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MASTER THESIS

Offshore upstream logistics in the Arctic:
Combining performance and risk management
in a Balanced Scorecard

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EN310E



SAMMENDRAG

I dag er olje og gass utvikling i Arktis en realitet. Litteraturen viser at det er utallige vanskeligheter og trusler ved olje og gass- aktivitet i det gitte området. Logistikken er i senter av disse aktivitetene og behøver særlig oppmerksomhet grunnet at det er av avgjørende viktighet.

I denne konteksten er ytelses måling og relaterte risikoer spesielt interessante da det er veldig knyttet opp til praktisk utførelse. Balansert målekort oppfunnet av R.S. Kaplan og D.P. Norton gir det beste verktøyet for å måle ytelse. Balansert målekort gir den fordelene ved å gi brukerne et balansert syn som understreker betydningen av innovasjon og interne prosesser. I dag har balansert målekort blitt implementert med risikoen relatert til oppnåelsen av strategiske mål. Få applikasjoner har blitt gjennomført innen industrien men det gjenstår å se om denne modellen kan bli benyttet offshore oppstrøms logistikk og hva som er dens fordeler.

Målet med denne masteroppgaven er å bygge et felles forbedret balansert målekort som sikrer ytelse måling og kontroll av risiko som igjen kan bli delt av alle aktørene i tilknyttet til oppstrøms offshore logistikk verdikjeden. Til dette formålet har jeg benyttet kvalitativ tilnærming som bringer sammen maksimalt antall aktører som berøres av dette problemet. Hovedfunnene er at vi kan lage et balansert målekort som kan benyttet og delt av alle aktører. For hvert strategisk mål kunne jeg kombinere prestasjonsmåling og risikoleidelse. Avslutningsvis kunne jeg lage et felles forbedret balansert målekort.

Hovedkonklusjonen av studien min er at kombinasjonen av prestasjonsmåling og risikostyring er viktig for å være ytende, og at et felles balanser målekort fører aktører til å dele strategiske mål mellom dem. Dermed kan byggingen av et forbedret balansert målekort forbedre ytelsen til alle involverte aktører i offshore oppstrøms logistikk.

PREFACE

This master's thesis marks the end of five years in business school. I started in Marseille under the sun of south of France and finished in Bodø under the northern lights and the midnight sun.

I have chosen performance measurement and risk management as the topic of my master's thesis because I consider that the combination of both bring a new dynamic where the two concepts benefit. Indeed, the association of risk management to performance measurement implies much greater effects such as a better precision and a better safety of the strategic approach.

I carry out my research within the framework of logistics in the offshore upstream in the Arctic. Combining performance measurement and risk management among the various actors is an interesting challenge. Then, the Arctic environment will act as a threats' catalyst. In this context, the team spirit should prevail, and stimulate actors to share performances to be measure and risks to be managed, as a business unit would do. Lastly, this allows me to delimitate the field of study.

I hope the results from my research will contribute to shed lights on possibilities for optimization of business processes of the offshore upstream logistics. In so doing, I hope I can respond to the wish expressed by Milaković et al, (2014:169) "Further, most important performance indicators (KPIs) as well as risk factors should be collected for each of the stakeholders. All questions should be answered while keeping in mind that the operations will be taking place in the arctic environment."

I take this opportunity to thank my supervisor Nadezda Nazarova, PhD at the University of Nordland, for her precious advices which helped me to structure my thought and guided me to the final writing of this master's thesis.

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ABSTRACT

Today, the oil and gas development in the Arctic is a reality. The literature provides information which shows that the difficulties and threats to oil and gas activities in the Arctic are numerous. The logistics is at the center of these activities and deserves a particular attention because of its crucial importance.

In this context, performance measurement and risks related are interesting because they are closely connected to the practice. The Balanced Scorecard invented by R.S. Kaplan and D.P. Norton seems to be the most appropriate tool to measure the performance. Indeed, it confers the advantage to provide users with a balanced view which emphasize the importance of innovation and internal processes. Today, the Balanced Scorecard has been implemented with the risks related to the achievement of the strategic objectives (enhanced Balanced Scorecard). Few applications within the industry have been done but it remains to be seen whether this model can be used for the offshore upstream logistics and what are its advantages.

The aim of this master's thesis is to build a common enhanced Balanced Scorecard which ensures performance measurement and control of the risks and which might be shared by all actors of the offshore upstream logistics chain. For this purpose, I used a qualitative approach which brings together a maximum of actors concerned by this issue. The main findings are that we can build a Balanced Scorecard which can be shared by all actors. In addition, for each strategic objective I could combine performance measurement and risks management. Lastly, I could make a common enhance Balanced Scorecard.

The main conclusion of my study is that the combination of performance measurement and risk management is essential to be performant, and that a common Balanced Scorecard leads actors to share strategic objectives between them. Thus, the building of a common enhanced Balanced Scorecard can improve the performance of all actors of the offshore upstream logistics.

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TERMINOLOGY AND ABBREVIATION

Terminology

Arctic: For the oil and gas exploration and production, the Arctic can be divided in three areas (Karlsen, 2014):

- ✓ *Workable Arctic*: Oil and Gas activities are possible with today's technologies, for example Southern Barents Sea and East Coast Canada.
- ✓ *Stretch Arctic*: Requirement for incremental innovation and technology development, for example East Barents Sea.
- ✓ *Extreme Arctic*: Requirement for radical innovation and technology development, for example North East Greenland.

Turbulent environment: "environment with a high degree of *volatility* and *complexity*" (Borch and Baltaden, [2014](#):1).

- ✓ *Complexity* "is defined as the presence of a large number of dependency relations, a high degree of spatial dispersion, specialization and heterogeneity among the actors involved, and a high number of interactive relations between them" (Borch and Baltaden ([2014](#):4)).
- ✓ *Volatility* "is regarded as instability and lack of predictability that will aggravate the uncertainty of outcomes" (Borch and Baltaden ([2014](#):4)).

Abbreviations

AHTS: Anchor Handling, Towing, and Supply vessel

BSC: Balanced Scorecard

CSCMP: Council of Supply Chain Management and Professionals

DOT: Department Of Transportation

ERM: Enterprise Risk Management

E&Y: Ernst & Young

FMECA: Failure Modes Effects and Criticality Analysis

FSV: Fast Support Vessel

GLONASS (ГЛОНАСС): GLObal NAVigation Satellite System (глобальная навигационная спутниковая система)

HSEQ: Health, Safety, Environment and Quality

IT: Information Technology

KPI: Key Performance Indicators

KRI: Key Risk Indicators

MBO: Management By Objectives

MSV: Mini-supply vessel

NASA: National Aeronautics and Space Administration.

NGL: Natural Gas Liquids

OpLog: Operational logistics and business process management in high arctic oil and gas operations

OSB: Onshore Supply Base

OSV: Offshore Supply Vessel

OTIF: On Time In Full

PSV: Platform Supply Vessel

RADius: Short-range relative positioning system (Kongsberg)

SBU: Strategic Business Unit

ROCE: Return On Capital Employed

SCM: Supply Chain Management

TQM: Total Quality Management

U.S.: Union States (of America)

U.S.G.S.: United States Geological Survey

°C: Degree Celsius

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1. INTRODUCTION

The offshore upstream logistics will be facing new challenges. Logistics will play a crucial role due to the threats and difficulties posed by the Arctic environment on oil and gas exploration and production activities. Due to the Arctic, the context of the offshore upstream logistics has a particular dimension. This particular dimension and what it implies can be explain from the historical perspective. In the next section the reader will find the context and a short historical overview, whose aim is to show how, logistics, performance measurement and risk management met.

1.1. Context and historical perspective

Theodore Roosevelt once said, “The more you know about the past, the better prepared you are for the future.”

1.1.1. Further North

Since the discovery and exploitation of oil and gas in the North Sea at the beginning of 1970s the oil and gas activity has moved progressively to the north. The 2000s saw the oil and gas activity going one step further in the Norwegian Sea (e.g. Ormen Lange), then in the south of the Barents Sea (e.g. Snøhvit at 71.6°N) and today we can observe that licenses have been granted by the Norwegian government until the 74th parallel North at the level of Bear Island, which is situated around 450km from the Norwegian coast (Hammerfest).

The transfer of the offshore oil and gas to the north is due to the depletion of the first oil and gas fields, to the conflicts-settlement on maritime boundaries. For example the one which used to oppose Norway and Russia in the Barents Sea, and also and in particular to surveys full of promises. The United States Geological Survey (U.S.G.S., [2008](#)) estimates that resources of hydrocarbons in the Arctic represent around 22% of the undiscovered, technically recoverable resources in the world: 30% of natural gas, 13% of oil, 20% of NGL. Most of these resources (84%) are offshore.

This transfer to the north has consequences on activities, such as Exploration & Production or Midstream but also on all related activities such as logistics which is of crucial importance for the offshore oil and gas (Rowbotham, [2014](#)). Indeed, heading north adds difficulties to threats.

Today, the logistics is crucial for the offshore oil and gas industry, but it has been essential for military operations for a long time already. Historians trace its origins back to Alexander the Great when he launched his conquest of Asia (330 - 325 BC). Indeed, Alexander the Great was organizing his conquests with great care; taking into account future needs of supplies (e.g. Food, water, materials,...), distance, meeting points and schedule for the whole campaign (Laly, [2003](#)). Alexander was aware of the strengths and weaknesses of his logistics and was building his strategy by foreseeing measures to offset limitations (Hugos, [2011](#)). Julius Caesar became a master in logistics, he created a force called *Logista* which was in charge to organize movements of the Roman legions and plan the supply activities. Edward Luttwak ([1979](#)) compares the Roman Empire to a “*one vast logistic base*”.

Of course it is during conquests, when troops have to travel away from their base that military logistics is of crucial importance.

General A.J. Jomini ([1837](#)) theorized the critical role of logistics in the conduct of military operations. It is interesting to note that first A.J. Jomini had been a General for Napoleon I then put himself at the service of Nicholas I of Russia. When he was in serving of France he participated in the Russian campaign (1812 – 1813). This campaign, which has been disastrous for the French, emphasizes how the longer distance from the base and hostile climatic conditions have been decisive threats to the logistics of the great army. Remoteness of infrastructures and extreme cold: I will have the opportunity to come back to these issues later. About this military disaster a very interesting graphic has been made by Charles Minard (1869). This graphic shows that heavy human losses of the Great Army have been proportional to the distance from the base and to the extreme temperatures of the Russian winter. See [appendix 1](#).

Closer to our time, the allied landing in Normandy in June 1944 has permanently installed logistics in the forefront of “the art of war”. Indeed, allied forces won twice the logistics battle: on the one hand by destroying German logistics (aerial bombardment of infrastructures) and of course on the other hand by preparing very carefully since 1941 the operation “*Overlord*” (Colin, [1996](#)).

After the Second World War, the concept of logistics takes off successfully in companies. After a first period during which top priority has been put on operational optimization, the real growing

period occurred in the 1980s and 1990s, and arouses in the same time researchers' interest. Michael PORTER ([1985](#)) identified logistics as one of the “*primary activities*” in company's value chain.

The development of information technology (IT) as well as the Internet will provide information system and communication which enable to multiply and secure exchanges between different actors of the logistics.

1.1.2. Overcome threats and difficulties

Today, the movement of oil and gas activities further north will confront the logistics to the same threats and difficulties that conquerors met. We could easily identify the remoteness with all the implications like for example the lack of infrastructures and the increase in travel time. But there is also the extreme cold with associated threats like for example the ice in all its form.

Threats can be attributed first to unfavorable climatic conditions at those latitudes. The Arctic is cold, even extremely cold, and temperatures can be extreme: -30°C... -50°C. Ice in all its forms (ice, icebergs and growlers) is the main threat to ships and infrastructures such as fixed jacket, floating structures and subsea facilities.

In addition to that, high winds or storm impacts strongly installations, especially ice storms which cover installations with a thick coat of ice. High winds or storm lead to difficulties even an inability to conduct maritime (wave height) and air operations. Long dark periods of low visibility are another problem enhanced by the fog. For example, in the Kara Sea, there is an average of one hundred foggy days per year. Of course, these threats (extreme temperature, storm, darkness ...) can occur at the same time and increase the severity of the situation (Emmerson and Lahn, [2012](#)). Anatoly Zolotukhin ([2014](#)) considers: “Everything takes two to three times longer to complete if season is limited by access to free water.”

To these threats are added difficulties. First and foremost is the geographical remoteness. To illustrate this difficulty I take the example of a Search and Rescue helicopter with a capacity of 18 passengers, it will not be able to take (save) more than two people if it has to intervene at 450 Km away from its base (Jacobsen, [2012](#)). Another issue concerns the lack of port infrastructures and communication network. These gaps combined with threats are generating risks and uncertainty.

In this difficult context, actors will have to pay attention to performance more than elsewhere. Indeed, in the Arctic, because of the threats and difficulties, the failure will impact more than the financial result. The threats to people and the environment are real. The best way to ensure the performance is to measure it. Here again the history can bring particularly relevant insights.

For a long time the measurement of the company's performance was still limited to financial ratios. After the Second World War, the concept of product value appeared (work of L. Miles at General Electric). This has led to the emergence of value analysis or value engineering which aims to satisfy the customer's need through functions of the product at least cost. Through its involvement in the product value, the customer becomes a partner of the measurement of the company's performance. In the 70s, when the value analysis moved to Europe, the Quality approach will also be based on customer satisfaction. Then the Quality will take place in a wider framework with the Total Quality Management (early 90s). Indeed, from the requirement to satisfy the customer, Total Quality Management will broaden the performance spectrum by combining stock management, training of employees, project management, process control, ... without forgetting the financial aspects.

In [1992](#), Kaplan and Norton publish their first work about Balanced Scorecard (BSC). The Balanced Scorecard effectively articulates the four different perspectives (Financial, Customer, Internal processes and Learning and Growth) and evaluates the overall performance of a company after being incorporated within the framework of its strategy. It thus facilitates the proper operational implementation of that strategy. Of course the supply chain is concerned and in 2000 Kaplan and Norton ([2000](#):143) report the adoption of the Balanced Scorecard by the DOT (Department Of Transportation) in the U.S.

1.1.3. The need to manage risks

In the turbulent environment of the offshore upstream logistics it is not enough to measure the performances. Complexity and volatility must be also considered because they are directly threatening the achievement of the objectives. In response to this complexity and volatility, the risk management will allow to mitigate "the uncertainty of outcomes" Borch and Baltaden ([2014](#):4).

Again, the risk management is not new and was already outlined in Greek mythology. Indeed, in Greek mythology, Gods play a game of dices before the creation of the Universe. Zeus, the

winner, gets the heavens, Poseidon the seas and Hades hells. This dices game already represents the risk, its probability and its severity. Let us put ourselves in the shoes of one of the three Gods: “Play the Universe by rolling a pair of dice! What is the probability that I win, or come second or third and in this case inherit hells! In this case, is the severity to inherit hells negligible, critical, or catastrophic?” Through this game of dices Greek mythology presents how to assess the risk by evaluating the probability that the event occurs and by evaluating the severity of its consequences if it occurs.

If the Gods had mastered probabilistic calculations, perhaps the strongest of them would have chosen a good fight rather than dice. But it seems that Zeus was the strongest in that game too!

For the Romans, “*Aleae*”, meant games of dice and games of chance in general (Bernstein, [1996](#)).

