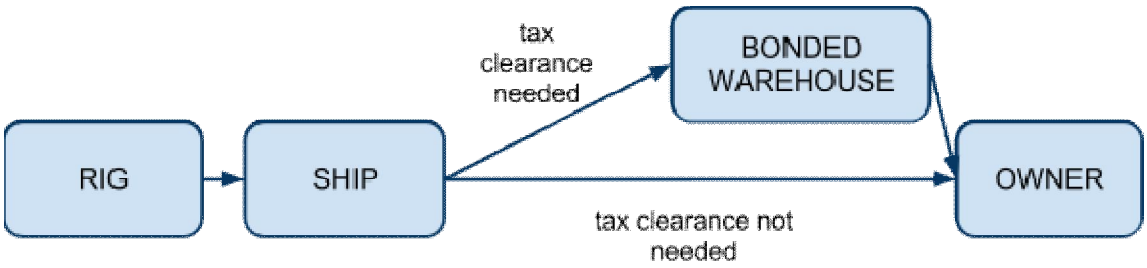


Fig.3. Material flow in back-loading process.

5.2.2 Information flows

While material flow is quite simple, information flows must be examined more attentively because they are complex. According to the picture illustrating the processes we have, the information flows are more frequently horizontal (i.e. spread between several more or less equal participants) than vertical (i.e. moving up and down the organizational hierarchy). At present they can be depicted as follows:

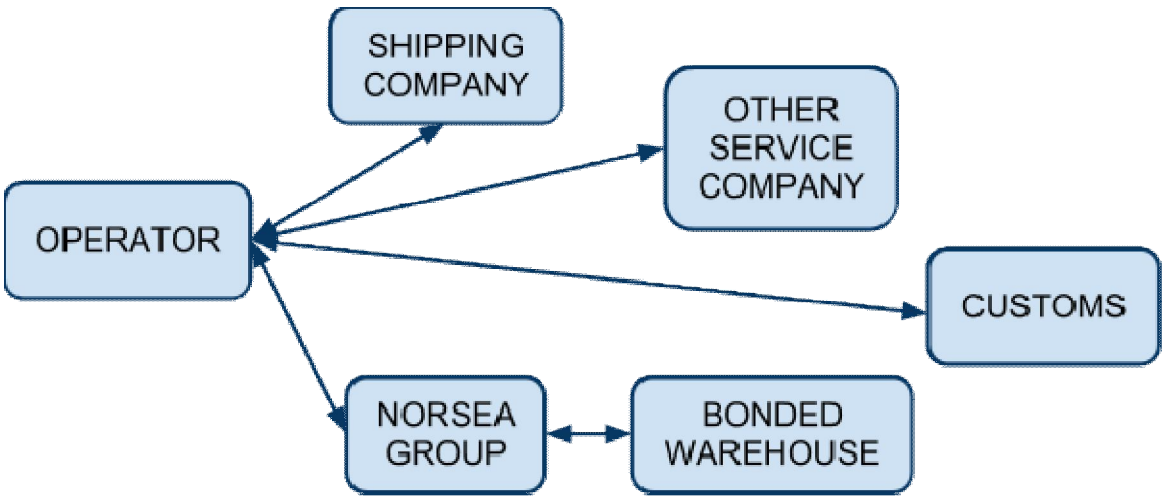


Fig.4. Informational flow in back-loading process.

5.2.3 Work-flow analysis

In order to analyze the work-flows properly and clarify the operations being done, it is necessary to touch upon some aspects of work-flows:

a Functional aspect: What is being done?

b Behavioral aspect: When and under which conditions will it be done?

c Information aspect: Which data will be used?

d Organizational aspect: Who will perform it?

e Operational aspect: Which software systems will be used to do it?

f Flexibility aspect: What kind of changes can be applied to a work-flow and when?

(Weske, 2000)

When these questions are answered, the processes are clearly seen and that is when the re-engineering can be performed if required. But to begin, it is necessary to define the current state of affairs.

5.2.4 Present work-flows in the company

At present the process of back-loading is held in the company in the following way:

- When all the goods that are to be moved from rig are on board a vessel, the stock-keeper at the rig creates a "manifest". The document contains an enumeration of all items in the shipment and their properties important for the shipment and transportation. After the vessel has left the rig, the manifest is sent to NorSea Group. When the vessel arrives at the base and is unloaded, and NorSea Group's employee checks if the arrived goods are according to the manifest. He/she checks the weight and other important parameters of the items. After everything is checked, the bonded warehouse number is generated, showing the date of the arrival of the goods. This is done according to the rules that allow to track the deadline till time when the owner of the goods must complete all the formalities with the VAT. That number also allows to send notifications to the owner to remind them about the deadline. Also, after the arrived goods have been checked, the delivery ticket is created in NorSea Group. It has its unique internal number that is generated automatically according to certain rules. The delivery ticket is sent to the owner of the goods after the information is filled in the spreadsheet in NorSea Group. After the owner company has performed all the necessary formalities with the tax, it sends the notification to NorSea Group and they mark the goods as "resolved".

The participants of the process are connected with each other as follows:

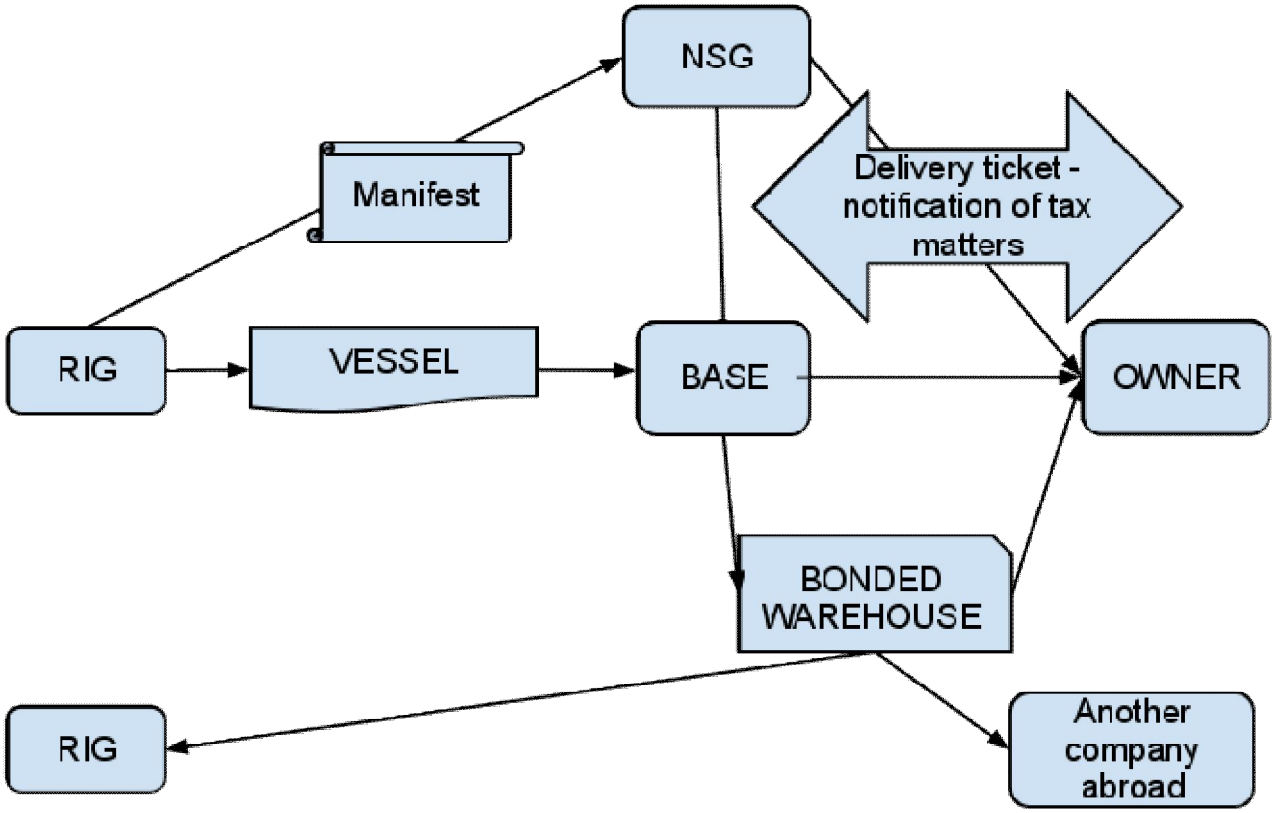


Fig.5. Present back-loading work-flows in the company.

5.2.5 Future work-flows

After the re-engineering and implementation of the single system the work-flows will certainly be changed. There will be a completely new "participant" in the process, and that is "The System". The system becomes the most important component of the process as it is not only a data reservoir, communication tool, and tool for performing the other participants' functions, but also a separate "third party" capable of doing a great number of jobs independently. Please, for the detailed picture see the attachment with the BPMN diagram of the new work-flows.

5.3 Information sharing

Information sharing is a strategy that helps the participants of the process achieve cohesion among them and acquire a better vision of the situation, and thereby achieve better results and make better decisions (Simatupang and Sridharan, 2001). In terms of the supply chain, information sharing helps to achieve mutual competitive advantage together with

increased value for the customer and reduced costs. That is why many companies realize the necessity of implementing information sharing principles in their work. For example, “Dell” can provide suppliers with access to customers’ orders. Suppliers can see what parts “Dell” needs today and which parts it will need tomorrow. Such collaboration helps them both provide a better service to their customers, as well as helps to reduce inventory on hand and lead-time terms. (Schonfeld, 1998)

It should be born in mind that data, information and knowledge are three parts of one hierarchy. Data become information when people assign meaning to them through interpretation, and information becomes knowledge when a person can immediately use it for problem solving or explanation. Some people use data to answer questions and others extract information out of data to solve their problems.

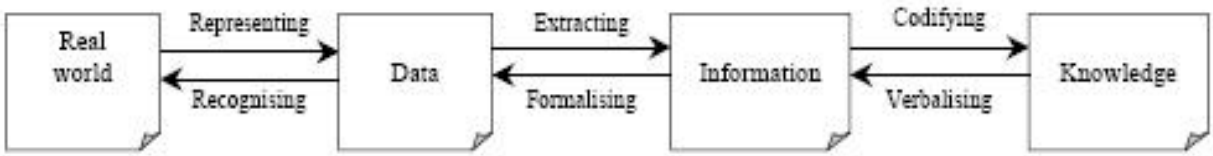


Fig.6. Interconnection od data, information, knowledge. (Simatupang and Sridharan, 2001)

An information system usually collects, processes, disseminates information and makes it available for users and decision makers. One of the major problems for information sharing is asymmetric information when different participants have different amounts of private information about the processes and states (Simatupang and Sridharan, 2001). This information can be necessary for others to make an important decision. When different participants have different positions and functions they can have different aims, strategies and roles, which is the reason that it is crucial to lead participants to more or less common goals and strategies. This helps avoid conflict about the objectives and rights, and also inappropriate behavior that can lead to ineffective allocation of the resources or overlapping activities.

The agreement to share information is a commitment to mitigate the asymmetric information among the participants by providing access to private information (Simatupang and Sridharan, 2001). The rewards will be seen in the ease of retrieving the necessary information (of an everyday nature and also information that helps make strategic decisions for future development), and facilitated documentation, transfer, and storage of information. There are four distinct benefits of information sharing:

1. Achieving contractual clarity
2. Dealing with uncertainties
3. Facilitating coordination of the participants
4. Reducing opportunism (Simatupang and Sridharan, 2001)

In addition, information sharing makes it possible to optimize resource allocation, to measure overall performance and to distribute the burdens and the benefits of the sharing among the participants (Simatupang and Sridharan, 2001).

Regarding the system under discussion, information sharing becomes the cornerstone of the whole concept. The obligatory conditions will be:

1. To set common goals, e.g. to facilitate and speed up the processes;
2. To agree on the benefits and requirements, e.g. the possibility of having access to information just after it is opened, and the necessity to share certain information;
3. To define the information needed for each participant to perform his duties.