The concept of risk did not exist in the Middle Ages. The concept did not exist, perhaps because as Magne suggests ([2010:12](#)), the word “risk” did not exist since the risk was everywhere. In the middle of the seventeenth century, the word appears in French and is defined in the first edition of the *dictionary of the French Academy* (1694) as *peril* or *danger* (the same words in French). In 1792, in the *dictionary of English language*, the word “risk” was defined as *Hazard, danger, chance of harm*, and in the same dictionary *Chance* is defined as the *possibility of any occurrence*. But, it was already over a hundred years that Edward LLOYD had opened his coffee on the Thames, and in 1771 the Society of Lloyd's is founded and subscribers (the Names) pay 100 pounds each to cover the losses of their clients (Bernstein, [1996](#)).

Then, with the Industrial Revolution, the manufacturing in large series, but also aeronautics and space, the risk will become the norm for companies. As said Magne ([2010:1](#)): “the risk management almost would become the management itself”.

A closer linkage between risks and BSC is carried out by T. Nagumo ([2005](#)), and in [2009](#) R.S. Kaplan definitely establishes the link between BSC and risks.

This is why since the end of 2000s, performance measurement and risk management are moving forward together for the best of logistics.

It is now established that oil and gas exploration & production will continue to move further north. This movement leads to new threats and difficulties which will need an effective risk management. In this sensitive context, companies involved in the offshore upstream logistics will have to innovate not only technologically but also on their management of business processes and not just intra-organizational but also inter-organizational with customers, supplier and sometimes even with competitors.

1.2. Problem statement

As seen above, in the past few years, offshore oil and gas activities in the Arctic have been developing. Physical characteristics of this area, especially those related to the climate (low temperatures, remoteness, darkness, fog, icing, sea ice, sea spray and polar lows) are not those that the offshore oil and gas activity usually meets. That is why, despite the experience of the actors and even though few cases of offshore oil and gas activity in polar environment exist, the offshore industry will be faced with new challenges to overcome such as remoteness, harsh weather conditions, and all of this in a turbulent environment.

The first idea is that the oil and gas activity in the Arctic is going to lead to significant changes and improvements over the way things were used to be. Naturally, we think first about technological leap (winterized vessels, specific platforms and equipment) required by the unique environment of the Arctic region and associated costs and many other, like for example to remedy the lack of port and support infrastructures. Changes must go further and actors' strategies and tools to support strategy should be modified.

Of course, scientific and technical literature treats subjects related to the offshore oil and gas activity, but many authors regret that this literature does not situate more often these issues in the Arctic. Thus there is here the opportunity to explore this topic and contribute to the knowledge in this domain.

On the other hand, I believe that logistics is vital to reach objectives of a project, a campaign, or any other complex actions for which the success is uncertain. The offshore upstream logistics is composed of two main segments: supply operations and supporting logistics which allow the delivery of products and services required to ensure safe and efficient operations on offshore platforms.

The interdependence between actors of the offshore upstream logistics and the challenges which have to be overcome should push actors to collaborate more intensively. Therefore, a common tool could help them to work together more effectively, especially if this tool could help them to have a common strategy for the adventure they will share.

This is why I believe that the use of the Balanced Scorecard can help to overcome difficulties and threats which have been seen above. The Balanced Scorecard is an enabler of strategy, and a good tool for performance management. In a normal Balanced Scorecard, a company defines its objectives and related Key Performance Indicators (KPIs). These KPIs allow the organization to measure and monitor its performance. Kaplan ([2009:3](#)) admits that “candidly, the measurement, mitigation, and management of risk have not been strongly featured in David Norton’s and my work.” By extension, it seems interesting for me to take into account risks events that could threaten objectives (Kaplan, [2009](#)) and related Key Risk Indicators (KRIs). Indeed, in such environment risk management must be at the same level of importance as performance management. Ernst & Young ([2009:6](#)) argues that “...full use of KRIs in all four areas of the BSC has an important additional advantage: it helps to ensure that risks are detected and taken into account...” Also, in view of the above considerations, and the fact that the offshore upstream logistics is composed of various actors, it is interesting to explore the feasibility of an enhanced (i.e. with risk indicators) Balanced Scorecard common to all these actors.

Therefore, the research question will be:

What Balanced Scorecard can improve performance measurement and manage risks and how to build it?

Answering this question could have practical implications to improve the offshore upstream logistics in the Arctic. To answer this question, I will identify strategic objectives for each actor (in the four perspectives) and related Key Performance Indicators (KPIs) (Kaplan and Norton, [1993](#)). These KPIs allow measuring the performance. The possibility for actors to share some elements of the Balanced Scorecard will be investigated. Then, I will identify unwanted events threatening strategic objectives and the related Key Risk Indicators (KRIs). All of this will be done within the framework of an iterative process between theory and practice.

1.3. Boundaries of the study

The following boundaries define the framework of my study.

- ✓ In the context of the offshore upstream logistics operations in the Workable and Stretch Arctic. (Karlsen, 2014),
- ✓ Operations taking place between Onshore Supply Base and offshore field,
- ✓ Actors concerned: Oil and Gas Company, Rig owner and operator, Logistic coordinator, Support vessel owner and operator, Supply base operator.
- ✓ Some of these actors have other functions like Search and Rescue, fight against oil spills. Those functions are not part of this study.

1.4. Structure

The thesis is organized around the 6 following chapters.

Chapter 1 – Introduction:

This opening chapter presents the context and its link with the historical perspective of the logistics, the risk management and the performance measurement. After that, the issue of the study and the research topic are introduced. Then, the boundaries of the study are defined.

Chapter 2 – Field of study: the offshore upstream logistics

This short chapter presents the offshore upstream logistics and show the importance of this activity for the exploration and production of oil and gas. It is the opportunity to describe the sectors of the offshore upstream logistics and to introduce Offshore Supply Vessels.

Chapter 3 – Theoretical framework:

This chapter presents the theoretical perspectives of my study. Logistics, Supply Chain and Supply Chain Management are defined. Performance measurement with the Balanced Scorecard is developed. Risk management is first presented with a generic point of view. The connection between risks and strategic objectives of the Balanced Scorecard is explained.

Chapter 4 – Method:

This chapter introduces the research philosophy as well as the research approach and methodology used in this thesis. I explain the choice for a qualitative approach and highlight the

importance of a clear methodology including research design, data collection method and data analysis. The importance of validity and reliability in research are provided at the end.

Chapter 5 –Empirical findings:

This chapter presents my five findings. The first one is a predictive Balanced Scorecard which shows how to build a Balanced Scorecard together with the risks related to the strategic objectives. The second finding is the common Balanced Scorecard. The third finding is the strategy map. The fourth finding is the risks related to the strategic objectives. The fifth finding is the enhanced Balanced Scorecard.

Chapter 6 – Discussion:

This chapter reviews the findings presented in the previous chapter. Links with the current theories are examined and I show how the findings answer my research question. Then, I discuss the limitations and weaknesses of my study. After that, I present the recommendations for future research. Lastly, I conclude by presenting the major theoretical contributions and empirical implications of my study.

2. FIELD OF STUDY: THE OFFSHORE UPSTREAM LOGISTICS

Oil and gas activity, especially in its offshore upstream segment, is more complex than most other activities, even industrial. Thus, its logistics differs a lot from the common mental representation that most people have about logistics. As sharply Jacoby ([2012:1](#)) said: “In upstream oil and gas, replacing a worn part on a subsea wellhead is more complex than stocking an item in a bin”. This leads me to consider that the Arctic companies have to take into account three main constraints. I have talked about the one caused by the climatic environment (cold, wind, waves, fog, storm, etc.) and during offshore operations, these threats can occur at the same time and increase the severity of the situation. The second constraint is connected to the essence and core of offshore oil and gas activities for which every delay is extremely costly (Rowbotham, [2014](#)). Indeed, the value of the production of an offshore platform can amount from 3 to 12 million euros per day (Aas et al, [2007](#); Aas et al, [2009](#)). The third constraint is related to the cost of using OSV which are the principal vector of this logistics. Actually, going back and forth between the offshore supply base and platforms is very expensive (e.g., renting and operating costs of a supply vessel is around 18,000 euros per day) (Aas et al, [2007](#)).

As saw above, supply operations and supporting logistics are part of the key operational segments of offshore operations. It requires a high level of efficiency in order to avoid halts in the production and optimize the utilization of supply vessels (Milaković et al, [2014](#); Berlin, [2013](#)). Rowbotham ([2014:132](#)) argues that “the oil and gas supply chain is based on super-efficiency, where time is money, and wasted time means millions of dollars or pounds disappearing into a black hole.”

Having this in mind, I will now describe specificities of the offshore upstream logistics. Based on Kaiser ([2010](#)), there are 3 sectors (Inbound sector, Port sector and Offshore sector) but for a better identification I have decided to describe the offshore supply vessels (OSVs) as sector in its own right.

Inbound sector

The inbound sector or also called inland transportation sector (Kaiser, [2010](#)) regroups all the means of transportation (trucks, trains, planes, boats) to bring the necessary supplies, equipment and services coming from many different suppliers land-based to the harbor or onshore supply

base (Kaiser, [2010](#); Milaković et al, [2014](#)). The transportation networks have to be efficient because it is an integral part of the umbilical cord (life line) of offshore activities.

Port sector (the link between the inland sector and the offshore sector)

The port sector is composed of an Onshore Supply Base for cargo handling and vessel stowage which include different other infrastructures such as warehouses, storage capacities for drinking water, fuel and drilling mud, and construction, repair and inspection shops (Kaiser, [2010](#); Berlin, [2013](#)). The Onshore Supply Bases has to be directly connected by roads, rail, pipelines, and docks.

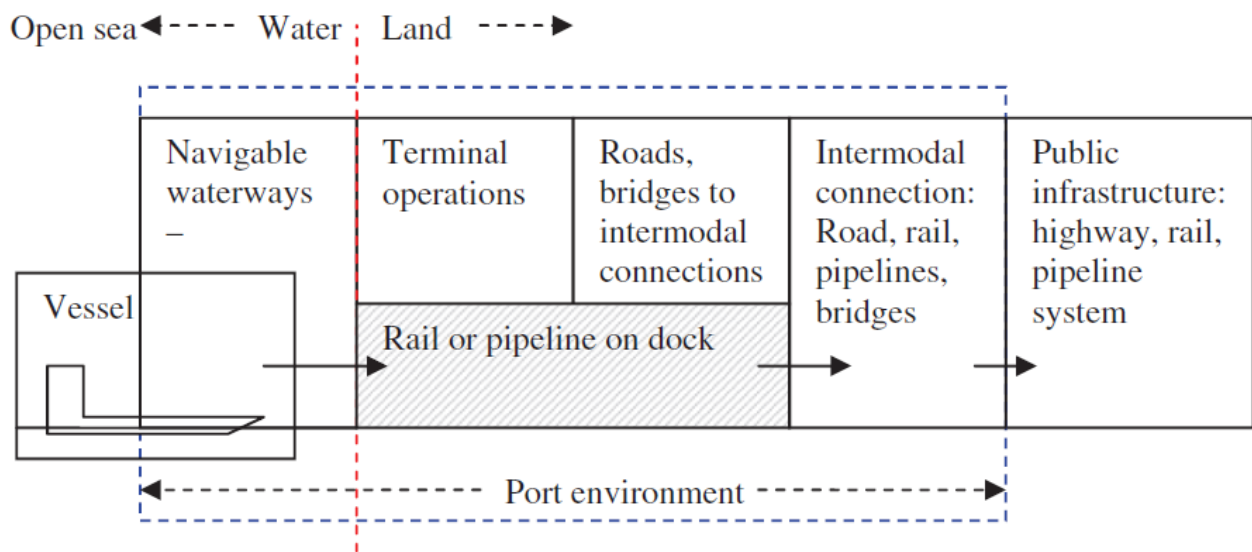


Figure 1: Port sector (Berle et al, [2011:609](#))

The onshore supply chain is the central point of the upstream logistics linking the inbound sector and the offshore sector (Milaković et al, [2014](#)). This is why its place is crucial and should be as close as possible from exploration and production sites (Berlin, [2013](#)).

The offshore sector

The two main elements of the offshore upstream logistics are the offshore field with its different stages of development with its various needs and offshore supply vessels which support offshore activities during the life-cycle of the field by transporting goods and services (Milaković et al, [2014](#)).

The life-cycle of an offshore installation is specific and essential to the development of an offshore field and according to (Kaiser, [2010](#)) there are 4 main phases, Exploration, Development, Production, and Decommissioning. Logistical requirements vary from one stage to another. The first part of the exploration phase does not need much logistic support in the sense that survey companies bring with them everything they need, and that work rotations are infrequent (Kaiser, [2010](#)).

On the other hand, drilling of exploratory wells demands substantial logistics support. Indeed, drilling operations involve several types of equipment and material (drill pipes, drill bit, drilling fluids, diesel fluids, pumps, etc) (Hyne, [2012](#)) and may take from some weeks to few months (Kaiser, [2010](#)). All of this has to be transported by Offshore Supply Vessels to the drilling platform then back in addition to the drilling mud to the Onshore Supply Base. Berlin ([2013:422](#)) argues that “Exploratory platforms require many more supplies than production platforms, since they are constantly using drilling mud, pipe and fuel while drilling.” A drilling platform usually needs two OSVs to keep the supply flow going without any stop in the drilling procedures (Kaiser, [2010](#)). This is due to the fact that “Offshore platforms have limited storage capacity, so their ability to cope with supply disruptions is limited.” (Berlin, [2013:420](#)).

During the development phase several operations are carried out, geophysical surveys, design, fabrication and installation of production facilities, pipeline installation, drilling of production wells. Except from geotechnical site investigations, all these operations require a lot of logistics support over a certain period of time, which may be short or long, depending on the location of installations (shallow water, deep-water, icy water).

During the production phase logistics support is well schedule, and OSVs have to do regular rotations between the OSB and the platform, but again if additional wells or refurbishments of the platform are needed then the demand for supplies will increase and be volatile.

The decommissioning phase consists in removing production facilities from the field and sealing unused wells. Here the demand is the same that for the development phase (Milaković et al, [2014](#)). I will not take into account this phase in my study.