5.4 Collaboration

Professor Barbara Gray describes collaboration as, *"a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible."* (Gray, 1989). In essence, this term describes mutually beneficial relationships between people or organizations who work together to achieve a common goal and share responsibility, resources, information and authority to this or that extent. In everyday life, collaboration can be met in well-coordinated sports teams, musical groups, etc., and even in a random grouping of people who discover things together and want to achieve the same goal. Barbara Grosz gives an example of collaboration in the healthcare sphere:

> "*A patient arrives at the hospital with three problems affecting his heart and lungs. Three specialists are needed, each providing different expertise needed for curing the patient. (...) Treating the patient will require teamwork. For example, the cardiologist and pulmonary specialist must agree on a plan of action for reducing the water in the patient's lungs. (...) Notice, however, that this is a team of equals. (...) The doctors need to come to a consensus about what to do and who's going to do it. Each of them has only some of the information needed to devise a plan for action; they will have to plan jointly.*

(...) Each doctor will be counting on the others to contribute what they know to the solution and to do their share. (Grosz, 1996)

This example describes the essence of collaboration. First, the participants must have knowledge about how to do the action; second, they must have a plan on how to complete this action; third, they must be committed to the group activity; and fourth, they must be committed to the other participants' ability to do their actions. The first two points are obvious for every activity, not only a collaborative one. The last two require a little expansion.

Commitment to the group activity presupposes that a participant of such a group must have the same goal that the group has and that he must participate in resource planning and information sharing. He should immediately inform other participants about the impossibility to perform his functions so that they help him to cope with the problem, find an alternative solution, or stop wasting resources and efforts in case the problem affects the whole system.

Concerning participants' individual roles, the participants must get together to combine their knowledge and work out a common conception of the activity or project. They must agree on who does what part to achieve the common goal; it should be noted that this delegation of tasks is usually connected with the centralization of control. This influences the flexibility of the relations in the group, and the strength and stability of the system.

It should be born in mind that collaboration is not just a summation of separate contributions. Collaboration presupposes joining of resources and efforts in the process of reaching the common goal in order to get a much better result (synergy effect).

Also, collaboration can sometimes be mixed with other notions:

- Interaction is not collaboration. For instance, cars driving within a city are interacting but not collaborating, as each is following its own itinerary and goal. Yet, cars in a convoy are collaborating as they have a common goal and are ready to help when one of the cars breaks down.
- Contracting is not collaboration. In the case of contracting, the parties just fulfill their tasks and care only about the timely payment for the job done, whereas collaboration presupposes mutual care and responsibility about the participants and giving them a helping hand if it is needed.

In spite of all the benefits that information sharing and collaboration can give it is still not so wide-spread as it could be. "*The Oil and Gas Collaboration Survey 2009, conducted by PennEnergy in partnership with the Oil & Gas Journal Research Center, surveyed industry engineers, geoscientists and business managers worldwide and found that more than 70 percent*

*believe that collaboration and knowledge-sharing are important for driving revenue, cutting costs and contributed to the health and safety of workers. However, in spite of this, most respondents stated that their organizations are still using older means of collaboration, such as face-to-face meetings, e-mails and conference calls - even though newer, more sophisticated technology tools are available and in demand today". (*Improving oil and gas collaboration, 2011) So, it is important to consider the problems that collaborative systems might face. Timely information sharing and up-to-date information are of crucial importance. A participant must notify the others that something has gone wrong, and at the same time provide as much information necessary for fulfillment of the task to the extent that this is possible. The other participants can either explore alternative solutions or stop their actions if further work within the system is not possible.

It should also be noted that collaboration is higher when groups are small rather than big, and when they are created for several projects rather than for one project. It is also important to have long-term obligations, concerns and inner beliefs.

5.4.1 What do we want to achieve with collaboration?

Collaboration provides a precious opportunity to benefit from sharing knowledge. This helps to be able to see the whole picture and to be able to model different situations and prepare for different outcomes. The companies involved also share risks, and this also very important.

In the case of a back-load handling system, collaboration will provide not only the above-mentioned results, but will also reduce the time spent on the process as the participants will always be able to learn the new information and to do their part of the common work.

5.4.2 Collaborative software

The notion of collaborative software is used when it is necessary to describe computer software designed to help people involved in a common task to reach their common goals. Usually this phenomenon is associated with co-workers who are not physically close to each other but instead work with the help of an Internet connection. Also the software includes remote access storage systems to allow distributed work group members to input, modify, store and retrieve common use data files. Actually collaborative software should presuppose the inherent collaboration feature. Basically collaborative software should allow an authorized user to get and modify documents. It is better if the document is blocked for other users when the document is being worked at. If the collaborative software is more advanced, it is allowed for several users to

work at the document at the same time (e.g. Google docs). In this case the document should have the log of what was modified and by which user.

Here are some good examples of good collaborative software:

- Facebook and LinkedIn (www.facebook.com and www.linkedin.com). These tools are presented as social networks helping people make friends (the former) and find business contacts (the latter). Both of them involve crowd sourcing – the phenomenon that is used for solving different problems by an identified group of people through the Internet.
- MindMeister (www.mindmeister.com). This resource is a great help for those who work jointly on a project but are geographically far from each other. The tool helps to structure thoughts and share them with co-workers.
- Wikipedia (www.wikipedia.com). This worldwide known database is composed of knowledge that is shared by users themselves. As such, the system is constantly self-enriching and self-updating. Of course, there is always a chance that the information added is false, but in this case honest users eliminate the wrong data and the unfair user is banned.
- Realtime board (www.realtimeboard.com). This is a nice tool for those who create projects and involves other people in working at them and contributing to the common process. The web-service allows to create everything starting from "sticky notes" with reminders to the usage of the shared Google Drive and creating real-time presentations and prototypes.

These examples show how a so-called "collaborative working environment" can be created which provides the conditions for e-people to work together, irrespective of their geographical position.

5.4.3 Philosophy of building collaborative systems

To create a system meant for collaboration it is necessary to follow certain principles in order to have a common view of the final result and also to reach this planned result successfully. The ideas for collaborative system can be as follows:

- the final goal must be stated clearly and be understood by every participant of the process;

- all the information that is to be discussed must be shared and have a common access to - there mustn't be information that is important for everybody but is not available to everybody; the same regards decision making;
- the participants must have clear understanding of the whole system: the more they understand their place in it the more they are involved in reaching result;
- it is important to create a safe working environment for every participant to be encouraged to share and collaborate;
- egalitarian approach to the input into the common task can be also considered in the process of building the system; this doesn't deny the authorities but meant that the input is evaluated basing not on the position of a person but on the value of the input itself;
- finally, the system must inspire future development, i.e. be capable of adjusting to the future needs of participants' collaborative needs.

5.5 Parallel vs sequential tasks

The main problem that has been stated by NorSea Group is that a huge amount of time is lost on processes that can actually be done within a much shorter time frame and that leads to unnecessary increase in cost. The problem lies also in the fact that the processes are done mostly sequentially rather than in parallel. The difference this can have on benefits for the company is substantial.

Sequential tasks are a series of tasks performed one after another, and only when the first task is finished can the second one begin. In our case, the example can be that only when all the necessary information about an item being back-loaded is received can the employee start filling out the shipping document. However, sequential tasking is not a necessity. It can be much more effective to use parallel tasking – where several tasks are performed simultaneously. In the case under discussion, some of the tasks can be performed simultaneously. For example, there is no need for customs to wait until the cargo comes into the port to start the tax clearing procedure if all the necessary information is already known and can be retrieved from the central repository.

Applying these two notions in the IT sphere will have a slightly different explanation. The system we are going to implement should be able to perform mostly parallel tasks, i.e. be able to process several tasks at the same time and probably on the same data massive. The necessary conditions will be the following:

- the system is able to combine all the changes of the document/data made by different users;
- if the changes contradict each other, the system can suggest the optimal solution;
- if the above stated is impossible, there is an option in which access to the document/data is given to one user at a time, while the others remain in "read-only" mode;
- the system is able to trace all the changes done to the document/data.

5.6 Information visibility

"Information visibility within the supply chain is the process of sharing critical data required to manage the flow of products, services, and information in real time between suppliers and customers". (Handfield, 2002) In the oil and gas sphere the information about "things" is generally generated within a special context - this or that project. This can be a drilling operation, maintenance at a platform, etc. For each such context special software application may be used and usually such software does not make it simple to transparently make data from one context flow to another context.

In the case of back-load it is obvious that information about the containers, owners, items inside the containers, etc. is generated in the contexts other than the back-load and so there is very little reason to re-enter all the information. Actually most information can be taken from some previous operations. As long as an operation is handled by one company using one system - e.g. SAP - it is more or less straightforward to make information from one part of the supply chain be visible in another part. The hard part is how to achieve information visibility between different companies and between different systems.

What is also very important regarding information visibility is to create rules about who can see what information - and in which context. Of course, the companies that can be competitors in a certain context should not possess the right to see the information of such a kind. At the same time, such information as inspections, damages, repair history, etc. is probably very important to make visible for all the customers.

Managing contexts and rules for information visibility is very complex. It is however important to note that even though information about containers, content of containers, shipments, items, etc. already exists "somewhere else" it is not a trivial matter to get access to that information. One of the ways to solve the problem can be mash-up applications - they will be discussed later.

5.7 Motivation for sharing information

Information sharing is an important aspect of most modern organizations. Many companies now tend to share different types of knowledge and collaborate in the information society, but still information sharing can meet some obstacles in smaller companies. Among the reasons for it is a lack of motivation to share. Indeed, such questions as, "Why should I share?", "What will I get out of it?", "How this will influence my work?" are not uncommon. Among the barriers for information sharing are the following ones:

- lack of time;
- geographical distance;
- lacking abilities;
- cognitive distance (Hendriks, 1999);

In addition, there are particular reasons for failing to share information in the case of co-workers connected by the Internet/Intranet. People can be less willing to contribute when a co-worker's contribution is not very vivid, or when people cannot see their co-workers' work in order to compare results (Chidambaram and Tung, 2005).

Companies have a tendency to encourage information sharing with the help of incentive schemes. For example, Siemens ICN has a system of "shares"; their ShareNet initiative is a global collaboration and information-sharing network for the sales departments. Any contribution to the ShareNet is evaluated and an employee rating is determined. Not only are contributors assessed, but re-users of the content too. The "shares" can be exchanged for real Siemens product (Andriessen, 2006).

Another example is the approach introduced by Chevron, who tried to build information management into the work process. Information sharing and re-usage of this information is evaluated together with other indices of annual performance, and then used for career promotions and the like. (Andriessen, 2006)

Scientists of human behavior defined the reasons that motivate employees to share information into two categories, initially:

- Extrinsic factors (rewards, payment, career promotion, gifts, access to information)
- Intrinsic factors (enhancing reputation, public praise, need to collaborate, need to experience something new).

Subsequently, Deci and Ryan (Ryan and Deci, 2000) identified the following two intermediate groups after studying the topic empirically:

- that presupposing the effect when extrinsic factors become inner controls ("I do it because I don't want to be guilty for not sharing the information like the others do")
- that presupposing the effect when the external motivators become inner beliefs ("I do it because I feel great after sharing").