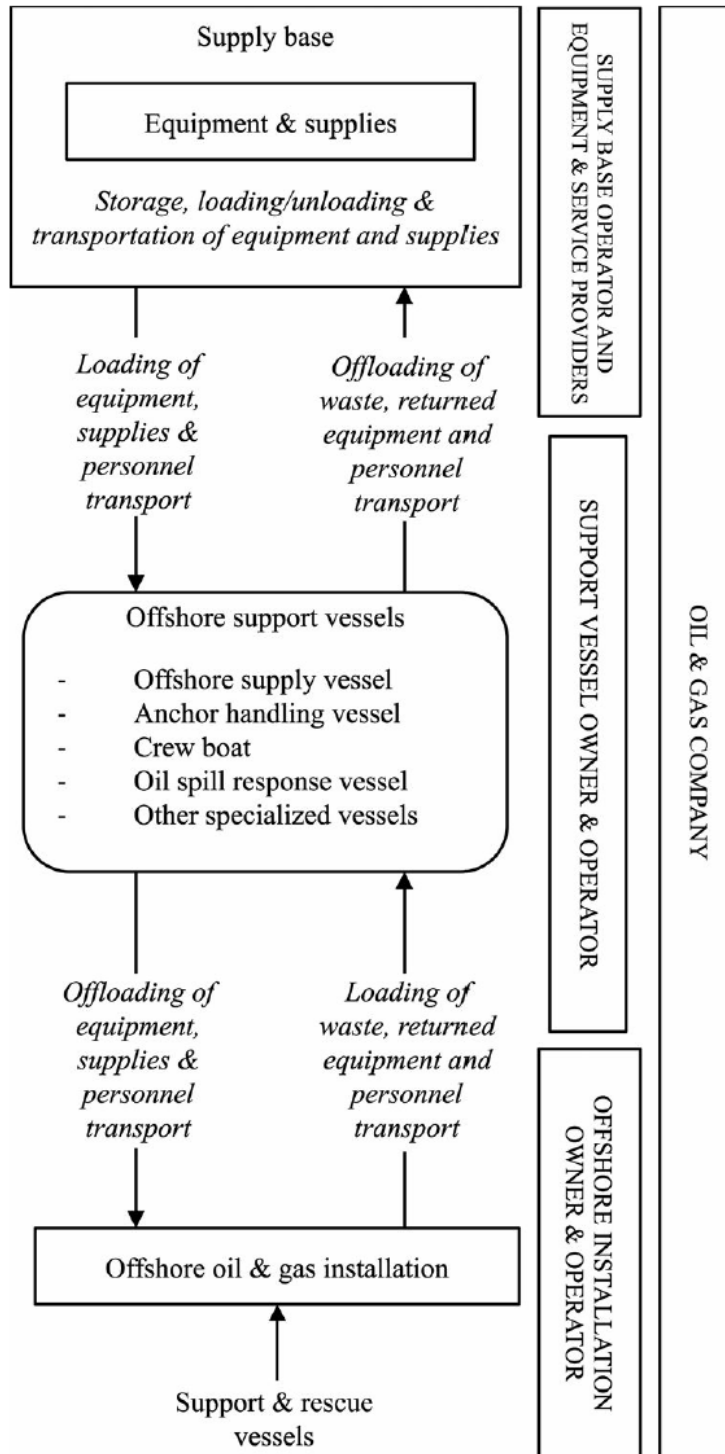


Figure 2: Overview over an offshore upstream logistics supply chain (Milaković et al, 2014:165)

Offshore Supply Vessels sector

Supply vessels are a key element of the offshore upstream logistics. Designations differ from one author to another. For some *Offshore Supply vessels* (OSVs) has a generic meaning, and thus encompasses all vessels providing services for the offshore oil and gas. For others it is the most common category of supply vessels, those with transport of equipment, materials and crew as a main function.

Functions and characteristics of supply vessels vary according to the zone they carry out their operations. For example, supply vessels which operate in the Gulf of Mexico do not need to be winterized. However, regardless latitudes, there are some main functions as for example, the transportation of elements necessary to drill such as diesel fuel, pipes, cement, drinkable water... but also drilling muds and wastes which need to be brought back onshore.

Aas et al. (2009) distinguishes the main characteristics of supply vessels as follow:

- ✓ The reliability and operational capability which characterizes the capability to fulfil the mission it is chartered for.
- ✓ Carrying capacity which characterizes the capability to transport cargo in bulk, in tanks, in offshore containers or directly on the deck for bulky elements like pipes.
- ✓ Sailing capability which characterizes the capacity to navigate safely specific weather conditions (wind force, wave height, temperatures...)
- ✓ Loading/unloading capability which characterizes Loading / unloading capability

These performances have to be put into perspective of the costs (acquisition but also operating costs), and thus decisions should be made according to the cost-effectiveness ratio. To all of this we can also add international, national regulations and regulations related to the activity (e.g. The Norwegian Oil Industry Association.)

Supply Vessels are classified into categories which differ from one author to another. For example, Dismukes (2010) distinguishes six categories Tug; Platform Supply Vessel (PSV); Anchor Handling, Towing, and Supply vessel (AHTS); Fast Support Vessel (FSV); Mini-supply vessel (MSV); Diving Support Vessel. (See [appendix 2](#))

In addition of supply services between onshore and offshore facilities, new types of needs like in-field supply services have arisen, especially for offshore activities in the High North. Tasks of

these new types of vessels will be dedicated to safety functions (ice management, Search and Rescue, firefighting, oil spill...). In-field supply service is not part of my study.

Finally, the routing of supply vessels is important for several reasons. The first reason concerns the weather conditions which are the first disruptive element for both navigation and loading/unloading and can lead to delays. The need for service at a platform can be three times a week (Aas et al., [2007](#)), on the other side, vessels during a round-trip can supply several platforms and their particular needs. The routing optimization is essential for the following reasons:

- ✓ Operating costs of supply vessels is very high,
- ✓ Operating losses in case of production halt due to an overloaded platform are very high (several millions of euros per day).

3. THEORETICAL FRAMEWORK

This chapter presents the theoretical perspectives of my study. Logistics, Supply Chain and Supply chain management are defined. First of all because it is the general framework within which the offshore upstream logistics evolves. Then, the various concepts are defined to show their differences and what they have in common. Performance measurement with the Balanced Scorecard is developed, including its interaction with strategy. The Balanced Scorecard is the core of my study. About the risk, risk management is first presented with a generic point of view. Then, the connection between risks and the strategic objectives of the Balanced Scorecard is explained because it is under this dimension that risks are dealt with in this study, indeed they are the risks which threaten the achievement of the strategic objectives.

3.1. Logistics, Supply chain and Supply Chain Management

The first people who decided to look into the many aspects of logistics were from marketing. They started to pay close attention to the transport and storage functions and consider logistics as an important and integral part of the product (Clark, [1922](#)).

The American Marketing Association is the first to propose a definition of logistics: “*So-called logistics refers to material resources moving from production stage to consumers or users and the management of the process*”. (Quoted by Qin [2009](#):248). As I said in the introduction during 1980s and 1990s logistics has known a real growing period, companies and researchers have started to be really interested in logistics.

Today the Council of Supply Chain Management and Professionals give a slightly different definition. Indeed, they introduced the concept of Supply Chain Management. “*Logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers’ requirements.*” (CSCMP’s glossary, [2013](#):117).

Figure 3 describes the movement of materials, elements and products as a complete process inside, through and outside the company

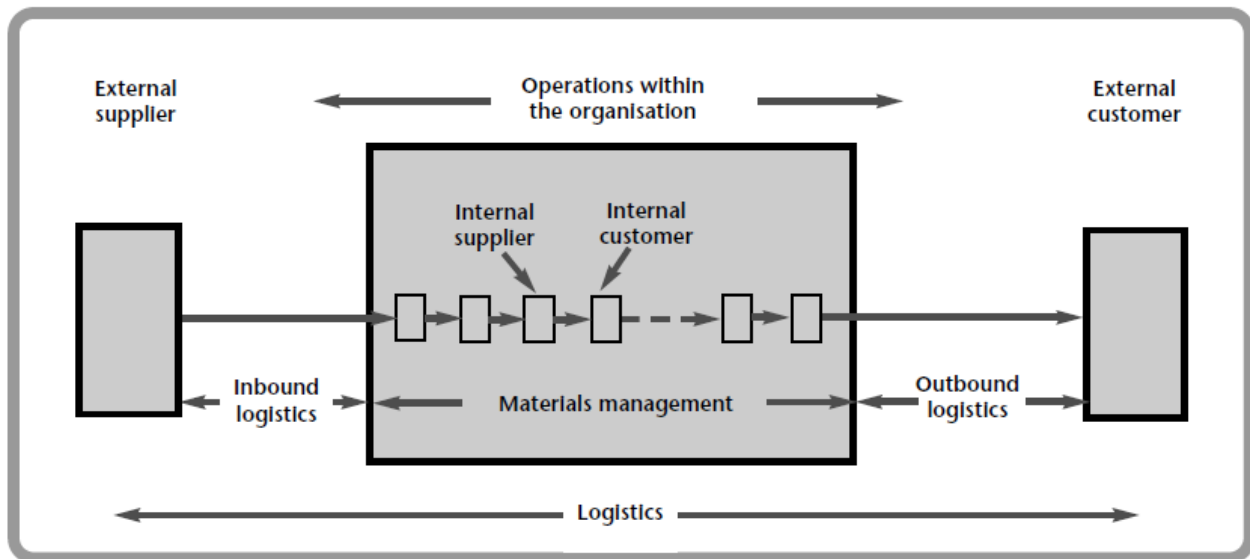


Figure 3: The role of logistics (Waters, 2003:6)

The notion of supply chain is rather new and is often associated with the different stages of production and distribution of a good. The important thing to understand is the global approach which links all the actors from the raw material to the final consumer. (CSCMP's glossary, 2013:186). Thus, the supply chain connects all actors of all companies which contribute to bring a product to consumers or companies which need it to product other goods. The supply chain is a succession of operations creating value and inter-operations creating cost and time loss. Therefore the aim of companies is to reduce non-value adding operations. This is here that we realize the importance of supply chain management (SCM).

Regarding the concept of supply chain management, we can underline the fact that it refers to a certain vision of companies' management. This is why it is important to define it with precision.

It is in 1982 that the term supply chain management appears for the first time in a book written by O.R. Keith, M.D. Webber (1982). Later, Cooper et al (1997) describe Supply Chain Management and try to show how it differs from logistics.

Once again I will refer to the definition of the Council of Supply Chain Management and Professionals which presents supply chain management as follows:

“Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it

also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology.” (CSCMP’s glossary, [2013](#):187).

Today, this definition can be considered as the official definition of supply chain management. It is interesting to note that this definition insists on the need for *coordination and collaboration* within the supply chain. This shows us that supply chain management affects strategic and operational levels (Gibson et al., [2005](#)). Supply chain management focuses its attention on interfaces between different industrial sites and logistics, but also physical operations in a unique production site. Supply chain management is focused on inter-operations, interfaces and inter-processes and aims to bring closer the demand and the source of supply to get rid of non-value adding operations which are costly and time loss.

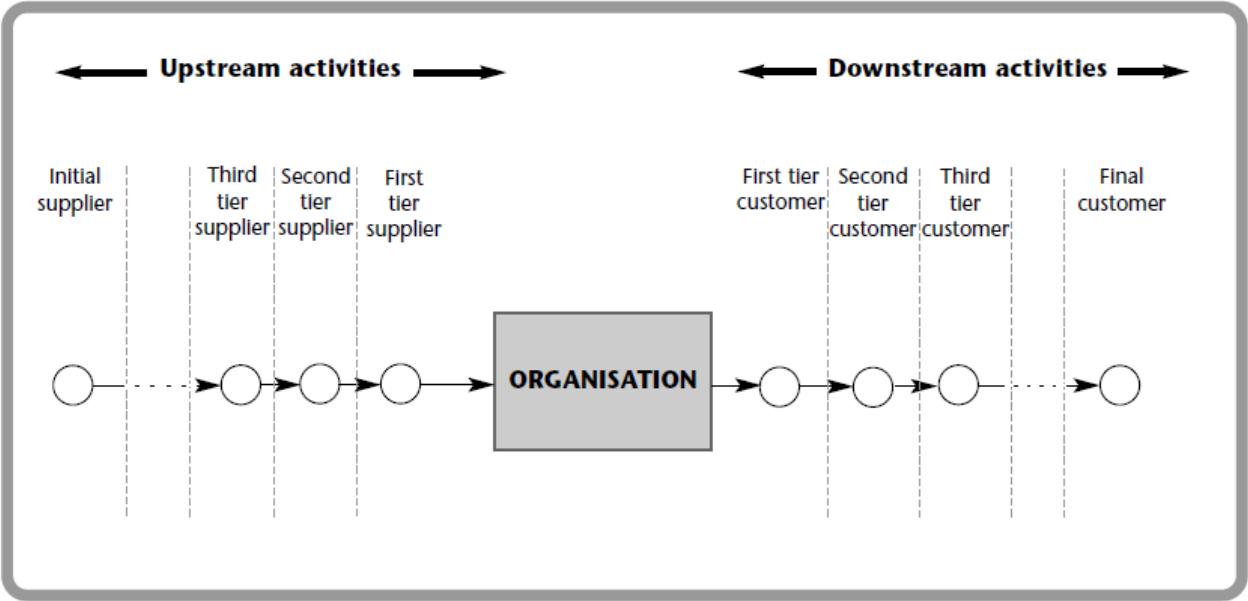


Figure 4: Activities in a supply chain (Waters, [2003](#):6)

3.2. Balanced Scorecard

In [1992](#), Kaplan and Norton wrote the foundations of the Balanced Scorecard (BSC). They describe the four perspectives, what they mean and the importance of strategic objectives and their related measures. According to Kaplan and Norton ([1992:72](#)) the Balanced Scorecard “provides answers to four basic questions:

- ✓ Customer perspective: *How do customers see us?*
- ✓ Internal perspective: *What must we excel at?*
- ✓ Innovation and learning perspective: *Can we continue to improve and create value?*
- ✓ Financial perspective: *How do we look to shareholders?”*

They explain that the traditional measurement system, essentially based on the financial function has led to a *control bias* (p79) and how the addition of the three other perspectives allows balancing the whole performance measurement. The link with the strategy is already announced “The scorecard puts strategy and vision, not control, at the center” (p79). Kaplan and Norton also insist on the compatibility of the BSC with new ongoing initiatives in companies such as customer-supplier partnerships, continuous improvement and team accountability (p79).

Lastly, we can consider how relevant the use of the Balanced Scorecard is in this study. The answer is given by Kaplan and Norton. They consider that if a unit “has (or should have) a mission, a strategy, customers (internal or external), and internal processes that enable it to accomplish its mission and strategy. If it does, the unit is a valid candidate for a Balanced Scorecard.” ([1996a:36](#)).

3.2.1. Strategy within the Balanced Scorecard

Strategy may concern different levels of organizations like corporate strategy or business unit strategy. Kaplan and Norton ([1996a:173-175](#)) go further and define a possible common strategy and Balanced Scorecard associated for joint ventures and alliances.

The aim of the business unit is to obtain a competitive advantage in its sphere of activity. For that, Porter ([1985](#)) proposes two main ways to achieve competitive advantage: lower costs than competitors or provide exceptional products or services to customers. From these two ways and given the size of the market segment, he distinguishes three generic strategies: *cost leadership*, *differentiation* and *focus*.

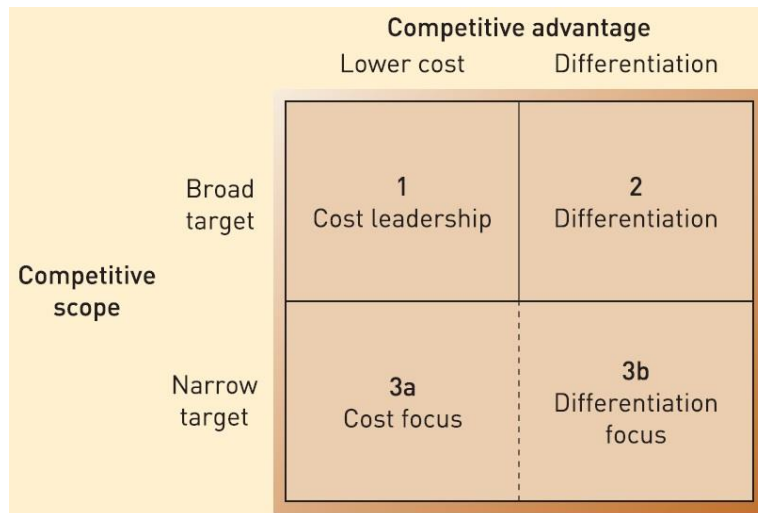


Figure 5: Three generic strategies (Johnson et al., [2011:199](#))

Cost leadership is a strategy based on four key cost drivers: *Input costs, Economies of scale, Product/Process design and Experience*. *Cost leadership* targets a broad segment of scope of activity.

Differentiation is a strategy based on a high level of value for the customer. Its key factors are identification of the strategic customer and key competitors (Johnson et al., [2011](#)). *Differentiation* targets broad segment of scope of activity.

Focus is a strategy that targets a narrow segment of scope of activity. The *Focus* strategy may be *cost focus* oriented or *differentiation focus* oriented.

As regards the topic, the logistics chain required to offshore upstream operation in the Arctic environment can be modeled as a business unit: specific value chain, specific customer, and specific skills. Given the narrowness of its target, the strategy of this business unit is a *focus* strategy.

This view is supported by the literature. Indeed, according to Johnson et al. ([2011](#)) *focus strategy* is composed of three key factors (Distinct segment needs, distinct segment value chains, viable segment economics) and the success of the strategy is based on a least one of these factors. Here, two factors are relevant.

The first factor is the *distinct segment needs*, because the needs of the offshore upstream logistics in the arctic environment are very particular and will stay like this.

The second factor is the *distinct segment value chain*, because the value chain of the offshore upstream logistics is very specific and requires strength in terms of expertise, equipment and processes. For competitors, it will be difficult and expensive to enter into this segment of the market.

As seen above, *focus strategy* has two variants (*cost* and *differentiation*). According to Johnson et al. (2011:205) “*Differentiation focusers* look for specific needs”. That is exactly the characteristics of the requirements for logistics to offshore upstream operations in the Arctic environment.

Given these elements the chosen strategy for the business unit is a *differentiation focus* strategy which “...increases commitment to service and can improve brand recognition and customer loyalty.” Johnson et al. (2011:206).

3.2.2. Balanced Scorecard principles

Above all, it is necessary to define the strategy. Strategic objectives, then indicators (KPIs) which will assure the role of performance measures will be defined from the strategy. In this study, the strategy is the differentiation focus strategy as described in section 3.2.1.

Construction of the Balanced Scorecard required several steps. The example is given by Kaplan and Norton (1993:135-136). They present the case of Rockwater which, at the beginning of the 90s, was a worldwide leader in underwater work and used to work mainly for the oil and gas industry. Here is the “Rockwater’s approach”. (Figure 6)

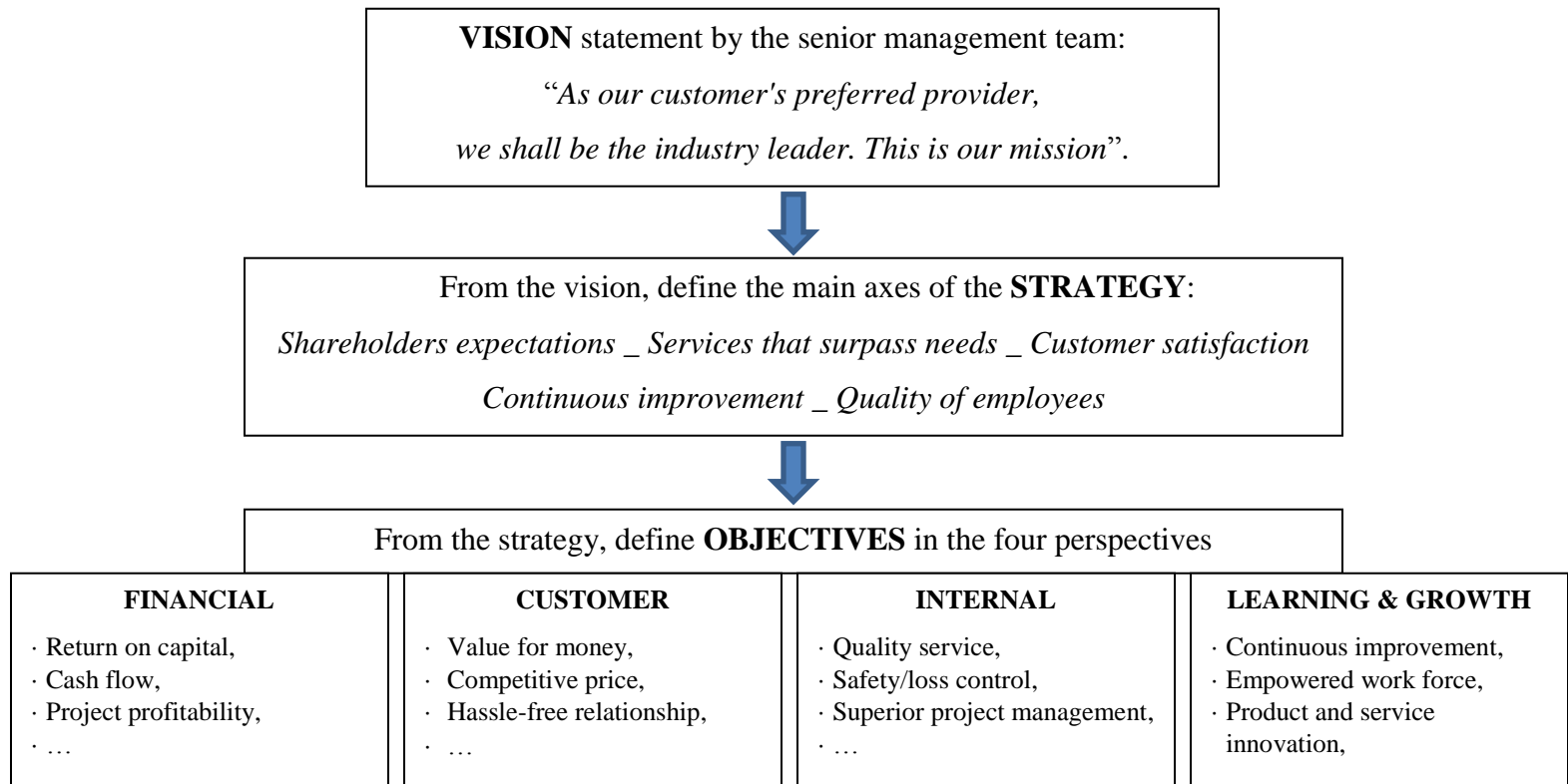


Figure 6: Rockwater’s approach (Adapted from Kaplan and Norton, 1993:135)

From objectives several indicators are defined. A majority of these indicators are measures but some of them can be a survey. This example shows that a Balanced Scorecard is not a heterogeneous arrangement of objectives and indicators. All objectives and all indicators are aligned and follow the same pattern: in order to achieve its financial objectives, a company, or to be more precise, a Strategic Business Unit (SBU) must satisfy customers’ need. Therefore, the business unit needs to implement efficient internal processes. To have efficient internal processes, it needs to have a successful organization, competent staff and competitive technologies. This approach is illustrated by the top-down process of the Figure 7 which demonstrates that the starting point is the strategy. This covers the four perspectives which structure the Balanced Scorecard and that I describe in detail in the next paragraph.

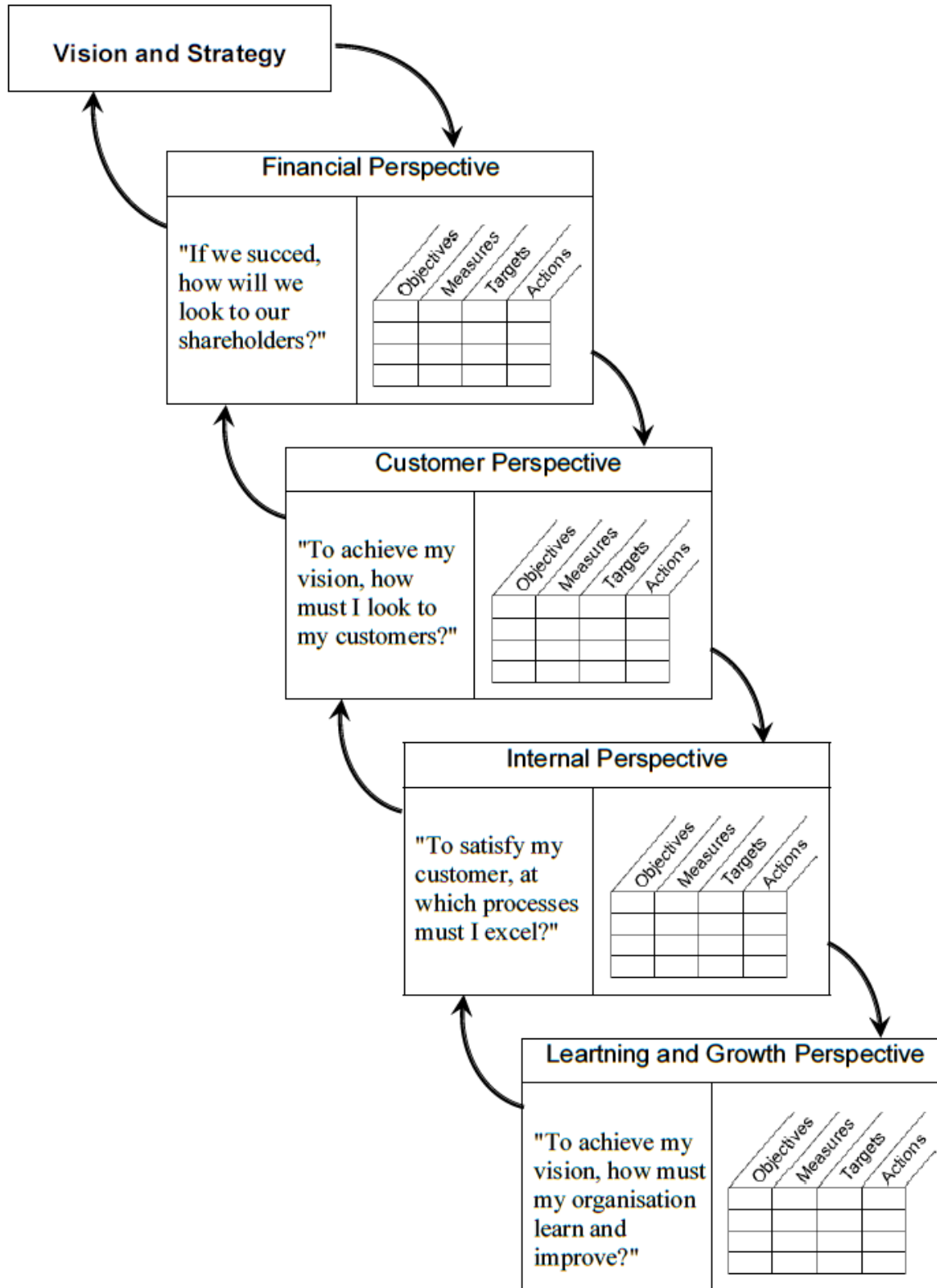


Figure 7: Architecture of a Balanced Scorecard (Kaplan and Norton, 2000:77)

3.2.3. The four perspectives

Financial

The Financial perspective is a source of misunderstanding. This comes from what Kaplan and Norton start to denounce in their first article. According to them, traditional financial measures are too dominant. “The traditional financial performance measures worked well for the industrial era, but they are out of step with the skills and competencies companies are trying to master today” (Kaplan and Norton, [1992](#):72). Nevertheless, financial performance measures have their place in the Balanced Scorecard, with this precaution: “The scorecard obtains the benefits from keeping financial measurements as ultimate outcomes, without the myopia and distortions that come from an exclusive focus on improving short-term financial measures.” (Kaplan and Norton, [1996a](#):34). Ideally, the financial perspective should have its own balance between long-run and short-run objectives.

Regarding the topic, the business unit lies within the stage of its life cycle called *Rapid Growth* ([1996b](#):56). This stage is characterized by the need for large investments in equipment, staff and methods in order to create new operational capacity.

Customer

The customer is at the center of the Customer Perspective. Objectives and related measures are classics. We can find for example, purchase retention and satisfaction objectives. Nevertheless each of them will have to be customized to be adapted to the market segments and customers. Kaplan and Norton, ([1996b](#):61-62) recommend to go further: “beyond the core: measuring customer value propositions” by considering the attributes which constitute the value proposition which is provided to the customer to insure its loyalty and its satisfaction. The Figure 8 below clarifies this notion.

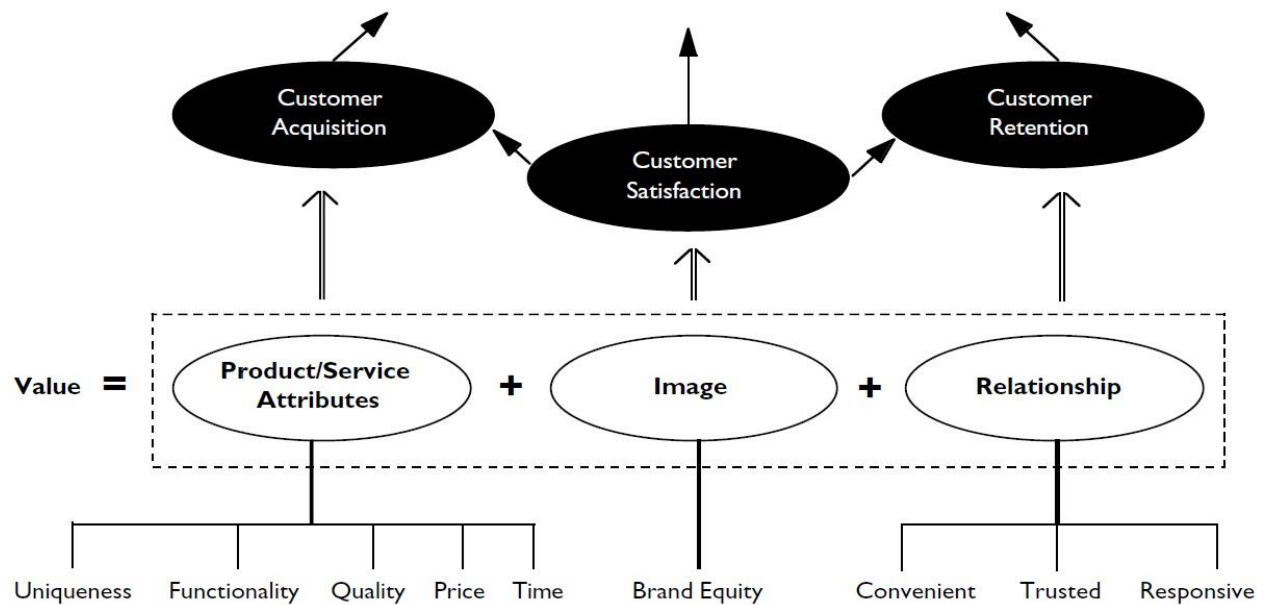


Figure 8: Customer Perspective: Linking Unique Value Propositions to Core Outcome Measures (Kaplan and Norton, [1996b:62](#))

As regards the topic, the offshore upstream logistics presents a particularity which has been underlined by Rowbotham ([2014:124](#)): “The upstream offshore supply chain does not equate to the conventional commercial supply chain sector is that the customer is usually the oil company itself”. What could appear as a difficulty in the first place is usually solved by solid and formal “customer-supplier” internal relationship. In this respect, the Balanced Scorecard as a tool helps by structuring attitudes of the various actors.

Internal Business Process

The *Internal Business Processes Perspective* or *Internal Perspective* cares about critical internal processes in which the organization must excel. The organization should satisfy the customer but also satisfy financial objectives. It is therefore necessary to well define the needs of the customer in order to provide a product or a service which create a maximum value for the customer. “Identifying the critical internal business processes that the unit must excel at to deliver the value proposition to customers in the targeted market segments” (Kaplan and Norton, [1996b:78](#)). The emphasis is given to both the improvement of existing processes (*Short-wave* value creation) and the creation of innovation processes (*Long-wave* value creation).