Deci and Ryan have proven that often people who are intrinsically motivated show better commitment and persistence in information sharing, achieve better results and overcome more difficulties than those who are extrinsically motivated. Moreover, in the latter case people may turn to dysfunctional behavior as the reward becomes the goal and the way to it (i.e. certain behavior) becomes of no importance. (Andriessen, 2006)

So, based on the five needs of Maslow (1968), the following table can be created:

Incentives → *Need for ↓*	***Positive Outcomes / Incentives:*** *People share when the following outcomes are valuable to them and when they expect that by sharing knowledge they receive those outcomes*	***Negative Outcomes / Incentives:*** *People will NOT share when they dislike the following outcomes and when they expect that by sharing they will receive these outcomes*
Existence and Security	Positive annual appraisal and career opportunity / Job security / Career advancement / hard rewards	Bad performance (rating) because sharing takes time Loose job because knowledge becomes codified and used by others.
Relations	Become and remain member of a particular group / community / Accepted by others / Group commitment	Get criticism because direct colleagues do not want the person to share with others outside the group
Status	Acknowledgement of expertise / reputation	Fear of loosing face, because information may be bad or not relevant, or already well known by others.
Power	Gain power by showing expertise	Loose power because others use information given by the person
Achievement and Self actualization	learning and personal growth / fun and satisfaction	

Table 3. Knowledge sharing incentives related to needs. (Andriessen, 2006)

When trying to motivate employees for information sharing, they should be directed to the above-mentioned positive outcomes. Summarizing the studies conducted in motivation theory, the following additional advice can be given:

- Information sharing should be made an explicit responsibility of the employees;
- Employees should be provided with all the technologies needed for information sharing;
- Employees should be immediately trained to use the necessary technologies to share the information;
- All contributions should be evaluated and praised;
- Encouragement should be given for experimentation and overcoming difficulties;
- It should be born in mind that the contribution employees make to information sharing is the contribution to a whole business that will help each employee perform his duties more effectively in less time and with fewer resources.

5.8 Trust

If asked what is needed for successful information sharing, most people will focus on technology such as a common information system, access control, or data security. But one thing that is no less important concerns the human mentality – it is trust. *"People who don't ordinarily work together need to develop trust before they're comfortable sharing information,"* says Gerard McNulty, federal specialist for Cisco. (Fostering Trust, the Essential Human Ingredient of Information Sharing, 2007) There are many examples of successful usage of the trust concept: *"Netflix trusts its employees to take whatever vacation they feel they need. Rock band Radiohead released its last album online, trusting fans to decide how much to pay, and generated more revenue than all its previous releases."*
(Seidman, 2009)

Information sharing is no doubt important and makes people work together much more easily. But, there are risks associated with trust. In considering examples such as WikiLeaks, it is clear that in practice the theory of trust must be supported by precaution measures. There should be a clear understanding of who can be trusted, such as those whose accountability is created by giving them a right of access. In this context, the following issues can be discussed:

5.8.1 Roles and authorities

It is obvious that if there is a system there should be users. The users should be able to benefit from information sharing and collaboration by having the right to retrieve the information

they need as soon when they want it. Yet the question of privacy policy arises here. Participants may agree to share information only if they are sure that their commercial secrets (or other data not meant to be widely available) are guarded safely. It becomes very important to give the participants the right to discuss the amount and kind of information they agree to share. In this case the question, "What information is necessary and sufficient for the users to perform their functions?", can be asked. In other words, users' rights should be specified according to their functions.

The access rules can be defined according to the status of the user of the system:

1 The owner of the information
2 The user of the information
3 The administrator of the system.

The rights can dictate a status indicating the level of authority and access. For example, "owner" can input and change the information, "user" can read and edit the information that directly relates to his duties, whereas "administrator" can read, edit, manage data, integrate data into reports, see which "users" have access to what information, and can either access a separate part of the system or its entirety. It is very important to clearly define what information is necessary and sufficient for a given user, and determine accordingly what level of access he should have.

5.8.2 Permit withdrawal

The concept of trust presupposes that the user obeys certain rules, such as to fulfill all the functions, to share the necessary information, to contribute to the common goal and - to not disclose information to other people who do not need the information for fulfillment of their tasks. The punishment for not keeping to the verbal and presupposed conditions can be withdrawal of their access to information permit. Beyond that, a user who has violated the rules can be forbidden to participate in the work of the whole system. To have the ability to identify the account from which the disclosure or violation of the rules was committed, the system must have a log for every change made. Traceability serves as a hidden guarantee that that users' behavior can be trusted.

5.8.3 Openness

It is really important that users trust each other, but also that users can trust the system. The accountability of the system can be showed by the opening to the user of the way the system works. So, together with the limited access to some information the user should have a possibility to trace the related transactions and changes one by one to get the general idea. Only when he can see the structure and the work-processes he feels trusted and involved into the common work and can trust back. Of course, this possibility of openness of the system and the depth of the user's interference into it must be thought over very carefully.

5.9 System design

Systems design is actually a process when the technical solution is developed in order that a system satisfies specified requirements. It is the process of transforming theoretical user requirements into a specific practical software product. In order to create a system to fulfill the user's needs some preparatory work is required. There is a methodology to the process:

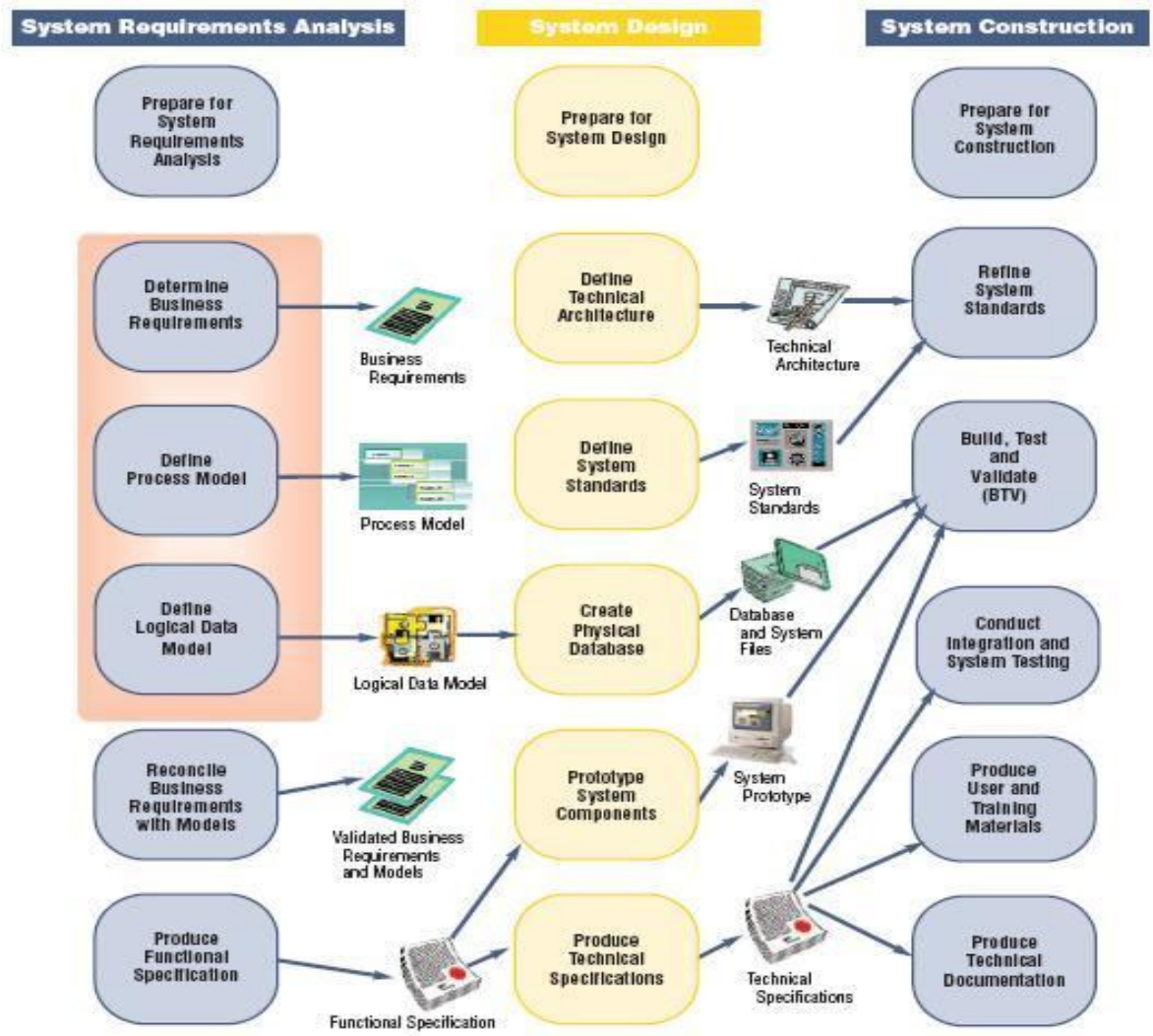


Fig.7. Methodology for creating a computer system. (Pataki, Dillon and McCormack, 2009)

As we can see, there are three main elements of system design: first it must be determined what business requirements this system will meet, then a clear picture of the processes and flows the system will manage must be developed, and last but not least, a general database must be created.

In the case of back-loading for NorSea Group, the peculiarities of the business requirements are the following:

1. The system should perform all the operations and transactions characteristic of the process.
2. It should be possible to track the movement of all the items.
3. It should be possible to provide all the information about the items whenever it is needed.
4. All the documents and reports required by the local authorities should have the possibility to be formed immediately.
5. The customs clearance held with the help of the system should be in full compliance with the requirements of the customs.
6. At any time all the transactions can be traced and justified.

The process model is actually the work-flows that the system will use. They were described in the chapter “Work-flows” (see Attachment).

Concerning the database architecture, where the system takes information from should be defined. The main idea is that the system is a “mash-up” as far as possible and stores minimum information in itself. The important fact is that the system acts as an equal participant in the process as it takes and automatically processes information, and all the changes completed during the operations are noted, as is mandatory. It should also be mentioned that the system can possibly act as an application to a bigger system performing much more functions than processing back-loading.

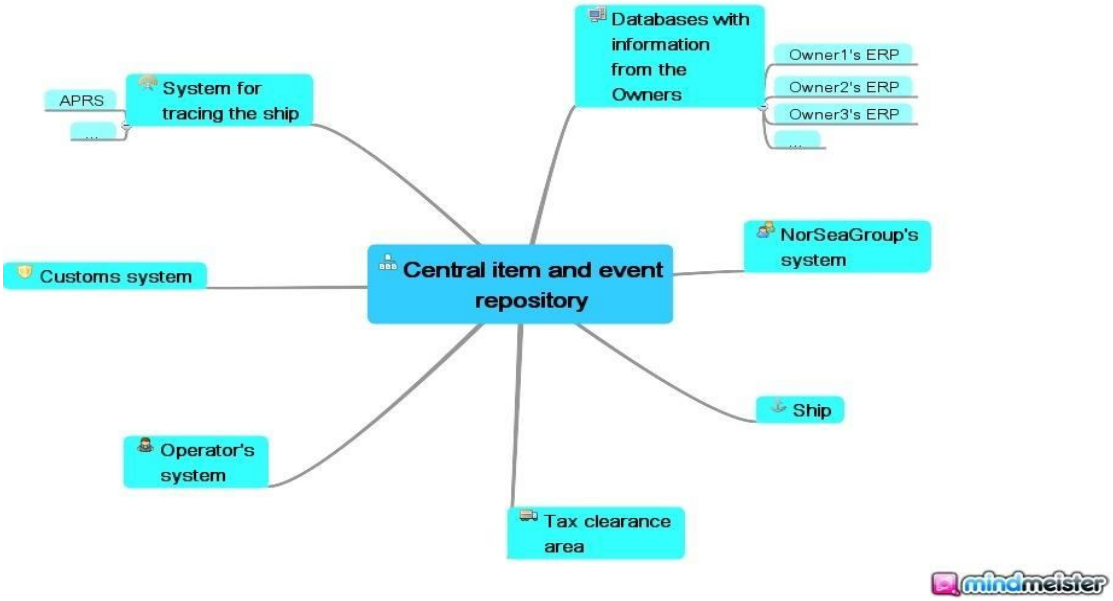


Fig.8. The system to-be as an hub for the information pulled from different other systems.

5.10 Technologies

5.10.1 Automatic Identification and Data Capture

Automatic identification and data capture are meant for automatically identifying objects and entering related data into some system without human involvement. Technologies like this include bar-codes, RFID tags, voice recognition, magnetic stripes, etc. Usually in the process of data capture, the data that are presented through pictures, sounds or videos are read with special devices (such as bar-code scanners and portable computers) and this information is later converted into digital form. The information in digital form is stored within a database as a file. It can be later analyzed by computer, and the information is given out in response to a user's query.