About the topic, in a turbulent environment (see section 1.1.3), internal processes which directly create a value (e.g. transportation of spare) should be particularly thorough. To achieve excellence, operations management processes such as preparation, planning and coordination which are key factors for success will have to be innovative and carry out with “zero defects”. The same applies to all that concern safety.

Learning and Growth

The *Learning and Growth Perspective* concerns people, systems and organizational procedures. About people, the aim here is to optimize their expertise in order to fill shortcomings that might exist between their skills and the ones required by most critical internal business processes to insure success of the strategy. The same applies for technical systems; again innovation should allow the technology to be able to respond to challenges of strategic objectives. Lastly, procedures and routines should be improved to insure efficient internal business processes.

As concerns the topic, it should be noted that in the context of a differentiation focus strategy (see section 3.2.1), the learning and growth perspective is extremely important. Indeed, by gaining a rare and specific expertise to the Arctic, the staff will gain a distinctive know-how which will be a key factor for success. It is the same for equipment which is implemented by the staff.

3.2.4. Key Performance Indicators

As discussed in section 3.2.2., the strategy has to be developed in objectives in the four perspectives of the Balanced Scorecard. Key Performance Indicators allow measuring how different objectives are achieved. In the “Rockwater” case (Norton and Kaplan, [1993](#):135) for example, the *safety* is considered as a strategic objective and appears into the *Internal Perspective*. Thus, the scorecard includes a safety incident index which is fuelled itself by an incidents’ classification system. In the same way, continuous improvement is a strategic objective of the learning and growth perspective. The scorecard links to this objective the metric: *percentage of revenue from new services*.

The relationship between objectives and Key Performance Indicators is not always a one-to-one relationship. One Key Performance Indicator may be used as metrics of two or more objectives. Or, conversely, an objective may need more than one Key Performance Indicator to measure if it has been well achieved.

Key Performance Indicators can be divided into the two following categories.

1- *Leading indicators* which allow to measure actions which are prerequisites for a successful strategy. They are also called *Performance Drivers*. *Leading indicators* are in the *Internal Business Perspective* and *Learning and Growth* because these are the perspectives which support actions which allow the strategy to succeed. They are specific to the business unit.

2- *Lagging Indicators* allow to measure that *Outcomes* expected by the strategy are achieved. They are also called *Outcomes Measures*. *Lagging Indicators* are generic and mainly in the *Financial Perspective* (expected outcomes).

In the *Customer Perspective* we can find both types of indicators. Customer's satisfaction is considered as a *Lagging Indicator* by Kaplan and Norton ([1996a](#): 149) and to measure hours spent with the customer is a *Leading Indicator* ([1996a](#): 153).

Kaplan and Norton conclude ([1996a](#):32): “A good Balanced Scorecard should have an appropriate mix of outcome (lagging indicators) and performance drivers (leading indicators) that have been customized to the business unit's strategy”.

3.2.5. From the Balanced Scorecard to Strategy map

In the section 3.2.2., we have seen how strategy develops objectives in the four perspectives through a Top-Down approach. As soon as the Balanced Scorecard is built, it is possible to verify, this time by a Bottom-Up approach, that cause and effect relationship allow to “close the loop” with indicators. The Figure 9 illustrates this principle by showing how from the performance driver “*Employee skills*” we end up with an outcome measure (Return On Capital Employed_ROCE).

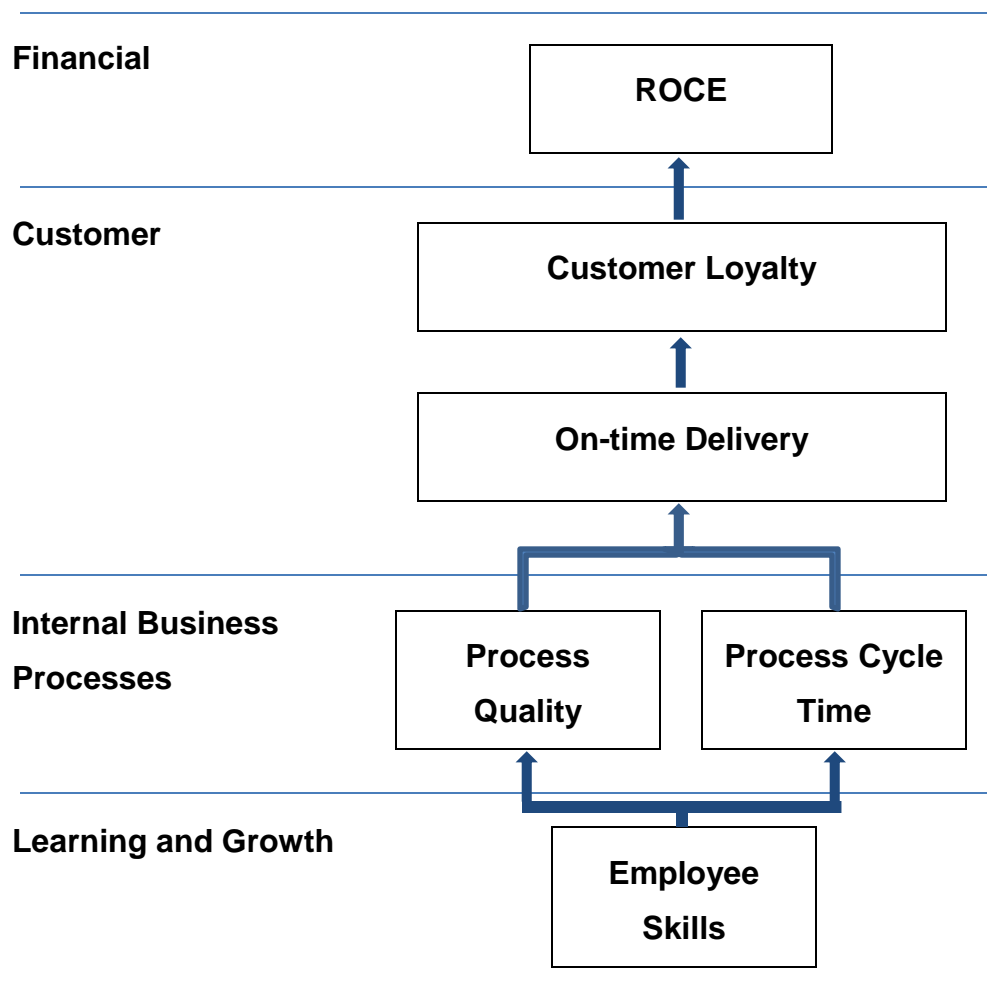


Figure 9: Cause-and-Effect Relationships (Adapted from Kaplan and Norton, [1996a:31](#))

As said by Kaplan and Norton ([1996a: 224](#)): “The cause-and-effect interrelationships in the scorecard help identify the critical drivers that will allow breakthrough performance on important outcome measures, particularly financial and customer ones”.

The representation of all interrelationships constitutes the strategy map of the company. Kaplan and Norton ([2000:69](#)) argue that “the strategy map describes the process for transforming intangible assets into tangible customer and financial outcomes”.

3.2.6. Strengths and weaknesses of the Balanced Scorecard

The success has not prevented the Balanced Scorecard from criticisms. Kaplan ([2012](#)) answered them and underlined the fact that most of the criticisms were based on the first article (1992)

without taking into account their subsequent publications. Nevertheless, when researchers compared the Balanced Scorecard to rivals theories, it was often declared better.

Some of R.S. Kaplan's peers have addressed criticism to the Balanced Scorecard. The first criticism can be considered as a compliment. The Balanced Scorecard is considered to be good for teaching management accounting and an excellent tool for teachers. Kaplan (2012:540) answers that the goal pursued by Norton and himself was above all to "create an innovation in management theory and practice" and if the success was achieved, this "would eventually be noticed by management accounting teachers who could then devise clever ways to expose their students to the concept." The second criticism highlights the difficulty to roll up Balanced Scorecard metrics of Business units at the corporate level. Kaplan (2012) answers that if business units have similar activities, then the rolling up is easy and if business units have different activities it is unnecessary with the exception of financial metrics which are generic and therefore easily rolled up. The third criticism is that it is difficult to decide who is in charge of the strategy. After having recalled the Top-Down approach to define and develop the strategy, Kaplan (2012) answers that it is not a problem for private company but he admits that it is more complex for companies from the public sector. The fourth criticism considers that the Balanced Scorecard is a "myth". Kaplan (2012) reminds about the fact that the BSC is adopted by thousands of companies and is regularly ranked top 10 of management tools.

There are other performance measurement tools. Salem et al. (2012) compare the Balanced Scorecard to other performance measurement tools such as TQM, Performance Pyramid (which includes financial and non-financial Measures), Performance Prism, European Foundation Quality Management (EFQM) Excellence Model, and Management by Objectives (MBO). They conclude that without being the perfect performance measurement tool, the BSC is the best: "Comparing BSC with other performance management system resulted that BSC has the ability over other system to present the different dimensions of the performance. The BSC has been a highly regarded performance measurement tools, which can measure different aspects in the company." (Salem et al. 2012:8)

3.3. Risk Management

3.3.1. Definition of the risk

“Risk” was defined by Kaplan and Garrick ([1981](#):12-13), as “a triplet of scenario, probability of that scenario and consequence of that scenario”. For that it is necessary to answer three questions:

- “1. What can happen? (i.e., what can go wrong?)
2. How likely is it that that will happen?
3. If it does happen, what are the consequences?”

The answer to the first question implies to imagine and characterize the scenario. This is the job of experts who, with their professional experience can predict unwanted events. The causes of an unwanted event must be perfectly defined.

Indeed, the work based on causes will be useful to answer the second question which supposes to determine the frequency, or the probability with which the unwanted event will occur. This probability can be precisely evaluated (failure rate) for technological systems (planes, systems, etc.). When the human factor plays a determinant role, it is more difficult to estimate the probability accurately.

Lastly the third question will allow measuring the severity of the consequences.

This definition has been widely adopted, especially by space activities. NASA (Stamatelatos, [2004](#)) refers directly to the definition of Kaplan and Garrick ([1981](#)).

3.3.2. Risk assessment

About the definition cited above, in each scenario will be associated a probability and a severity. Each unwanted event will be then characterized by a greater or lesser degree of probability that it happens and by a greater or lesser severity of consequences. It is common to represent it as follow:

$$\textit{Probability} \times \textit{Severity} = \textit{Criticality}$$

Thus, an unwanted event with a high probability and catastrophic severity has a criticality much higher than an unwanted event with a low probability and minor severity. Several ranking

systems are available depending on methods but they all embrace two simple principles: usually grades go from 1 to 5 or 5, where 1 represents the lowest probability or the least serious severity. Thus, it is necessary to establish a correspondence scale between these grades and the level of probability of occurrence and the level of severity of unwanted events. So, the criticality will be the product of both and risks will be ordered according to their criticality.

Afterwards, this is the time for actions to mitigate risks. This consists in reducing the criticality to a minimum by acting on the probability of occurrence and/or the severity. A new ranking has to be carried out to verify if with these mitigation actions the risk is now at an acceptable level. These actions have to be managed as fundamental tasks for and by companies.

Many risk analysis methods are based on this principle. Some methods add a new setting which is the possibility to detect that an unwanted event will occur. This is the case for the FMECA (Failure Modes Effects and Criticality Analysis) method which became in 1949 a standard for the American Army (Military Procedure MIL-P-1629) and has been adopted by many other sectors.

Nowadays, the risk analysis is everywhere: in the project, in design, in manufacturing process, in finance, etc. and the notion of risk management has been gradually implemented in companies. About this, please see Magne section 1.1.

The international standard ISO 31000 (2009:2-5) “Risk management – Principles and guidelines” codifies and defines all concepts and applications related to risks and especially:

Risk analysis: process to comprehend the nature of risk and to determine the level of risk

Risk management: coordinated activities to direct and control an organization with regard to risk,

3.4. Combining risk and performance

Beasley et al. (2006) propose to integrate risk-related objectives and their associated measures to the Balanced Scorecard within the context of Enterprise Risk Management (ERM). Authors suggest that ERM should not be isolated in one “silo” but to use the Balanced Scorecard to include risks, and thus creating synergies between performance measurement and risk management. However, it is important to note that at the time there was no direct link between risks and strategic objectives of the Balanced Scorecard, even if authors place risks in the four

perspectives as shown in the example below presenting the Internal Business Processes perspective. (Figure 10)

INTERNAL BUSINESS PROCESSES	
To satisfy our stakeholders and customers, where must we excel in our business processes?	
GOALS	MEASURES
<ul style="list-style-type: none"> · To reduce waste generated across the supply chain · To shorten the time from start to finish across the supply chain · To achieve unit cost reductions 	<ul style="list-style-type: none"> · Pounds of product/scrap sent for disposal · Length of time from purchase of raw material to delivery of product/service to customer · Unit costs per product/service delivered and percentage of supply chain target costs achieved
Enterprise Risk Management Components	
RISK-RELATED GOALS	RISK-RELATED MEASURES
<ul style="list-style-type: none"> · To reduce high probability and impact threats to supply chain processes · To identify specific tolerances for risk for key supply chain processes · To reduce number of exchanges of supply chain risks to other enterprise processes 	<ul style="list-style-type: none"> · Number of employees attending risk management training · Number of process variances that exceed specified acceptable risk tolerance ranges · Extent of risks realized in other functions of enterprise from risk drivers traced to supply chain processes

Figure 10: Example of an Integrated Balanced Scorecard and ERM Framework for Supply Chain Management (Adapted from Beasley et al., 2006:54)

Ernst & Young (2009) notice that for many companies, performance is correctly measured but information about risks related to the strategy “is of much lower quality and sometimes merely anecdotic”. Also, E&Y suggest combining directly risks and performance objectives. Here are three examples they gave and which show that risk is directly linked to the strategic objective.

***Performance:** engage suppliers at a very early stage to increase speed and efficiency of product development / **Risk:** unintentional disclosure of trade secrets and other proprietary technology or knowledge.*

***Performance:** increase sales in emerging markets / **Risk:** increased exposure to political instability or legal uncertainty.*

***Performance:** acquire a competitor and merge it with an existing business unit / **Risk:** organizational stress and reduced employee loyalty.* Ernst & Young (2009:3)

In these examples, risk is driven by the objective itself or more precisely actions implemented to achieve it. The risk does not directly threaten the achievement of the objective but will create a threat to another objective. For example, the willingness to “reduce labor force by 10%” to

achieve the objective of a better cost level can lead to the early departure of “high performers” which can decide to “take the money and run” and thus weaken the objective to excel in business processes. This point of view is very interesting.

Lastly, E&Y introduce the notion of Key Risk Indicators (KRIs) as a complement to Key Performance Indicators (KPIs). In the same way that Kaplan and Norton argue for the KPIs (See section 2.3.3), non-financial KRIs are often leading indicators, whereas financial are lagging indicators. They took-up the Balanced Scorecard in which, for each perspective and each objective, they insert one or several KRIs. See figure 11, example with the business process perspective.