5.10.2 Tagging

Tags are very important if traceability of the items is one of the core elements of the business. Modern technologies like bar-codes, QR codes, and RFID tags enable the items to "tell" the user a great deal of information. As technology evolves, more and more information can be stored on such tags. For instance, bar-codes began with a limited capacity, and now RFID tags can store much more information. Technology has further evolved from the use of passive tags to the creation of active ones. Active RFID tags are an example of this technology; they

have a battery, which enables them to not only be readable to the scanner but to independently transmit information over long distances and in much harsher conditions. Active tags can also store a much larger amount of information. For the system under discussion these features of RFID tags will be extremely useful, but at present, in choosing a method of tagging while the system is developing, QR codes can seem “aurea mediocritas” - a suitable middle ground.

5.10.3 UUID

A UUID (Unified Unique Identifier) is an standard which helps for the distributed systems to identify information without been coordinated centrally. An example of a UUID can be a 16-byte number with a certain structure: as a hexadecimal string it can be represented by 32 characters generated according to the rule of 8-4-4-4-12. The theoretical number of possible UUIDs is therefore 2^128. Thus it is possible to create a UUID that, with reasonable confidence, will never be used to identify anything else. Thus, this number can be used for the identification of a transaction, a document, or an item; any of these in the back-ordering process is given a UUID registered in the common database so that they are traceable.

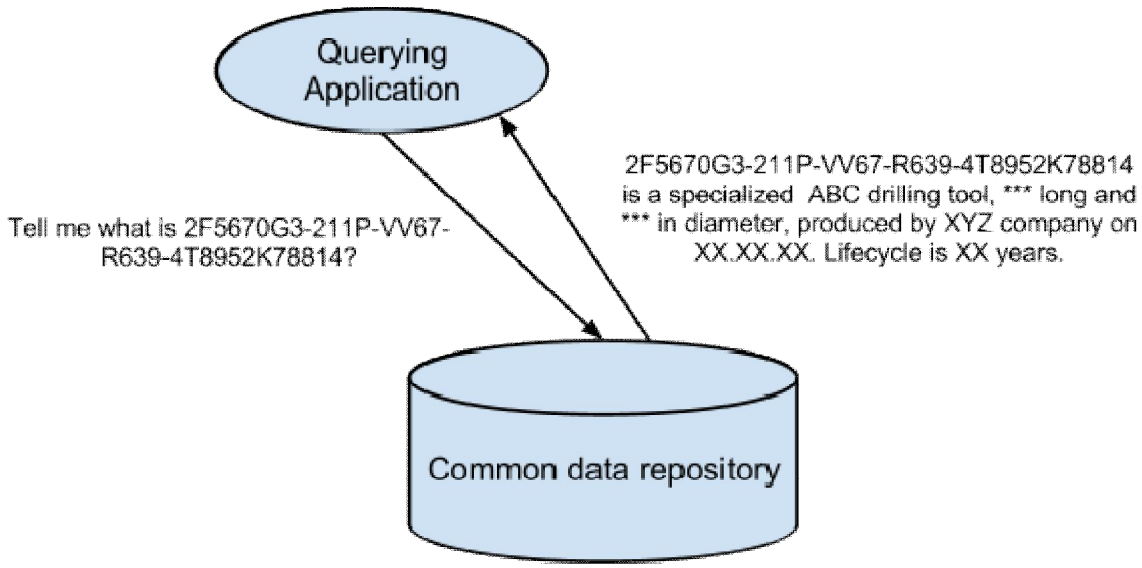


Fig. 9. Scheme of the UUID in action.

Simple examples of UUID can be unique computer MAC-addresses and even phone numbers - once you have the number you can reach the object/person.

5.11 Mash-up

A mash-up is a web application that combines different services into one application. A mash-up takes needed data from third parties and constructs new functionality for the user. Beyond that, one information source can become a new source for another mash-up service, forming a net of interdependent and integrated sources of information.

This feature has increased in popularity since the emergence of Web 2.0. One example is the following: a real estate website with an integrated Google Maps service can present a completely new service for the user, who will be able to instantly see the apartment on a map. The important thing is that the information about the location is not kept on the real estate website, it is simply taken from the other source: Google Maps.

There are three main kinds of mash-ups: consumer mash-ups, data mash-ups and business mash-ups. (Peenikal, 2009) The first one combines elements from several sources and hides them behind a simple and unified user interface. The second one combines close data from different sources, e.g. creating a report containing external data about the general state of the real estate market and internal data from an agency about the property sold during the week. The third one combines the above stated while focusing on the aggregation and presentation of the data; such mash-ups have the possibility of managing the data and using them as a business application. (Peenikal, 2009).

The concept of a mash-up is an extremely useful one when creating databases, as it helps to reduce the amount of stored information and avoid doubling information. In the discussion under discussion this feature of mash-up will be used extensively. The idea is that the central data repository can already contain all the necessary information - it is kept there after other related projects. And the system under discussion can use mash-up principle to extract this information and not to overload itself with the doubled data.

5.12 Checklists

As the system introduces a new way of handling the back-load process, it is critical to be sure that all the operations are performed just like they are meant to be to provide the proper result of the work. In his book “The Checklist manifesto: How to Get Things Right” Atul Gawande, a practicing surgeon from Boston, introduces using checklists as a successful tool to get things done in a proper way. He divides the human mistakes in doing things into 2 parts: those of ignorance (when we just do not know enough to do things properly) and those of

inaptitude (when we do not make a proper use of what we know) (A.Gawande, 2009). Through the example of introducing checklists in a surgery, A.Gawande shows that it is possible to cut the errors of inaptitude by 50% just by using checklists. The theory was actually taken from pilots who cannot avoid going through the checklists before each flight without taking into account their experience and skills. The idea is that the knowledge in our world becomes bigger and bigger and more and more complex, and to make sure we do things properly, the checklists can be developed in two opposing forms: a) the checklist that helps to ensure that routine but critical activities are done, and b) the one that helps people take responsibility and communicate when they face unpredictable events within their sphere of competence. Moreover, it is important that the checks should not be just for the sake of the idea; the concept should be accepted as a necessary part of the daily routine.

Regarding the thesis I believe that the idea of the checklist can make sense at the first steps when the system under discussion is being introduced to the users. The set of checks should be compiled of the necessary actions that are to be performed during the whole procedure of backload. This will help to convert the things that are new to the users to the daily routine. The use of the checklists after the users are successful in handling the backloads with the help of the system is discussable.

5.13 Security policy

5.13.1 Information security policy

Any organization has some sort of high-level information policy that defines how and what information will be handled in the organization. One aspect of information policy is information security policy, which is a set of laws, rules and practices regulating the processing of sensitive information and the use of the resources by the hardware and the software of an IT system (Olson and Abrams, 1994). It deals with many issues, such as disclosure, integrity, availability, access to information, controls, authorities and more.

There is no unique set of rules for working out the frameworks, therefore each organization must set the rules depending on how and what it wants to guard. Despite that, the three most common objectives for information security policy are:

- - the preservation of the information's confidentiality (prevention of an unauthorized access and disclosure);
- - availability (openness of the data to the authorized users whenever they need it);
- - integrity (data continue to be a proper presentation of information and the information continues to perform the proper operations).

Such notions as granularity of controls (single-/multi-user access and controls) and authority (rights to perform certain actions over files/data depending on the status of the user) should be also well defined in the information security policy.

The information security policy should presuppose the decision-making process concerning user access to the system. The conditions for it can be defined by:

- - user characteristics: personal attributes, "need-to-know" level, role or belonging to a certain group, etc.;
- - object characteristics: sensitivity labels, information identifiers, access control list, etc.;
- - external conditions: certain time, location, status, condition, etc.;
- - data content vs. context: access to a certain data under a specific condition.

When creating the information security policy for a complex system with gigabytes of data and dozens of participants, all these features should be carefully analyzed and stated. In so doing, the system will be able to provide all the necessary and sufficient information to authorized users within seconds while at the same time avoiding the unintended disclosure and hacker attacks.

5.13.2 Message validation

In order to prevent the messages from unauthorized changing, hashing is used. *Hashing is creation a small unique identifier for an item based on its properties or features.* (Holmes, 2011) In other words hashing is to generate a message digest (or a hash value, i.e. a hash) that is significantly smaller than the message itself. A hash is created and sends it together with the message. The receiver decrypts both the hash and the message with a special software, produces another hash and compares it to the initial one. If both hashes coincide, then the message is transmitted uncorrupted.

Four main features are typical of cryptographic hash-function:

- it is quite easy to generate a hash for every message
- it is impossible to generate a message that reproduces a certain hash
- it is impossible to change the message without changing its hash
- it is in practice impossible to find two different messages with the same hash

The latter feature is connected with the notion of hash collision - the phenomenon when two different messages have one hash value.

With the help of hashing, it is quite easy to make a certain "validation and tracking system" to render the actions transparent and approved. Verifying the authenticity of a hashed message digest is considered to be the proof that the message itself is authentic. This algorithm allows responsibility for the transactions to be shared, which is particularly useful when the party approving the transmission in actual fact has no right to see it. It is also easy to restore the way the information was transmitted, and to see who is responsible for the transaction.

Secure hashing is very often used in digital signature technology in order to ensure that an electronic document is authentic.

5.13.3 Proof of authenticity

Hashing is often used in electronic signatures. Electronic signatures offer the option of moving the majority of paperwork into the digital frame, which is why electronic signatures are important for this thesis. According to "The Electronic Signature Act of 15 June 2001 No81" that is valid for Norway, *"electronic signature means data in electronic form which are attached to other electronic data and are used to check that these data come from the person who appears as the signatory"*. (The Electronic Signatures Act, 2001).

5.14 Legal issues

5.14.1 Organization of the process

In creating the new system, legal issues are of great importance. Governments and authorities have always been a kind of a part most opposed to the innovations implementation basing on the "status quo". The more centralized is the organization of the society, the more bureaucratized it is – the harder it will be to turn the legal system to the acceptance of new rules for leading business.

Luckily the Norwegian society is quite dynamic due to the fast development of the country's economy. Norway is ranked among global leaders in information and communication technologies, resulting in faster and simpler access to information and the possibility of making life easier in Norway. *"We want the users to be met by an open, accessible and coherent public sector offering integrated and fully digital services via sound electronic self-service solutions. We also want to effectivise and free up resources through the use of ICT in order to strengthen public welfare provisions, while reducing administrative burdens."* (Report No. 17 to the Storting, 2006–2007) Both the Norwegian government and tax authorities are quite supportive of all new information and communication technologies and ideas, which would facilitate the fulfillment of this thesis' proposition. Indeed, the proposition is a quite new way of leading processes connected with supply chain management in the oil and gas sphere through the implementation of a centralized and unique software.

Still, the legal aspects regard not only the fulfillment of the process itself, but also how the process is being done and how that can be demonstrated and proven. There is a widely-used practice of allowing companies to lead their business as they please so long as it is legal, and periodically checking that all transactions, operations and documents are correct, registered and traceable. Here the concept of trust plays a very important role – the government "trusts" the companies to lead their business by themselves and without interference. The companies in turn accept "the rules of the game", and understand that it is better to conduct business legally and be required to periodically justify any business matter rather than pay huge fines when the authorities discover something legally reprehensible.

5.14.2 Customs and customs procedures

All customs procedures issues in Norway are governed by the Customs Act dated 2007. The process of back-loading is submitted because the taxation of parts being moved from the rig to the owners is calculated according to the rules of the Act, the order of procedure is stipulated by the Act, and because it is always best to follow the law. Exceptions from general rules must also meet the Act's requirements.

Concerning the legal aspects of implementing a new method of customs clearance for items, the Act states that it is possible to submit documents and approve clearance using not paper but electronic devices (Customs Act, 2007). The next step will be to implement it technologically. However, the caveat is that in the event of a significant or repeated breach, intended or unintended, the permission to use electronic forms for the back-loading process can be amended or revoked (Customs Act, 2007). That is why every transaction and piece of

information needed for clearance at customs must be verified and double-checked before making it available to customs officials.

5.14.2.1 Tax issue

Back-loading process is tightly connected to the tax issue. Usually it is VAT - Value Added Tax, *"an indirect tax on the consumption on goods and services"* (Guide to a Value Added Tax in Norway). All the issues about the VAT are regulated by the VAT Act of 1969. VAT is paid for the goods and services both coming into the country and leaving the country. In this case VAT is called input and output ones respectively.

Goods that arrive in Norway should normally be paid VAT for and the rate is usually 25%. Meanwhile the goods going offshore and being consumed there (whatever that implies) are exempt from VAT. So, for goods that are in transit from abroad and going offshore it doesn't make sense to pay VAT (especially if the goods are very expensive). For this reason companies in Norway that receive goods from abroad prefer keeping such goods at bonded warehouses - *"a secured facility supervised by customs authorities, where dutiable landed imports are stored pending their re-export, or release on assessment and payment of import duties, taxes, and other charges"*. (BusinessDictionary)

At the same time the goods that were not used offshore for any reason and are returned to Norway have to be paid VAT for. The rental equipment returning onshore also has to be paid the tax for. As the amounts of tax are really great in oil and gas sphere, it is very important to distinguish between these categories of goods (subject to tax and exempt from it) and keep track of them. All items going offshore are counted and reported with a code describing the peculiarities in taxation.

While solving the problem stated in the thesis it is necessary to bear in mind the following peculiarities of taxation issues:

- it is the owner of the goods that is to pay VAT for the goods;
- the taxation issue can be handed over to a third party company to handle the problem;
- some goods are not subject to the taxation procedure because they are returned from offshore installations as trash, samples or goods of Norwegian origin;
- since there are values for billions going offshore, the tax authorities really want to know what's happening - and for this purpose they demand that everything going offshore and back is documented and can be tracked to origin/destination/owner.

5.15 Measuring the efficiency

In order to evaluate the system's work and determine whether the solution was finally right it is necessary to develop several KPIs. KPI – or, Key Performance Indicator – is a tool for measuring the degree to which tactical and strategic goals were reached. The usage of KPIs helps to evaluate the present state of the company and fulfillment of the strategic goal. KPIs are usually connected with the goal and are derived from it. In considering a new solution for the back-loading problem, the following KPIs can be suggested:

- average cost of the back-load process of one item, per month - the solution is considered right if the cost is significantly lower;
- average time spent on the back-load process of item, per month - the solution is considered right if the time spent is significantly less;
- average number of paper documents produced during one back-load transaction, per month - the solution is considered right if the number of the documents is significantly less;
- average number of operations involving human participants, per month - the solution is considered right if the number of operations is significantly less;
- average number of persons involved for completing one back-load transaction, per month - the solution is considered right if the number is significantly less;
- average time the item spends in the tax clearance area, per month - the solution is considered right if the time spent is significantly less;
- average cost for one item placed in the tax clearance area, per month - the solution is considered right if the cost is significantly lower;
- average number of mistakes/breaches during the process of back-load, per month - the solution is considered right if the number is lower or is zero.

The KPIs given here don't have an exact measuring value as it should be decided with the NorSea Group representatives what figures will indicate that the system was a success. So, the KPIs are still a question for further discussions.

6.0 Stakeholders' analysis

Stakeholders are the parties that are involved in the project. In the case of the system described in the topic the following stakeholders can be discussed:

- NorSea Group
- Operator
- Taxation authorities
- Owners of the items
- Bonded warehouse representatives

The needs and attitude of the parties involved can be shown in the following table:

Stakeholder	Understanding of the main value of the project	Attitude	Main interests	Limitations
NorSea Group	The new system will re-organize the whole process of the backload, which will help to achieve information visibility and concurrence of the actions through the whole chain.	The initiator of the project. Strong support.	Simplifying the tax handling procedure and minimizing bureaucracy, cutting costs and avoiding delays.	The system as an API must be compatible with the main system used. The UI should be simple and understandable.
Operator	The new system will help to organize the backload process more effectively.	Interested in the project.	The items should be moved from the rig on time.	Not specified.
Tax authorities	The system will help to simplify the process of tax handling.	Interested in the project in case if the project really simplifies the process.	The information about the item to go under the taxation procedure should be delivered by the system as soon as this information is known.	The system must correspond to the legislation regarding taxation.
Owner of the item	The system will help to simplify the	Interested in the project.	The information about the item to	The system must be able to "drag"

	process of tax handling.		go under the taxation procedure should be delivered by the system as soon as this information is known. Reminder about the deadline for taxation procedure accomplishment.	the data about the item from the owner's system.
Bonded warehouse representative	The system will let to make the process more visible and predictable.	Interested in the project.	The information about the item approaching the coastline base should be delivered as soon as this information is known.	Not specified.

Table 4. Stakeholders to the project.

7.0 Requirements

During the research, we have outlined the main concepts that could best help in forming a solution to the problem under discussion. Accordingly, certain system requirements are outlined below:

- The system must be able to make -

The architecture of the system must correspond to the existing models and principles. The most difficult thing is to make the system collect all possible data from third parties, and to use this data within the system. Once these issues are settled, the rest can be done with just modern technology and know-how. The question that remains is whether they will want to create, contribute to, and use such a system. If these two problems are solved then it is possible to create the system.

- The system must be compatible with the ERP systems of the other participants -

As the system is designed in the way when the possible majority of the data are taken from elsewhere (i.e. the ERP systems of the participating users) the possibility to make all the ERP systems and the system under discussion "understand" each other is of crucial importance. The system should be designed regarding the common standard for data integration, sharing and exchange - ISO 15926. No doubt that the Standard must be taken into account at the stage of implementation as well.

- The participants must agree upon the common goal -

The main goal of the system being created is the one of making the whole process easier and faster. Regarding ease, the system will help avoid a global storage of data in one place and the necessity of coping with different item codes, as the data will be collected through the mash-ups. In addition, there will also be no need to compile huge volumes of documentation as any information required for the different reports will be turned into a report within a few seconds. Regarding speed, the system will provide the necessary and up-to-date information at the moment it is needed. Based on the concepts of information sharing and collaboration, this will help participants realize that only when the common reservoir of data and information is created is it possible to speed up the work by not wasting time on the communication.

- The participants must understand and agree upon the benefits -

The participants of the process are different and it is natural that the benefits they receive from using the system will differ. Meanwhile, the system's universality helps each participant outline his own benefits. For the operator and NorSea Group, the benefits are the cutting of costs by increasing the speed of the process and avoiding holding and handling costs. In addition for NorSea Group only is the simplicity of conducting the process in general. For the rig, the benefit is the timely removal of the unneeded item from the rig. For the customs and tax authorities, the benefits are no longer filling out all forms by hand, and being able to apply the stable up-to-date information to their other working duties. All participants benefit from the ability to retrieve the actual and necessary information whenever they want.

- There must be equality among the participants -

Equality is very important for organizing such a system. To have the motivation to share the information and to trust the other partners, a participant must be sure that he is treated equally to the others. The concept of trust allows the participants to be free from the constant evaluation of their contribution to the common work and comparison to what the others do. Yet, there will be inequality in regards to levels of information access, but that is an inalienable part of the system architecture and it does not infringe upon the rights of participants.

- The system must support heterogeneous systems/formats -

Of course, different organizations participating in the process have different ERP systems. The problem arises in the necessity of aligning the data regarding the items, documents and reports. The system should use a mash-up concept to retrieve data from the other sources and give both the items and the transactions certain internal ID numbers. It must also be designed to provide all the necessary formats of the documents and the reports that are characteristic of each organization participant.

- The system must be legal -

An important consideration is the close connection between the process of back-loading and the country's taxation and customs system. Given that authorities have always been the least flexible in terms of innovation, the system must be designed in strict correspondence with the requirements set by the government and the involved authorities. The system must also presuppose the possibility of storing/immediately printing the needed reports and templates to prove that the entire process corresponds to the local legal requirements.

- The system must be flexible -

The world of oil and gas, and particularly its logistic part, is constantly changing and so does the IT sphere and technology. The system must be adaptable to these changing conditions and circumstances. It must be easy to develop add-ons and applications to the system to improve and adapt the existing system to new requirements and priorities. Provided that the description of the problem is properly given, it should be quite easy to develop and adjust the new functions/applications.

- The system must be secure -

The system under discussion is vulnerable to intended/unintended disclosures and violations of the access rules. This happens because of the open format of the system, its global character, large number of users and the value of the data contained in the system. As such, providing a secure system is a must. With the help of data protection tools (encryption, masking, etc.) together with the tools that are used for verifying the authorized persons (digital signatures, hash-tables, encrypted links, etc.) it is possible to protect the system, the data, and consequently the users and their private information.

- The system must encourage collaboration -

Collaboration is not just the sum of the efforts to reach the personal goals of the participants. The concept of collaboration presupposes the realization that the work the participants are doing and the goal they have is a common one, and that the contribution they make will always benefit them. So, the participants must be internally motivated and sure that with the development of the collaboration, the results of the common job will improve. The participants must feel free and equal and this will inspire them for further collaboration.

- It must be possible to implement the system even in small companies -

The present situation in the oil and gas sphere shows a very interesting tendency called “a long tail principle”. The phenomenon is observed when small companies start to get “a piece of the pie” from the big companies. The phenomenon is encouraged by the growing popularity of outsourcing and crowd-sourcing. That is why the system under discussion must be affordable even for companies that do not have a large volume of data to share. And if it is assumed that the system will use mash-ups in order to not be too “heavy” and expensive, even companies that are not big can implement it in their work.

- There must be no or very little data replication -

The basic principle of the system in regards of the data storage can be described as follows: “If the data are available somewhere else, pull them into the system when needed”. By adhering to a mash-up design - the system will store only the data that is unique to this application. The system must be able to first, receive a request from the user; second, define what is needed; third, if the data are available for retrieval from some other system (i.e. the information about the relevant companies, the items, the location of the ships, etc.) then proceed by retrieving them; and fourth, if the data are unique and stored exclusively within the system database itself, proceed by accessing that storage.

- All the transactions must be traceable -

It must be possible to follow all the transactions from start to finish having a complete picture of what was done, when, why and by whom. This can be done with the help of the logs of each and every event in the system. The log must contain the information about the following: the date of the change; the location; the character of the change; what was changed; by whom the change was made; why it was made (explanation/commentary); the importance of the change; the link to other information that could have changed; and other information that will be considered as vital for tracing the events. In addition to this there should be a possibility to send the hash of the log to some external part to ensure that no one is doctoring the system.

These requirements can be a good guide for the technical specialists who will design and develop the system. Requirements can be added in accordance with the wishes of a given participant in the process.

8.0 The System

The system can be described as an application that utilize data residing in other systems. to a bigger one which can be used by the participants of not only the back-load process but of different broader projects. Of course, each participant of the system (e.g. the rig, owner of the item, NorSea Group, operator, tax clearing area, and potentially more) has the login/password pair given to him by the administrator of the system. The data about the participants, the items, the documents and transactions, as well as the history of the previous projects, is kept within the common data repository and can be accessed by the participants to the extent that is defined by their roles.