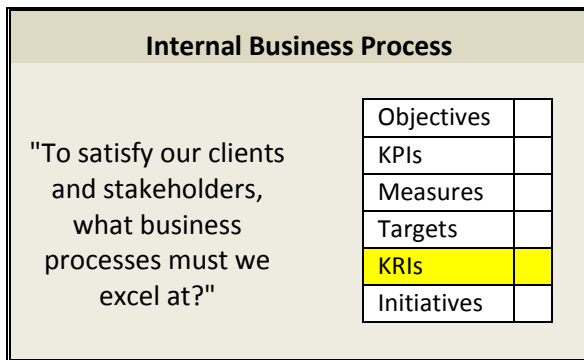


Figure 11: Insertion of KRIs (Adapted from Ernst & Young, 2009:5)

Kaplan (2009) introduces the notion of the risk threatening the achievement of the strategic objective. This is not an induced risk like with Ernst & Young. This time, this is the risk of not achieving the objective itself: “we could build a risk scorecard by first identifying for each strategic objective the primary risk events that would prevent the objective from being achieved”. To illustrate his idea Kaplan takes the example of the learning and growth objective which consists in improving competencies of employees working on strategic business processes. The achievement of this objective can be threatened by a turnover or a large number of retirements. It is therefore necessary to implement metrics such as turnover rates or retirements planned.

Kaplan and Mikes (2011a:5) make a difference between KPIs and KRIs. KPIs “guide a company forward in its journey toward achieving strategic objectives”, whereas KRIs “help predict the events that could impede or reverse the company’s progress in reaching its strategic destination”. However, they consider that both are equally important.

Kaplan and Mikes (2011b:3) conclude that: “The goal of the risk management function is not to inhibit or stop risky projects”. They add that: “An effective risk management function should enable an organization to undertake higher expected-return projects, as it mitigates those higher risks to acceptable levels”.

In my study I adopt the Ernst & Young approach (induced risks) and the Kaplan’s approach (direct risks). They are complementary.

In order to assess risks the following tables can be used.

Table 1: Calculating a risk score (Kaplan, 2009:5)

Probability of the unwanted event

Probability event will occur in the next 36 months	Score	5	4	3	2	1
	Rating	Virtually certain	Likely	Even odds	Unlikely	Remote
		95%	75%	50%	25%	5%

Severity of the unwanted event

Consequence	Score	5	4	3	2	1
		Highly adverse	Adverse	Moderate impact	Some impact	Little impact

3.5. Summary

In this chapter I have presented the logistics and its place within the supply chain management. The design of the Balanced Scorecard has been explained from the strategy to the indicators. Strategic objectives in the four perspectives have been defined and indicators have been explained. The strategy map which is composed of the inter-relations between strategic objectives has been illustrated. One part of this chapter has been devoted to assess strengths and weaknesses of the Balanced Scorecard. Lastly, risk management has been presented as a whole and with its

connection to the strategic objectives of the Balanced Scorecard. First links have been established between the literature, the theory and the topic.

I have chosen this theoretical framework because it seems to be the most adapted to my topic. The logistics is the field I study. The Balanced Scorecard is the tool the best suited to measure the performance. Theory about business unit's strategy has been addressed because it is essential in the definition of the strategic objectives of the Balanced Scorecard. Lastly, risks have been addressed in their connections with the strategic objective of the Balanced Scorecard to show how they can be combined with performance measurement.

4. METHOD

The purpose of this chapter is to present my research methodology. Exposing the method allows being transparent vis-à-vis the reader and will strengthen my arguments, my findings and my conclusions. Then, I define my research philosophy and I describe and discuss my research approach. Lastly, this chapter emphasizes the importance of validity and reliability in research.

4.1. Research philosophy

There is not one but several research philosophies available with rather two extreme positions (Yin, 2010). The first one, realist says that reality is single and consists of a set of facts, and independent of the observer. The second one, relativist says, on the contrary, that reality is multiple and depends on the observer.

Faced with two extreme positions, Yin (2010:13) argues however that the choice to make is not simply black and white: “Most qualitative studies will position themselves along a continuum between these two philosophical extremes.”

Saunders et al (2009) represent research as an onion (Figure 12) that the researcher needs to peel before reaching the central point (data collection and data analysis). This representation is not rigid and Saunders et al (2009:109) argue that “The practical reality is that a particular research question rarely falls neatly into only one philosophical domain as suggested in the *onion*”.

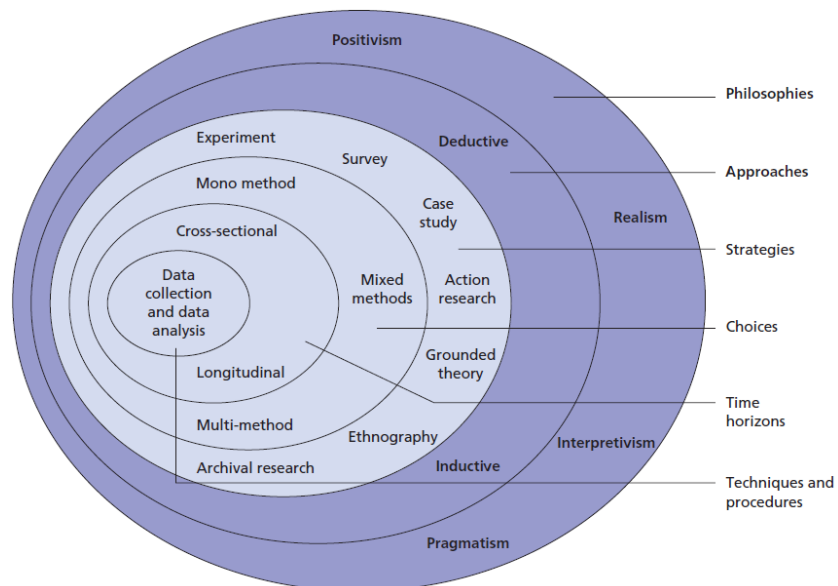


Figure 12: The research “onion” (Saunders et al, 2009:108)

With this in mind Saunders et al. (2009) suggest to the researcher four possible ways to follow based on his view on ontology, epistemology and axiology. (Table 2)

Ontology is “how chosen methods do or do not capture real-world realities and whether there is assumed to be a singular reality or multiply constructed realities” Yin (2010:313)

I assume that the ontology of my research is concerned with the objectivism aspect which “portrays the position that social entities exist in reality external to social actors concerned with their existence” (Saunders, 2009:110). In my case, my view insists on “*the structural aspects of management*” (Saunders, 2009:110).

Epistemology is “The philosophical assumptions you make about the ways of knowing what you know” Yin (2010:18).

In my research, I consider myself as a *resources researcher* as I collect and analyze facts. For me “reality is represented by objects that are considered to be *real*” (Saunders, 2009:112) and “the data collected are far less open to bias and therefore more *objective*” (Saunders, 2009:112).

Axiology leads the researcher to answer one question: what role do my values play in my research choices (topic, philosophical approach, data collection method, etc.)? Saunders et al (2009)

Axiology concerns influences that values of the researcher have on the research choices (Saunders, 2009). Thus “Choosing one topic rather than another suggests that you think one of the topics is more important. Your choice of philosophical approach is a reflection of your values, as is your choice of data collection techniques.” (Saunders, 2009:116). Heron (1996) argues that it would be interesting for the researcher to highlight the connection between personal values of the researcher and the topic of research. The fact is that my general topic fits with my major field of study and my personal interests guide to the two main axes of my research. On one hand the balanced scorecard is a tool that I consider interesting because it helps to structure, indeed tools structure attitudes. On the other hand, I have always been interested in risk management because I like to leave nothing to chance. Saunders et al (2009:108) argue that “The research philosophy you adopt contains important assumptions about the way in which you view the world”.

In the Table 2 my way is represented by the hatched blue background. This leads me to choose the research philosophy that Saunders et al (2009:119) called “Realism”.

Table 2: Comparison of four research philosophies in management research (Saunders et al., 2009:119)

	Positivism	Realism	Interpretivism	Pragmatism
Ontology: <i>the researcher's view of the nature of reality or being</i>	External, objective and independent of social actors	Is objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist)	Socially constructed, subjective, may change, multiple	External, multiple, view chosen to best enable answering of research question
Epistemology: <i>the researcher's view regarding what constitutes acceptable knowledge</i>	Only observable phenomena can provide credible data, facts. Focus on causality and law like generalisations, reducing phenomena to simplest elements	Observable phenomena provide credible data, facts. Insufficient data means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a context or contexts	Subjective meanings and social phenomena. Focus upon the details of situation, a reality behind these details, subjective meanings motivating actions	Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data
Axiology: <i>the researcher's view of the role of values in research</i>	Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research	Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective	Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view
Data collection techniques most often used	Highly structured, large samples, measurement, quantitative, but can use qualitative	Methods chosen must fit the subject matter, quantitative or qualitative	Small samples, in-depth investigations, qualitative	Mixed or multiple method designs, quantitative and qualitative

4.2. Research Process

The following (Figure 13) presents the process of my research, from the topic to conclusions. The first part consists in developing the design through an iterative process going from the topic to the research design. The second part is based on the design and consists in applying the methodology to the data collection and data analysis. The process ends with the discussion and conclusions.

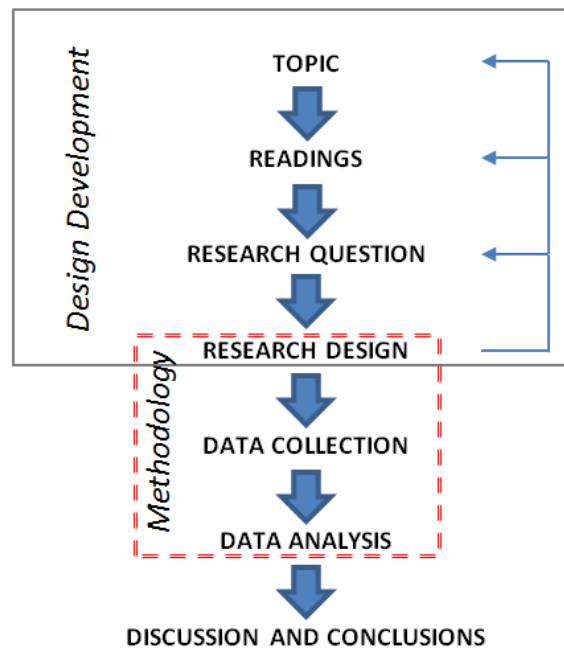


Figure 13: Research process (Adapted from Thietart, [2014:186](#))

4.3. Research Approach

The qualitative approach allows me to have a high flexibility in conducting an in-depth study about the chosen topic. With this approach I can face the unexpected and adapt my study (Bryman, [1999](#)). For example, the research question could be modified midway for results to be from the field (Stake, [1995](#)). There are many definitions of what qualitative research is. For Denzin and Lincoln ([1994:2](#)) “Qualitative research is multimethod in focus, involving an interpretive, naturalistic approach to its subject matter... Qualitative research involves the studied use and collection of a variety of empirical materials—case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts.” And for Creswell ([1998:15](#)) “Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The

researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting.” But Yin ([2010:7](#)) prefers to define the qualitative research by its features. He suggests considering five features which distinguish the qualitative research from other sort of science research: *Studying the meaning of people’s lives, under real-world conditions* _ *Representing the views and perspectives of the people in a study* _ *Covering the contextual conditions within which people lives* _ *Contributing insights into existing or emerging concepts that may help to explain human social behavior* _ *Striving to use multiple sources of evidence rather than relying on a single source alone*. I consider that the following four features may be applied to my study after being adjusted for my research study.

- ✓ Studying the meaning of the actors’ work under real-world conditions,
- ✓ Representing the views and perspectives of the actors in the study,
- ✓ Covering the contextual conditions within which the actors work together,
- ✓ Striving to use multiple sources of evidence rather than relying on a single source alone.

The qualitative approach presents several methodologies and orientations (Yin, [2010](#)). Indeed there are multiple methodological choices and variations when conducting this kind of research. I have decided to conduct a qualitative research without reference to any variants of qualitative research. However, in some point, my research could be assimilated with the action-research variant as the objective of it is to transform reality and produce knowledge from this transformation in collaboration with participants to the study (Hugon et Seibel, [1988](#)). Indeed action-research “...focuses on specific situations and localized solutions. Action research provides the means by which people in schools, business and community organizations; teachers; and health and human services may increase the effectiveness of the work in which they are engaged.” (Stringer, [2007:1](#)). Nevertheless, action-research is a demanding approach and the link between theories and practices can raise issues which are difficult to be dealt with for an inexperienced researcher.

But I believe it is important to outline the clear framework of my methodology while keeping in mind that the research strategy should not be too structured to keep space for modifications or slight changes in the trajectory of the study (Bryman, [1999](#)). Thus, I describe my methodology (research design, data collection method and analysis procedure).

4.4. Research Design

First I will describe the research design which helps to create a logical link between the research question, the collected data and the analysis of the data in order to make sure that empirical findings are aligned with the research question (Yin, [2010](#)). Moreover Yin ([2010:76](#)) argues that “the logic also helps to strengthen the validity of a study, including its accuracy” which is very important when doing qualitative research.

There are no pre-established designs but Yin ([2010:76](#)) proposes to choose several among eight procedures in order to have a solid platform for the research study. In accordance with the topic I have decided to select five main procedures which support my research design.

“Starting a Research Design at the Beginning of a Study” is my **first choice**. I decide to start the research design at the beginning of the study for two reasons. The first one is because I have thought it could help me to structure my approach. The second one has been dictated by the fact that I have at my disposal very useful data coming from a similar field of study (Logistics of offshore upstream operations in Greenland).

Given my research question: “*What Balanced Scorecard can improve performance measurement and manage risks and how to build it?*” and the secondary data (Greenland operations), I have done a predictive model to test the feasibility to build a Balanced Scorecard and to help preparing the interviews. Indeed, according to Collette ([1997](#)) in a deductive approach I can:

- ✓ Create a predictive model
- ✓ Assess this model with results from various studies

Once the predictive model established, it is therefore quite naturally that interviews are being prepared with intent to customize, validate or invalidate the predictive model.

Using of a business unit model is very useful because at the beginning of my study I have rich secondary data about oil and gas logistics of offshore upstream operations in West Greenland. I have decided to build a theoretical model in which the different actors of the logistic chain, with their actions and inter-actions, are considered as a business unit. For this business unit, I try to establish a Balanced Scorecard.

Using of a business unit model provide the following disadvantage to erase boundaries and at the same time inter-organizations problems, but I observed these problems nevertheless arise in interviewees (e.g. communications between OSV - actor 1 - and land - actor 2). On the other hand, using of a business unit model provide the advantage that I can see quickly if objectives and indicators may be shared by the different actors and it secures my approach.

After this stage, I follow a more “academic” approach: collecting data – analyzing data – examining the feasibility to share elements and construct the common BSC. At this time I check if my initial BSC, established under my virtual business unit, was relevant.

My **second choice** is “attending to Sampling” to “Obtain the broadest range of information and perspectives on the subject of study”. Kuzel (1992:37). In my case I have a double sampling, with the secondary data I have a first sampling which is composed of Ship Captains, HSEQ manager, Officers, Deck Officer, Chief Officer, Managing director shipping company, Human Resources manager and Base manager of Oil Company and with the primary data I can complete this sampling, HSEQ Oil spill adviser, Ship Captain, HSEQ manager, Marine operation manager.

“Incorporating Concepts and Theories into a Study” is my **third choice**. The main concept developed in this thesis is the concept of performance measurement through Balanced Scorecard. The link between balanced Scorecard and strategy is also exposed. I also talk about risk management in general but also within the performance measurement framework. Logistics, supply chain and supply chain management are defined along with the offshore upstream logistics including its variety of sectors with a particular focus on supply vessels.

“Planning at an Early Stage to Obtain Participant Feedback” is my **fourth choice**. I established a validation of my predictive model by interviewees, the model was presented at the end of the interviews to know if they would validate, customize or invalidate such a model.