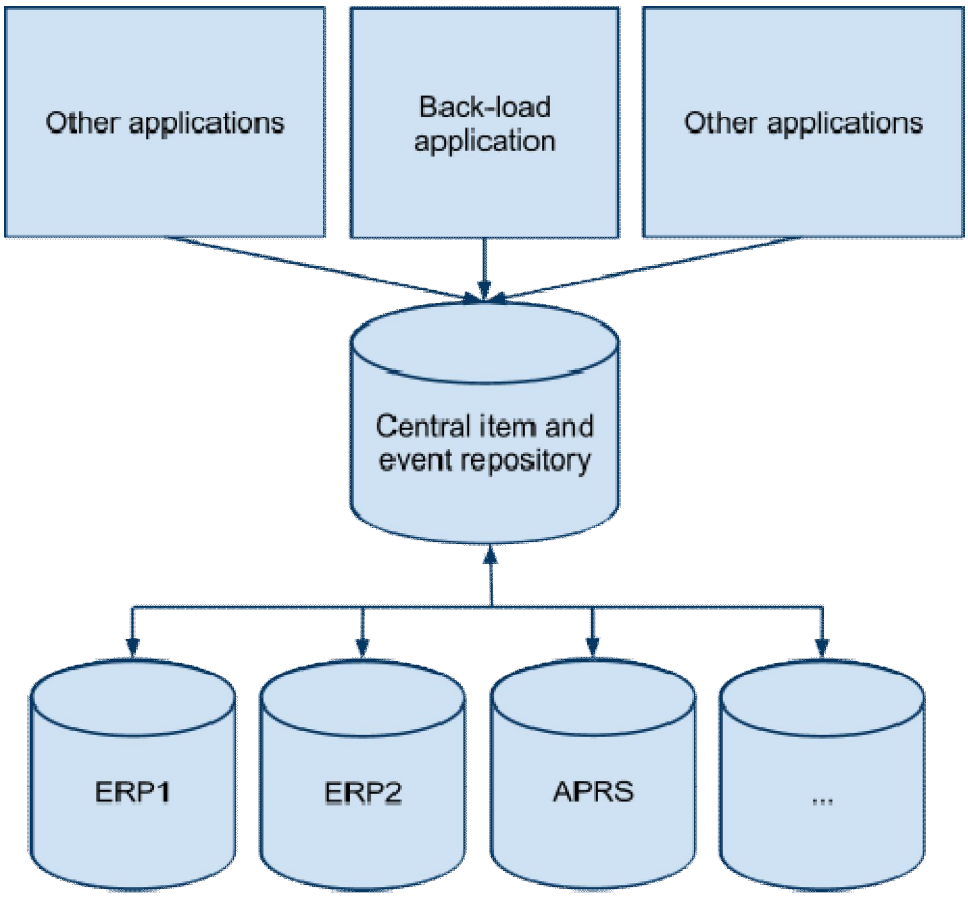


Fig.10. General architecture if the system.

Note1: The above stated can help to avoid the problem of standardization of the items, as each item has lots of different numbers in the different ERP systems of the participants. When the item is first entered into the common database, it is given a unique, randomly generated UUID number. In the future the idea of mash-up applications used for extracting the data right from the data-bases of the owners can be discussed.

8.1 General description of the process itself

1. The store-keeper on behalf of the operator as the owner of the process creates a cargo meeting in the system. The cargo meeting is the “event” which can be seen for all the parties involved (the notification about a new cargo meeting together with the link to it is sent automatically). A list of items at the rig is displayed, which the store-keeper uses to select the items to be placed on the "to be shipped" list (by either 'dragging-and-dropping' or 'ticking' the items). When the list is completed the store-keeper presses the “CONFIRM” button. This moment should be marked in the system for the ability to back-track if anything is done wrong. The digital signature of the employee is recorded.

The report that is formed in the system internally as the result of this process must contain the following information:

- the internal UUID number of the project
- the date of creation
- the list of (possibly UUIDs of) items contained (with links to the accounts of the suppliers involved)

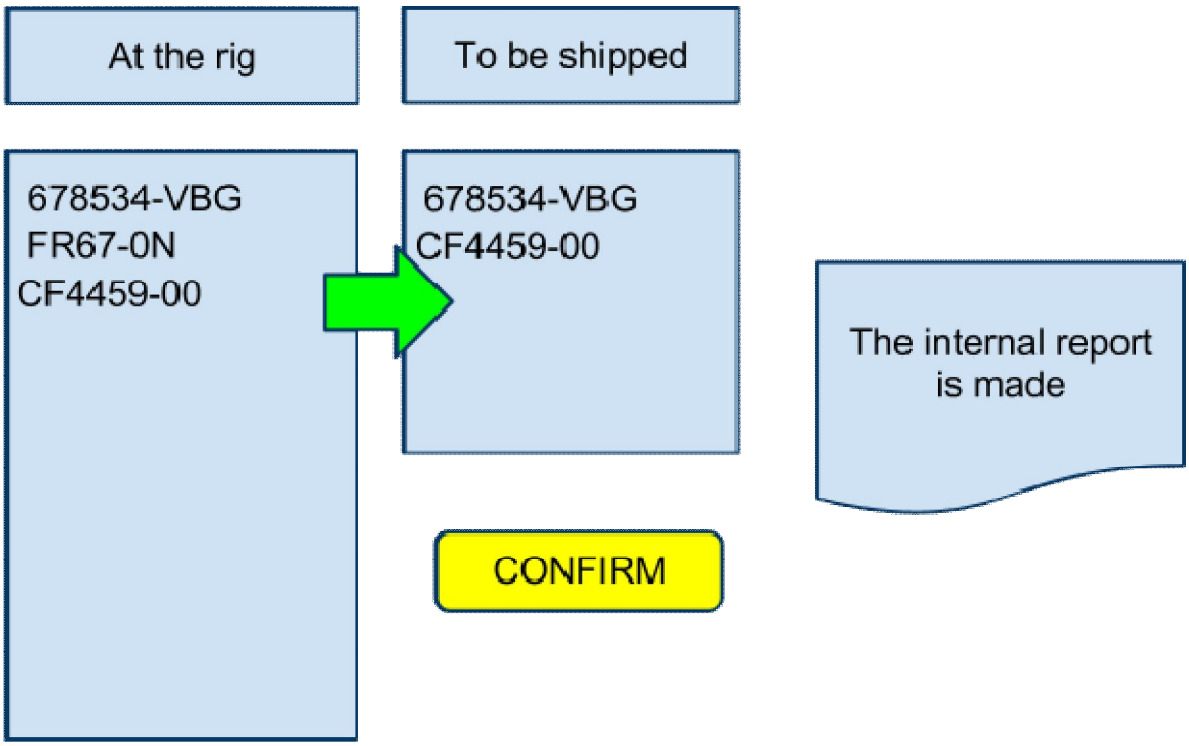


Fig.11. Items are picked up to be shipped.

Note2: It should be born in mind that the process of the loading (and consequently - the cargo meeting) can be really long.

Note3: The important thing is that the actual loading of the vessel can be done simultaneously with the cargo meeting (so, the people responsible for the loading can be among those who are allowed to participate or at least to see the cargo meeting).

2. When the process is finished, each item in the “to be sipped” list is marked in the system with the same “to be shipped” status. By the way, updating statuses can enable the participants to be always informed about where the items are. The changed status is seen to all the parties in charge: the owner (to be prepared for the procedure of taxation), NorSea Group (to see the items and their taxation properties), the bonded warehouse (to prepare the room for keeping the arriving items if the storage is needed). There can be some reason in sending the notification also to the tax authorities to have time before the arriving and to look through the taxation procedure and codes, but that is discussable.

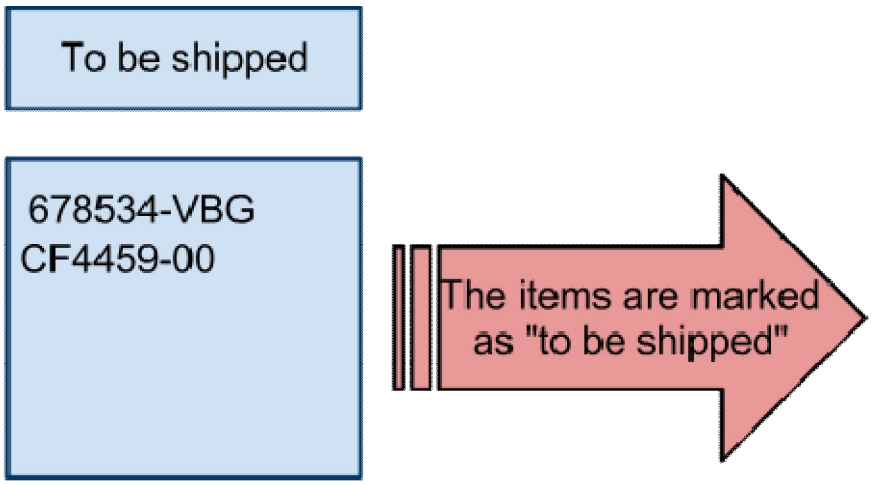


Fig.12. The status of the items is changed.

Note4: The roles and corresponding access rules of the participants of the project are defined according to certain principles (e.g. NorSea Group, rig, etc. are obligatory participants, customs/taxation authorities is defined depending on the home port or port of destination, etc.). With this feature, participants are not overloaded with unnecessary and confidential information but rather see only what is relevant to them.

3. The operator searches and finds the nearest and the most suitable vessel. After he does this, he enters the data about the vessel into the system, the system retrieves the specific and missing data about the vessel from AIS and a new form “Next vessel” can be automatically filled in. At the same time the vessel is actually loaded with the items from the list.

Note5: The important thing is that after the details about the vessel are entered into the system the item to travel with this vessel are “tied” to it. The allocation of the smaller items to “the mother” - bigger items (like Russian dolls) helps to create a logical “tree”. It makes it unnecessary to track each and every item but makes it enough to track only the top item and give its “children” the same location. Besides, as the ID of the vessel is known it is usually possible to track the location of the vessel with the help of sites using any AIS of vessels and satellite data about their itineraries. A nice mash-up of this is to combine “the system” with Google maps and AIS information from http://www.kystverket.no. So, any person authorized by the system can see the details about every particular delivery.

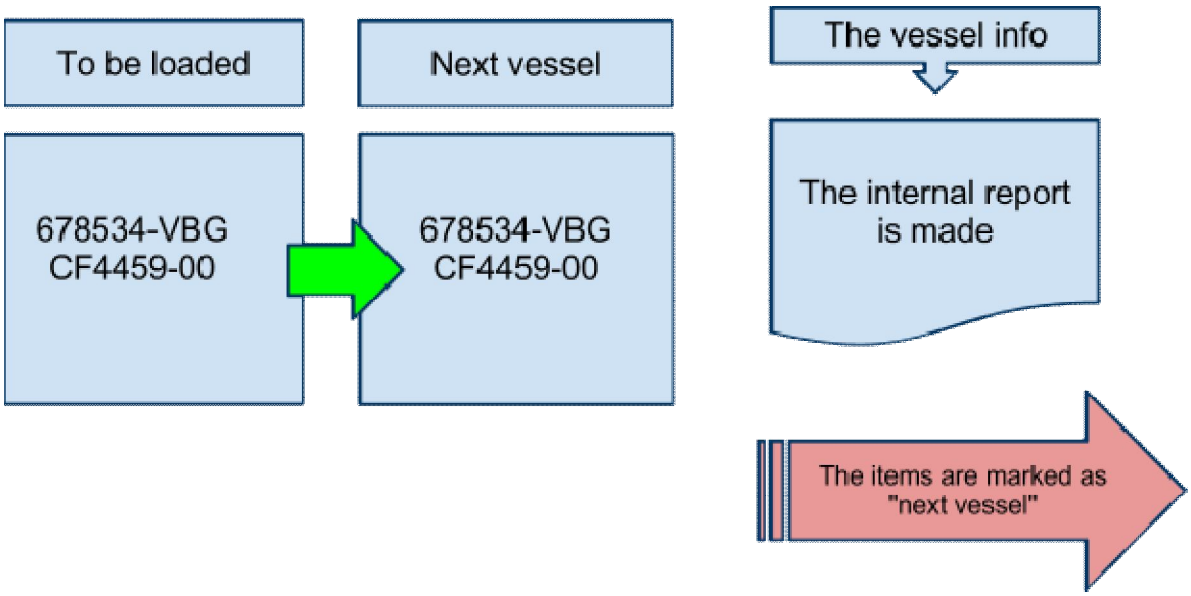


Fig.13. Status of the items is changed after the vessel to carry them is found.