“Being Concerned with Generalizing a Study’s Findings” is my **fifth and last choice**. I do not claim to generalize for everything and everywhere. However, a Balanced Scorecard common to actors of a logistics chain could be exported to other activities in other parts of the world.

These five chosen procedures allow constituting a solid platform for my research.

4.5. Data Collection and data analysis

I can now discuss the choice of the data collection method. I have collected data through interviews (primary data) and other data (secondary data) from scientific paper, books, and a case study carried out by the professor Borch ([2014](#)). Primary data and secondary data are complementary throughout the research process. Indeed, primary data can be completed by secondary data to get a better understanding of the background and help to structure interviews. Risks relating to the objectives of the Balanced Scorecard do not constitute data. Indeed, this is only after having built the strategy map (strategic objectives) that it is possible to identify, evaluate the risks and see how we can mitigate them. Kaplan ([2009](#):4) argues that “The strategy map thus provides a natural framework for identifying, mitigating, and systematically managing the risks to a company’s strategic objectives in an integrated and comprehensive manner”. However, for the primary data, questions about risks are asked to interviewees to highlight their perception about the risk.

4.5.1. Secondary data collection

In the context of my study on performance measurement and related risk factors for the offshore upstream logistics in the Arctic environment, I have access first to data from a case study about an oil and gas exploration campaign carried out in 2010 in West Greenland. These data have been provided by Professor Odd Jarl Borch from the Bodø Graduate School of Business. They have been compiled from the main actors of the campaign: Ship Captains, HSEQ manager, Officers, Deck Officer, Chief Officer, Managing director shipping company, Human Resources manager and Base manager of Oil Company. These data consist of excerpts from interviews (raw data) but also of data which have been processed (papers and presentations).

4.5.2. Primary data collection

To collect the primary data I used interviews. The interview is a method which intends to collect language data (verbal and body) that reflect the conscious and unconscious perception of interviewees. I based my interviews on semi-structured interviews with open-ended question. Saunders et al ([2009](#):320) argue that “In semi-structured interviews the researcher will have a list of themes and questions to be covered...additional questions may be required to explore your research question and objectives given the nature of events within particular organisations”.

The semi-structured interview aims to reveal the opinions and observations of people with specific knowledge and a particular status in the company. To complete this kind of interview the research uses an interview guide composed of questions and topics which have to be developed during the interview. For this reason the data collected are easier to analyze. However, the research remains open to a new topic that could appear during the interview.

The interview guide I have used to organize my interviews is attached, [appendix 3](#). I have based my interview guide on three types of questions (Rubin and Rubin, [1995](#)); main questions which allow me to introduce and guide the interview, additional questions which intend to get better insights, and clarifying questions which are defined during the interview to get more details on a topic of interest. The canvas of my interview guide corresponds to the four perspectives of the Balanced Scorecard. I start with the learning and growth perspective, I continue with the internal business process perspective, then the customer perspective and I finish with the financial perspective. In each of these perspectives I ask one or more general questions (main questions) and (if needed) I ask additional and clarifying questions. For each interviewee I did a short presentation of my research topic and I asked them if I could record the interview and ensure them that their anonymity will be respected.

This type of interview approach is useful for my study because I need to say “enough to be responsive but little enough to preserve the autonomy of the participant’s words” (Seidman cited by Yin [2010](#):134). Therefore “the qualitative interviewing requires intense listening and a systematic effort to really hear and understand what people tell you” Rubin ([1995](#):17). I need to make the effort to understand interviewees “on their own terms and how they make meaning of their own lives, experiences, and cognitive processes” (Brenner cited by Yin [2010](#):135). Thereby, the qualitative interview is well suited to the qualitative approach aims “to depict a complex social world from a participant’s perspective” (Yin, [2010](#):134).

About my sampling, I was helped by the OpLog project to get in contact with the companies. I chose three companies, ENI, Statoil and Troms Offshore. ENI and Statoil are two major Exploration & Production companies. They are both involved in very interesting and challenging oil and gas projects in the Arctic. Indeed, Statoil is operating the Snøhvit gas field in the Barents Sea and developing the Johan Castberg project. ENI is currently focusing on the start-up of the Goliat field. The Goliat FPSO arrived in April 2015 in Hammerfest and the start-up of the Goliat

field is foreseen for mid-2015. Troms Offshore is a shipping company operating as a service supplier for the oil and gas industry. The company owns six PSV and is able to carry out operation in the Arctic.

I selected the following professionals for my interviews: Logistics Supervisor, Material Controller, Drilling Materials Coordinator, HSEQ Oil spill adviser, Ship Captain, two HSEQ Manager, Principal consultant logistics. They are a good representative panel of the offshore upstream logistics chain from onshore base to offshore installation. This sample is composed of operational and managers with a global view on this topic. I contacted all of them. The following answered positively my request: HSEQ Oil spill Adviser, Principal consultant logistics, HSEQ Manager.

Interviews have been conducted by video conference and have been recorded with the permission of the interviewees. However, to respect their anonymity I will not display their names.

4.5.3. Data analysis

According to Yin taken up by Saunders et al ([2009](#):489): “where you have made use of existing theory to formulate your research question and objectives, you may also use the theoretical propositions that helped you do this as a means to devise a framework to help you to organize and direct your data analysis”. Thus, I use the following assumptions to organize and direct my data analysis:

- ✓ First assumption: the logistics chain required to offshore upstream operation in the Arctic environment can be modeled as a “business unit”: specific value chain, specific customer, and specific skills. The business unit’s strategy is based on differentiation focus. See section 3.2.1
- ✓ Second assumption: Data that I have access to should allow creating a set of performance measurements which will take place in a Balanced Scorecard as defined by Kaplan in his various scientific articles and books since 1992.
- ✓ Third assumption: The common Balanced Scorecard including the risks related to the strategic objectives will help in one hand to clarify the strategy of the “business unit” and on the other hand will contribute to support the success of a future campaign in a similar environment. (Action-research perspective).

The figure 14 shows that from the secondary data and by making use of the virtual business unit and the theory I have analyzed the data. I have been able to build a predictive Balanced Scorecard. From this predictive Balanced Scorecard I have built an interview guide to help me collecting primary data. After having conducted the interviews I have analyzed the primary data and drawn the last findings.

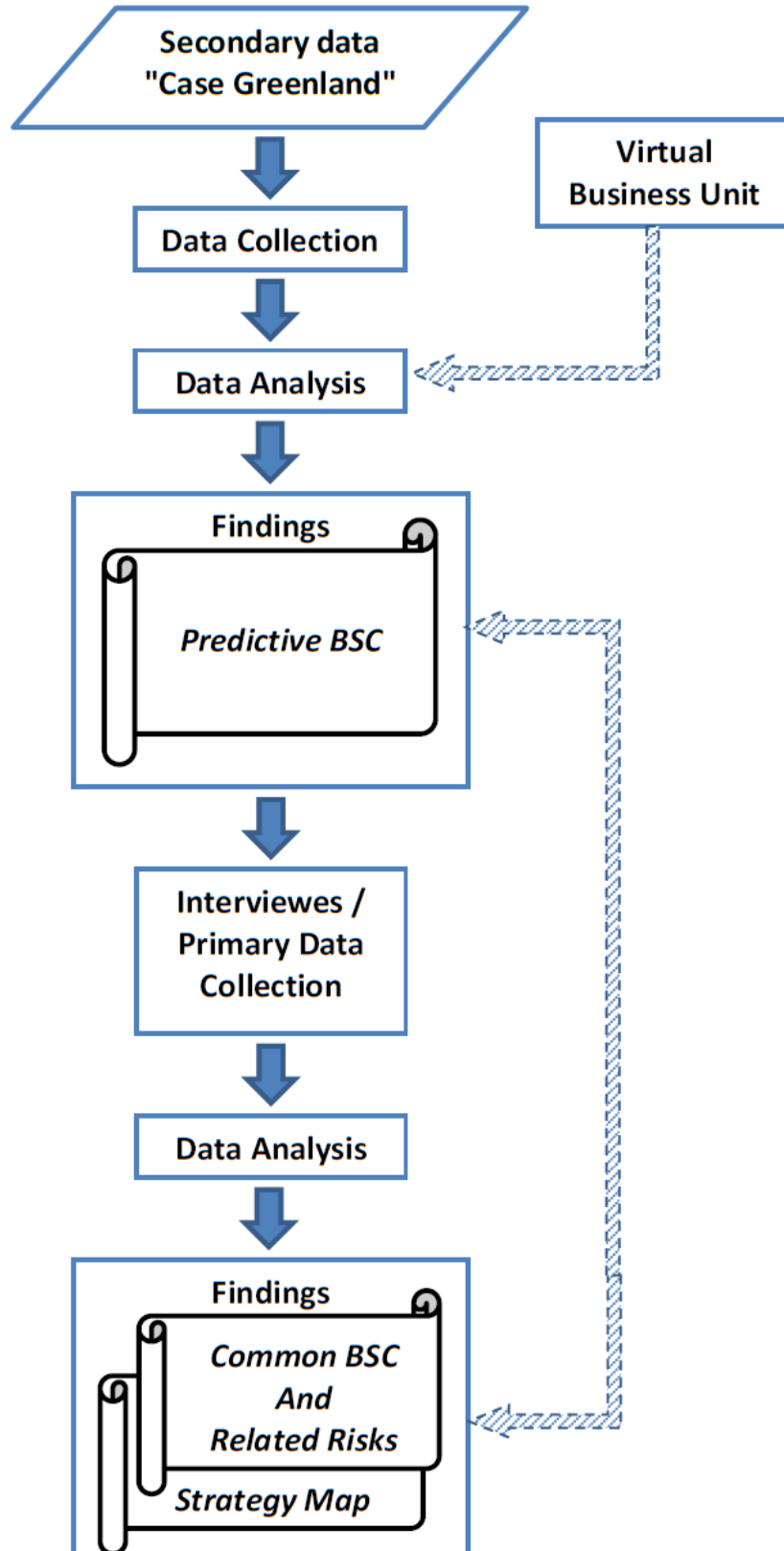


Figure 14: Data collection and Data analysis process

4.5.4. Data analysis

Secondary data are very valuable and I have sorted them out according to Kaplan's perspectives to highlight strategic themes and objectives. Indeed, Kaplan and Norton ([2000:78](#)) claim that "strategic themes reflect what the management team believes must be done to succeed. The themes do not reflect financial outcomes ... or customer outcomes. The strategic themes reflect the executives' view of what must be done internally to achieve strategic outcomes." Thus, I identify strategic objectives and their related indicators, then, I distribute them in the four perspectives in order to build a predictive Balanced Scorecard. Lastly, for each strategic objective I identify and assess the related risks.

The analysis of the primary data has been facilitated by the work done on the secondary data. The matters addressed by interviewees have been compiled according to the four perspectives of the Balanced Scorecard to bring out strategic objectives and related indicators. This analysis has allowed drawing a common Balanced Scorecard and the related strategy map. The work which has been done with interviewees on the risks has been interesting. Thanks to the interviewees' experience it has brought good guidelines to carry out a risk analysis and distinguish risks related to the strategic objectives. This allowed me to move from the common Balanced Scorecard to the common enhanced Balanced Scorecard.

4.6. Validity and reliability of the research

Validity of research involves verifying the global validity of the research by ensuring the internal validity and the external validity of the results. In addition, the validity of the measuring instrument (in my case interviews) should also be verified (Thietart et al., 2014). The reliability consists in verifying if the same research with another researcher would give the same results.

According to Thietart et al. ([2014:298](#)) "When we want assure the validity and reliability, whereas with quantitative research we proceed by test, with qualitative research these are not really test which are carried but rather precautions which are taken to improve the validity and the reliability of the research."

Validity

The internal validity is strengthened by the following precautions; they are inspired by the recommendations given by Thietart et al. ([2014:313](#)), from the example of a real research case about business model:

- ✓ The context of the study is presented (section 1.1),
- ✓ The approach is clearly exposed, see figure 13 research process and figure 14
- ✓ The literature review about the Balanced Scorecard is complete and rival theories examined by other researchers (section 3.2). Risks are presented in a general manner and with their link to the balanced Scorecard (section 3.3),
- ✓ The tool of data collection, that is to say the interview guide is presented ([appendix 3](#)),
- ✓ The transparency is ensured by quotations from interviewed actors, this allows the authenticity of the data ([appendix 4](#)),
- ✓ Lastly, the crossing data coming from two different sources (secondary and primary data) strengthen the internal validity of the results but also the one from the measuring instrument (interviews) which has been used to collect primary data.

External validity, also called *generalizability* (Saunders et al., [2009](#)), is not universal in view of the topic. Nevertheless, this research could easily go beyond the scope of this topic and for example, could be applied generally to a group of actors with a singular value chain and whose the activity could be modelled as a virtual business unit, as it is often the case for the logistics chain.

Reliability

According to Easterby et al. quoted by Saunders et al. ([2009:156](#)) “Reliability refers to the extent to which your data collection techniques or analysis procedures will yield consistent findings. It can be assessed by posing the following three questions:

- ✓ Will the measures yield the same results on other occasions?
- ✓ Will similar observations be reached by other observers?
- ✓ Is there transparency in how sense was made from the raw data?”

About the first question, we can note that the data analysis method which consisted in compiling data, whether primary or secondary data, and sorting them out into the four perspectives of the

Balanced Scorecard has given similar results. About the second question, data collected by Borch ([2014](#)) as well as his observations corroborate for a substantial part my findings. About the third question, as said above concerning the validity, raw data are presented in the [appendix 4](#).

4.7. Summary

In this chapter I have presented my research philosophy “realism” (Saunders et al, [2009](#)), my research process, my research approach as well as my research design. The data collection methods for secondary data (Borch, [2014](#)) and primary data (based on interview of practitioners from the offshore upstream logistics) have been presented as well. The analysis of all data has been described. Lastly, I have explained how I have ensured the validity and reliability of my research.

5. EMPIRICAL FINDINGS

The analysis of all the data has allowed me to get five findings. The first one is a predictive Balanced Scorecard which shows how to build a Balanced Scorecard. The second finding is the common Balanced Scorecard in which appear the strategic objectives, the related indicators as well as the targets and the initiatives. The third finding is the strategy map which allows ensuring consistency between the strategic objectives and the Balanced Scorecard. The fourth finding is the risks related to the strategic objectives. They are identified, assessed and actions to mitigate them are proposed when needed. The fifth finding is the enhanced Balanced Scorecard. The findings are supported by examples which illustrate the link between the interviewees' statements and the findings. Transcription of the interviews can be found in the [appendix 4](#).

5.1. The predictive Balanced Scorecard

This first finding is to establish the predictive Balanced Scorecard and to show how to build it. The predictive Balanced Scorecard is composed of the strategic objective and the related indicators. First risks are identified and assessed.

5.1.1. Strategic objectives and indicators

The first step for building the predictive Balanced Scorecard is to find the strategic objectives and related indicators. This has been done based on statements from the secondary data.

The following statements allow identifying the strategic objective **Suitable equipment** and its related indicators.