The information that is added into the previous report as the result of this process must be the following:

- the internal number of the vessel
- the unique number of the vessel in the automatized system for tracking its itinerary online
- the time of its departure

- the port of destination
- the approximate time of arrival

4. When the vessel is actually loaded, the owner of the process (usually the store-keeper at the rig) issues the manifest. This document is of crucial importance. The manifest is made in an electronic form with the possibility to save as PDF and print out. It contains all the necessary information about the items loaded on board a vessel, together with the unique codes of the items (the EPC, to be associated in the electronic database), the short description of the items (the broader one can be found in the common database or achieved in the proprietors' databases through the mash up applications) including their weight, the name of the proprietor of the items and the information about the character of taxation regarding these items. Just after the manifest is created, the notification about it with the link to it in the system is automatically sent to all the participants of the cargo meeting. The manifest has the status of "Open".

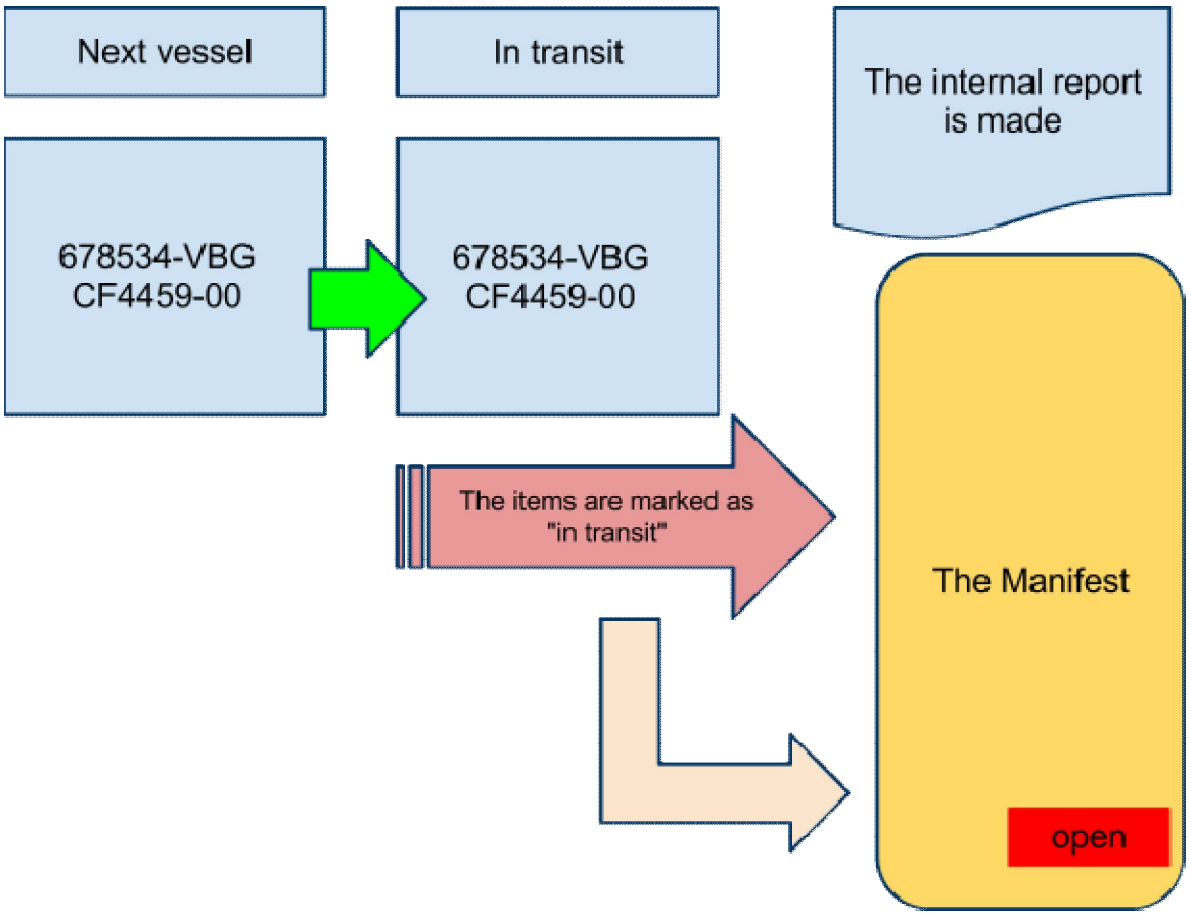


Fig. 14. The status of the items is changed into "in transit". Manifest is created.

5. The items are put into containers to go on board a vessel. While being loaded each container is given a QR-code. The information that is in this code is the unique ID - the link that leads to the page describing it and its contents in the bigger data repository.

Note6: QR-codes can be later replaced by RFID-codes - they give more possibilities regarding the amount of the data to place in the RFID-tags and they are safer regarding surrounding conditions.

6. After the items are marked with “In transit” it can be possible for the system to check what items go without special taxation and which need special tax handling. The items are differentiated by groups according to the need to pay the tax on the basis of the special codes given to them. The report based on this information is formed independently and pops up as the involved parties look through the list of items in transit. The involved parties can be NorSea Group who handles the process of back-load, the owner of the item who has to pay the tax within a defined term, the bonded warehouse who is to be aware of how many items they are going to receive after the vessel comes to the base, and possibly - the tax authorities (the customs) but this is discussable.

Note7: two great possibilities emerge:
1) The involved parties are able to start preparation for the clearing procedures while the vessel is on its way to the port. This means that several tasks are being done simultaneously which saves effort, time and money.

2) The participants can view the status of the items in real time and that helps to plan their actions accordingly. And that again helps avoid wasting time and as a result, saves time and money!

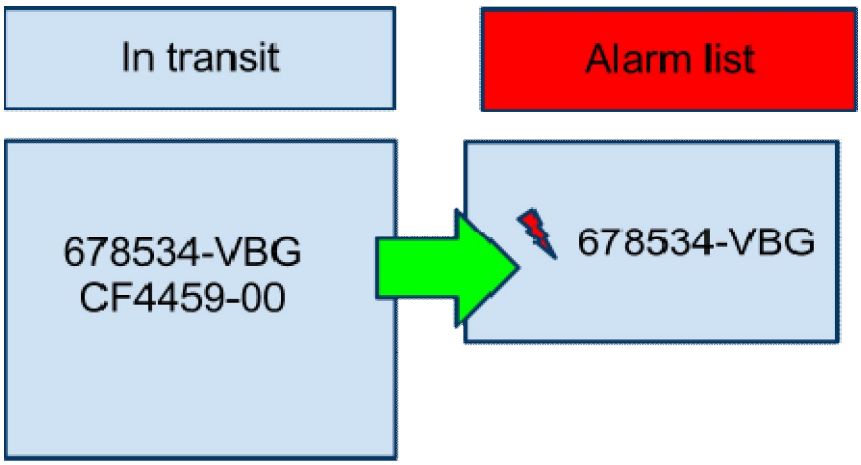


Fig.15. Items that require special tax handling are detected.

7. When the containers are unloaded at the base, the QR-code on each of them is read with the special readers and the information is instantly transmitted to the system. The items that are marked with “in transit” are changing their status for “arrived”.

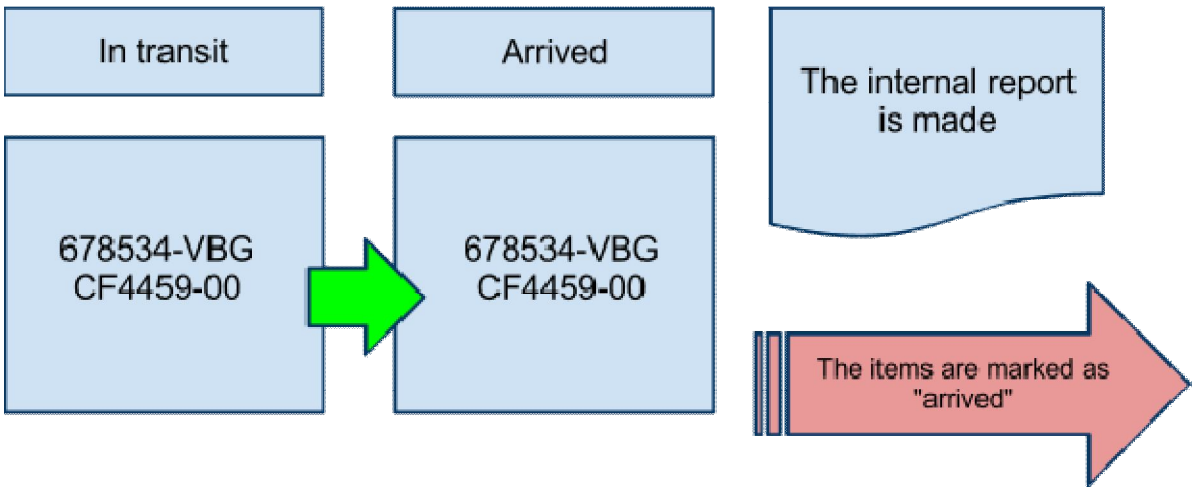


Fig.16. The status of the items is changed to arrived.

8. After the items are unloaded and each item is checked regarding its weight, NorSea Group enters the received data into the system, the status of the items that need to be tax cleared is changed for “waiting for the tax clearance” and the document called the Delivery note is automatically issued. The manifest is automatically marked as “closed”. The system makes the delivery notes by splitting the manifest according to the owners of the items. The link to the delivery note in the system is sent to the owners and this moment is marked in the system as the beginning of the “countdown” of the term (usually - 10 days) needed for the tax procedures. The delivery note can be also printed out for the taxation authorities (if needed) to be kept in case

they are to check the operations. It can also be that the delivery note is sent to the authorities in electronic format just after everything was checked and confirmed by NorSea Group.

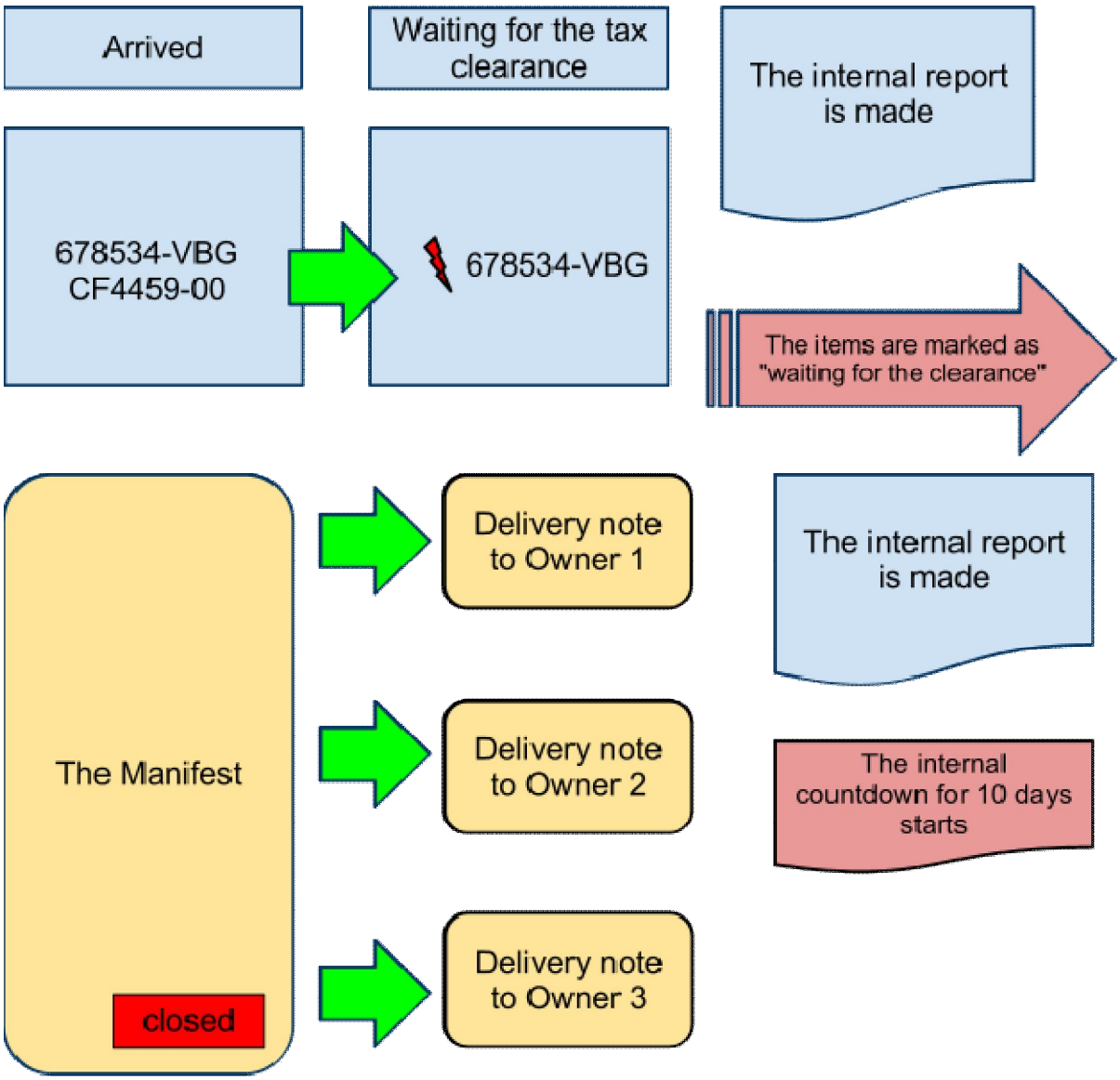
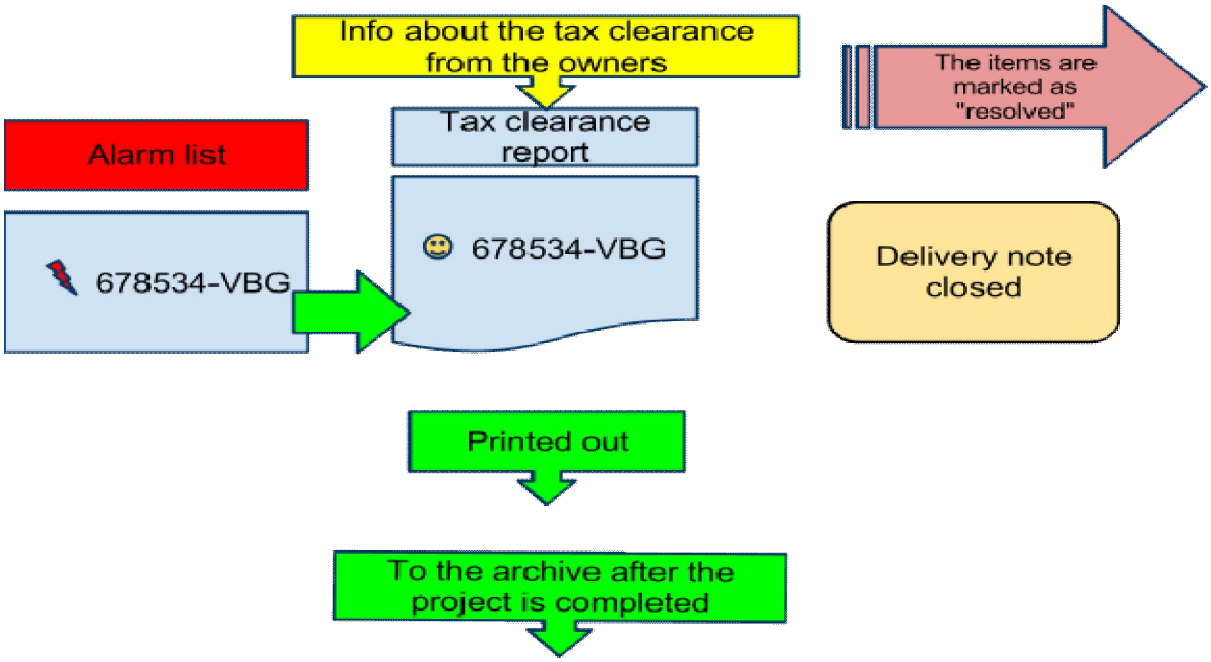


Fig.17. The manifest is closed and the delivery notes are crated and sent. The info is available 24/7.

Note8: The status “closed” of the manifest means only that the items in it arrived successfully. After being “closed” the manifest can be “reopened” by an authorized user if something went wrong. The manifest gets the final status “completed” after all the items are tax cleared and went to their next destinations.

9. The companies-owners of the items that are to be tax cleared do all the formalities and pay the tax. Usually they must do this within 10 days. After the things with taxation are

completed, the notification about it is sent to NorSea Group. The status of the item is changed for "resolved", the delivery note is closed and filed, the final report is kept in the archive for the taxation authorities. This moment should be marked in the System for the possibility of back-tracking.



Fig, 17. As the taxes are cleared, final report created.

10. Once the items are cleared the Manifest is marked as "completed". All the documents and forms connected with it are sorted by type and sent to the corresponding archive.

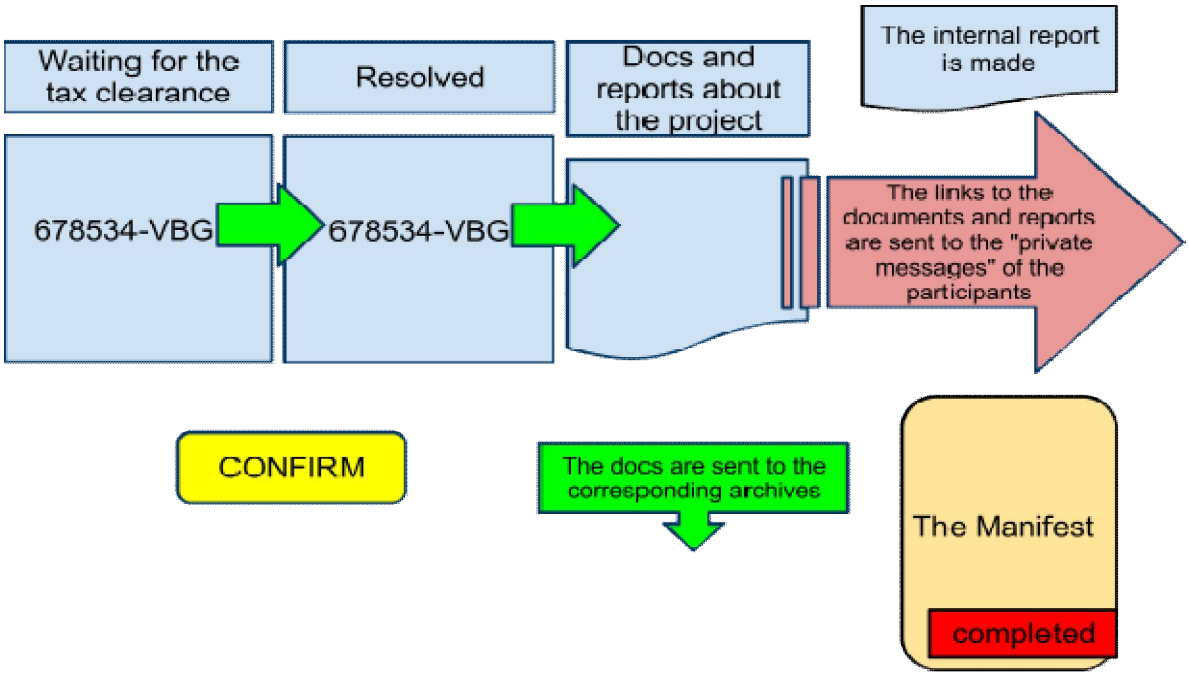


Fig.18. The Manifest is completed, the items are free, the documents are put to archive.

8.2 Expected benefits

The expected benefits of the new approach to the process cannot be overestimated:

1. Due to the fact that almost all the working processes are transferred to the online virtual system, the time spent on the routine and manual issuing and conveyance of the documents is significantly decreased.
2. For the same reason, the bureaucratic component of the work-flows is also diminished and this makes the whole process less complicated from the point of view of the number of actions and papers per person.
3. The central repository of the data and the relative transparency of the system make the retrieval of the necessary information possible at any moment the user wishes. This helps the participants to always be in touch with the current situation and react immediately to every change.
4. As a result of the last point, mistakes due to late response, inattentive behavior, or human factors are very rare.
5. The combination of the above-stated reasons is greatly beneficial in regards to the average time spent on each transaction/process. It is not difficult to calculate how much money companies save while saving the working time of their employees.
6. Thanks to the system the customs taxation issue is made simpler and more controllable. The terms and deadlines are better observed as it's not people but the system that keeps control of this.
7. Rare mistakes in the organization of the process contribute to money-saving and the maintenance of a good reputation for participants.
8. Finally, the combination of shorter terms of the back-loading process and the implementation of cheaper solutions allow the companies to perform better, and therefore achieve a competitive advantage.

9.0 Conclusions

The process of back-load in oil and gas logistics is apparently a very complicated one, mainly because of the complicated tax handling procedures. At present, back-load involves lots of items which cost can vary greatly, many participants who certainly have different aims, taxation rules that are different from item to item depending on the situation it is returned onshore and finally - piles of documents that are describing what processes are going on with the items and who is participating in them. In the thesis work an idea to simplify the process and make it less costly and more structured was suggested as one of the possible solutions to the problem. The system that is described in the thesis combines several techniques to make it possible.

- The system under discussion is based on the principles of collaboration and information sharing; this will make information visible to as many participants as it is needed and all the participants will always have this information updated and available.
- The complicated taxation problem is to be simplified through the indices of the character of the tax that are to be attached to each item in the system and timely update of the information about the movements of the items in the system.
- The "check-list" of the back-load process will show the ideal flow and besides the logs of activities performed within the system will help to see if the process corresponds to the way it should be.
- Due to the "application character" of the system it can be possible to be used by smaller companies and fewer number of employees and do not require much money to serve the expensive software.
- Due to "mash-up" character of the system it can be "thin system with deep roots": it takes the necessary information from a bigger data reservoir and by this avoids data duplication and overloading with gigabytes of information.

The thesis work actually describes the idea about how the problems that NorSea Group are facing now can be solved. It also gives the tools which help to turn the idea into reality, describes the key moments that have to be paid attention to and warns about the main problems the idea turning into reality can face. And the most interesting fact about the idea is that NorSea Group are now thinking over the possibility to implement this very solution. That means that the

work done in this thesis will have practical application and move a certain part of the oil and gas logistics a bit closer to perfection.

10.0 Further work

- “The system” is a small part of a larger system implementing some kind of “integrated operations”. In other words, if there is a bigger system managing important parts of logistics, the system under discussion can be integrated into it and function perfectly.
- The difficult thing is “semantic interoperability” - the ability of computers to transfer information so that this information is successfully interpreted by the computer that gets this information right in the sense that the transmitting computer intended. It is also very important to take into consideration the broader sense of the notion: the **sender** must be able to transfer all the necessary and sufficient information while the **receiver** must be able to understand and properly interpret the received message; both must agree upon the behavior when they communicate like this - the part that touches upon not only the technical issue of collaboration but also the aspects of information transferred (“necessary and sufficient”) and the human interaction.
- Another idea close to it is the problem of mash-ups. At the moment they are just a small application software that relies mostly on the data that are taken from other sources. But the task here is to get the data correctly, to establish transferring and representing the data in the unique and standard way and by this manner to make to easy and quick connections between different data storage systems. The increase of the efficiency of such connections in the integrated operation can be an issue for further work.
- A hard issue is also to make such a system work in other countries (differences in the mentality). Further work here lies in the careful study of different local rules (general related legislation, customs laws, taxation, etc.) and search of the ways to collaborate. The question of additional motivation is also to be studied with an individual approach to each country’s mentality.

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