- a) “Nobody prepared us for the challenges of limited satellite infrastructure. The communication between land base and the vessel was based on email through satellite link. However, this link fell out frequently. Even worse, we lacked the correction signals for our positioning system. This meant that we did not have the precision that was needed to enter close to the drilling rigs for supplies. Many ships had this problem but nobody communicated this because of the risk of going off hire.” Master ship B
- b) “Luckily we had persons with broad experience as to navigational instruments gained from service with the coast guard. We managed repositioning our bridge resources and

through R&D activity find out about the satellite navigation equipment we needed”
Master mariner on board B

- c) “All the ships had the same problems. However, we did not communicate with the competing shipping companies... We developed competence through our work on satellite communication and positioning that could have been an interesting resource for the other ships included.” Master mariner on board A
- d) “We did not plan for extreme weather during transit in spring time. This was even worse than the North Sea in winter time. Out of the storm the vessel faced a large belt of potential dangerous ice growlers in the operation area.” HSEQ manager shipping company C
- e) “Ice growlers are floating, it is fog, and we cannot see this type of ice on the radar.”
Master mariner ship B
- f) “It must be remembered that once operating in extreme temperatures many systems and components will be operating at or near their design limits.” Logistics Manager, the Norwegian Polar Research Institute

These data allow identifying the strategic objective **Suitable equipment** and its three macro indicators (**More than one satellite system on vessels, “relative position reference system” equipment, and Growlers detection**). This strategic objective is part of the learning and growth perspective.

Similarly, the following statements allow to identify the strategic objective **Safe and effective storage** and its related indicators

- a) “The limited supply base capacity and lack of planning capacity was frustrating. We had to wait for a long time in harbors and there were new orders coming all the time. Then we had to speed up to reach the rig in time. The crew change was also a nightmare. There

was limited airline capacity for all the people transferring to and from the rigs and ships. The operator did not understand the strain on the crew of all this uncertainty. All in all, the lack of infrastructure made this area extremely challenging.” Chief Officer Ship A

- b) “Harbor with limited depth. Extra loading personnel brought up from Nuuk. Loading capacity around 6-7 containers/hour due to limited capacity crane and less experienced crew. 36 hour transit distance 360 nm between Nuuk and Aasiat” (Borch, [2014](#))

These data allow to identify the strategic objective **Safe and effective storage** and its macro indicator (**Compliance between base capacity (physical and operational) and cargo and fluids**). This strategic objective is part of the Internal Business Process perspective.

The following statements allowed me to identify the strategic objective **Staff effectiveness** and its related indicators.

- a) “However, we did not have the right skills. Towing of ice bergs to protect the platforms was difficult from the start.” Deck officer ship D
- b) “Today we see that the crew may have needed some extra training for ice covered waters. We are emphasizing extra courses for this type of operations.” Personnel manager company C
- c) “It must be remembered that once operating in extreme temperatures many systems and components will be operating at or near their design limits. This is also true for crew members who may also quickly near their physical limits. Performance may degrade rapidly with a comparably rapid increase in the risks to personnel, equipment and the ship itself.” Logistics Manager, the Norwegian Polar Research Institute
- d) “I will not go up there again. It is too much stress as to situations that may come out of the blue. Ice growlers are floating, it is fog, and we cannot see this type of ice on the radar. If

something happen rescue is far away. All the uncertainty and the increased complexity are too much without more advanced ships and more empowered crew”. Master mariner ship B

- e) “Luckily we had persons with broad experience as to navigational instruments gained from service with the coast guard.” Master mariner on board ship B

These data allowed me to identify the strategic objective **Staff effectiveness** and its 2 indicators (**Hours of training for operations in the Arctic, Cumulative arctic experience of bridge officers by vessel**). This strategic objective is part of the learning and growth perspective.

By repeating this step with all the secondary data I could distribute the strategic objectives in the following four perspectives:

First perspective _ Learning and Growth: *staff effectiveness* and *suitable equipment* are mandatory, because the strategy is facing dramatic Arctic operations challenges.

Second perspective _ Internal Business Process: many difficulties threaten the smooth running of operations; that is why *process fluidity* is a prior strategic objective for the strategy success. Among difficulties many are not only disrupt of the smooth running of operations but mostly jeopardize lives and equipment. Thus, *work safety* is a transversal strategic objective that secures the whole activity and hence the strategy. *Safe and Effective Storage* and *Effective information system* are mandatory given the first “Greenland experience” and to support the strategy.

Third perspective _ Customer perspective: from the point of view of value analysis; for the customer the value can be consider as $\frac{\text{satisfaction of the need}}{\text{Cost}}$ (Tassinari, [2011](#)). The outcome *Customer satisfaction* is high when satisfaction of needs is close to maximum and cost is minimal. Of course, the strategy is to satisfy the customer, so *Customer satisfaction* is a good feedback for the strategy.

Fourth perspective _ Financial perspective: for Kaplan and Norton ([2006:229](#)) “The financial measures for a supply-chain scorecard are traditional and generic”. They suggest ([2006:231](#)) *achieve profitability* as financial outcome/objective, and propose as related measures *revenue growth* and *margins* in case of differentiation strategy.

5.1.2. The predictive Balanced Scorecard

From the strategic objectives and related indicators in the four perspectives, I can build a predictive Balanced Scorecard. (Figure 15)

	Strategic Objectives	Strategic Measures	
		Lead Indicators	Lag indicators
Financial	Profitability		<ul style="list-style-type: none"> · Revenue growth · Margins
Customer	Customer Satisfaction		<ul style="list-style-type: none"> · Customer satisfaction (intentions and loyalty)
Internal Business process	Safe and effective storage	<ul style="list-style-type: none"> · Compliance between base capacity (physical and operational) and cargo and fluids 	
	Process Fluidity	<ul style="list-style-type: none"> · Scheduling · Pre-established coordination system · Systematic briefing 	<ul style="list-style-type: none"> · OTIF · Rate of rescheduling
	Work Safety	<ul style="list-style-type: none"> · Risk analysis for each main operation 	<ul style="list-style-type: none"> · Incident and accident rate
	Effective Information System	<ul style="list-style-type: none"> · Efficient information network/ <ul style="list-style-type: none"> ○ Between vessels ○ Between land and vessels · Procedure which defines the exchange of information 	
Learning and Growth	Suitable equipment	<ul style="list-style-type: none"> · More than one satellite system on vessels · “relative position reference system” equipment · Growlers detection 	
	Staff effectiveness	<ul style="list-style-type: none"> · Hours of training for operations in the Arctic · Cumulative arctic experience of bridge officers by vessel 	<ul style="list-style-type: none"> · Staff satisfaction
	Innovation and Research	<ul style="list-style-type: none"> · Number of collaboration with research organization · Procurement expenses for new products/Total procurement expenses 	<ul style="list-style-type: none"> · R&D intensity

Figure 15: Predictive Balanced Scorecard

The majority of the indicators of this Balanced Scorecard are macro-indicators (not directly measurable). Indicators of the Balanced Scorecard (mainly leading indicators) show the desired performance.

About strategy in the Learning and Growth perspective, indicators concern:

- ✓ Highly qualified personnel, chosen for its Arctic experience and trained,
- ✓ Technological equipment dedicated to the navigation in the Arctic like for example, a second satellite navigation system (e.g. GLONASS) and also a relative position reference system like the RADius system from Kongsberg.

These kinds of indicators are characteristics of a differentiation focus strategy. In addition to this, in the Internal Process perspective, optimized work processes (Systematic briefing...) and special attention paid to safety which further strengthens the strategy.

Indicators of customer perspective and financial perspective will allow measuring the performance of the strategy in terms of operating outcomes.

5.1.3. Risk related to the strategic objectives of the predictive Balanced Scorecard

Strategic objectives of the predictive Balanced Scorecard allowed me to do an exploratory work on the risks in order to prepare the analysis of the primary data. As said above, section 3.4 *Combining risks and performance*, risks are considered with two different angles, the risk of not achieving a strategic objective (direct risk) and the risk driven by the achievement of the objective itself (Induced risk). Thus, it is only when strategic objectives have been drawn that potential risks threatening the strategy can be identified.

The following development shows how strategic objectives and related risks can be combined.

In the learning and growth perspective the strategic objective “Staff effectiveness” has been found. Improving staff effectiveness will lead to recruit personnel with an “arctic experience”, and to provide special training dedicated to the work in the Arctic.

Linked to the objective “Staff effectiveness”, there is a first direct risk: to have difficulty to recruit personnel with a significant Arctic experience. If this risk proves to be critical (high probability and great severity) it will be necessary to implement an action to reduce the criticality.

There is also an induced risk. Indeed, recruiting experienced personnel, training it, make these personnel a highly wanted worker which can be poached by a competitor. If this risk proves to be critical (high probability and great severity) it will be necessary to implement an action to reduce the criticality.

I choose to treat risks with a criticality superior to 9. That is to say, risks with an “odd” probability and a “moderate impact” severity.

Here is the risk analysis table. (Table 3)

Table 3: Risk analysis table

Strategic Objective: Staff effectiveness					
Risk	Cause	Effect	Probability	Severity	Criticality
R1- Difficulty to recruit personnel with significant Arctic experience	Few workers available with a significant arctic experience	Threats on process fluidity et safety	4	3	12
R2- Turnover	Workers with significant Arctic experience are highly wanted.	Loss of money due to training and threats on process fluidity et safety	3	4	12

An action to reduce the criticality of both risks should be implemented.

- ✓ Risk R1: For this kind of personnel, organize an attractive recruitment policy (Financial incentives, benefits, etc.).
- ✓ Risk R2: For this kind of personnel, organize a Human Resources Management (HRM) policy which will make them want to stay in the company.

By doing this, the aim is to reduce the probability to two (unlikely) for both risks. These actions only impact on causes of the risks, but it is difficult, merely impossible to impact effects in this case. However, by an extensive and sustained training policy, it is hoped to reduce effects of the turnover.

This first finding is composed of:

- ✓ How to construct a Balanced scorecard
- ✓ The predictive BSC
- ✓ How to combine risk and strategic objectives

5.2. The common Balanced Scorecard

The common Balanced Scorecard is my second finding. This is a classic Balanced Scorecard composed of strategic objectives, indicators, targets and initiatives for each of the four perspectives. This is a “common” Balanced Scorecard because the strategic objectives, the indicators and the initiatives are common to all actors.

The following statements allow identifying the macro-indicators of the strategic objective “suitable equipment”.

About “*relative position reference system*” equipment:

- a) “The thing that we are afraid the most is the collision between a vessel and an installation.” Principal consultant logistics
- b) “They want to have some extra features like RADius, equipment like this because the GPS will not be so reliable when they are going further north.” HSEQ Oil spill adviser
- c) “All the vessels we are operating which need to do some stand-by, we have a requirement that their vessels should be DP2 (dynamic position 2). The requirement there, it is that you have 3 independent reference systems and what is typical today that is you have 2 DGPS (Differential Global Positioning System) and another system based on laser, sending lasers and which reflect back, and the third system is the RADius system. So vessels that we will be hiring must have this equipment, and this applies for all new projects.” Principal consultant logistics

About *more than one satellite system on vessels*:

- a) “Yes or Galiléo, that’s also correct, because if you have more than one GPS system, it is not more precise but if one doesn’t work you can rely on the other system.” HSEQ Oil spill adviser
- b) “...what is typical today that is you have 2 DGPS (Differential Global Positioning System)” Principal consultant logistics

About *Growlers detection*:

- a) “We have not decided yet what kind of system we will have on board but of course we will have to install something that will give them the good information while navigating in icy water.” Principal consultant logistics
- b) “If you’re far north it could be a requirement to have ice detection system. But also, a better forecast and ice prediction are very important” HSEQ Manager

A new macro indicator has been highlighted by the interviewees, *vessels winterization*:

- c) “They need heating system, it is mandatory for the vessels now up there.” HSEQ Oil spill adviser
- a) “What I think will be the most important is the winterization so you could have safe access for the crew and personnel. It could snow so you have these tents; ice and ice block or snow falling on containers or equipment, we want no falling objects. It could be dangerous when we are lifting the containers.” Principal consultant logistics
- b) “But I know that for PSVs we will definitely need some winterization for safe access, you can use stairways, and every area safely. So personnel don’t fall and neither objects. We need some de-icing systems.” Principal consultant logistics

These data allowed me to confirm the strategic objective **Suitable equipment** and to identify its four indicators (Number of satellite system, Number of “Relative position reference” system,

Number of ice detection system, is winterization implemented?). This strategic objective is part of the learning and growth perspective.

The following statements allow identifying the macro-indicators of the strategic objective “Staff effectiveness”.

- a) “Regarding the arctic, the best way is that they have knowledge about the Arctic, you need to have like we have trying to do here, we had some workshops and we go through this with the administration personnel so they know what they should expect when they talk about the people working outside.” HSEQ Oil spill adviser
- b) “We need people who have the mission of surveillance (ice, weather etc.), in this case they would need to have very good knowledge about the Arctic region. How to read this kind of satellite data for example. Me for example, I am working in direct contact so I need to know the requirements, types of vessels etc.to have a dialogue as good as possible with the actors on field.” Principal consultant logistics
- c) “Some of the people in the company need to have it [first arctic experience]” HSEQ Oil spill adviser
- d) “In different categories of personnel, for example medical personnel need special arctic training, navigators; all crews should have a sort of introduction to the arctic. HSEQ Manager
- e) “They definitely need to go on specific training about the arctic, because if ice occurs then they need to have knowledge on how to deal with it. Training, training, training, to have the preparedness for Arctic conditions and of course to know how to use the good equipment, to know how to deal with the cold and the darkness.” Principal consultant logistics

- f) “Yes some formations are useful, to understand the challenges and talk the same language.” Principal consultant logistics
- g) “It [satisfaction survey of the staff during and after operation] is not necessary but it could be useful.” HSEQ Manager
- h) “Yes, maybe they should have something like that [satisfaction survey of the staff] as well.” HSEQ Oil spill adviser
- i) “We have already a good dialogue with them in real time...and yes it would be useful to get some kind of feedback and so understand what they experienced.” Principal consultant logistics

These data allowed me to confirm the strategic objective **Staff effectiveness** and to identify its three indicators (Training of operations in the Arctic, Cumulative Arctic experience, Staff satisfaction rating). This strategic objective is part of the learning and growth perspective.

By repeating this step with all the primary data I could distribute the strategic objectives in the four perspectives and built the common Balanced Scorecard.

Please note, this common Balanced Scorecard (Figure 16) reflects the objectives, the indicators, the targets and the initiatives to implement in order to be performant in the offshore upstream logistics in the Arctic. All of this was already or is about to be implemented in companies I interviewed. It would be mistaken to think that companies I interviewed do not have them. This common Balanced Scorecard presents what is necessary to carry out performant offshore upstream logistics operations in the Arctic.

	Strategic objectives	Strategic measures		Initiatives
		Indicators (KPIs)	Targets	
Financial	Profitability	Deviation of planned budget	Decrease by x%	All initiatives taken in internal process and learning and growth
Customer	Customer satisfaction	% of customer complaints escalated to management	Decrease by x% each year	Quality management Pre-defined indicators based on feedbacks All initiatives taken in learning and growth and internal process
Internal business process	Safe and effective storage	Is there compliance between base capacity (physical and operational) and cargo and fluids?	Yes	Examine the compliance of onshore base capacity related to the inbound and outbound logistics Examine compliance between vessels and harbor and wharf and quay cranes
	Process Fluidity	Is there a pre-established coordination system?	Yes	Between onshore base, vessels and installations
		On Time In Full	Increase by 10% each Year	
		Rate of rescheduling less than 48 hours before start-up	Decrease by 10% each year	
		Are there systematic briefing and debriefing?	Yes	
	Work safety	Is there Risk analysis for each main operation	Yes	HSE management HSE workshops between actors
		Are there prevention plans?	Yes	Good working environment with open dialogue
		Incidents and accidents rate	Decrease by x%	
	Effective Information System	Is there an effective information system between all actors?	Yes	Operation support room/department working 24/7 within companies.

		Are there well-defined procedures on how to exchange information?	Yes	Quality assurance
Learning and growth	Suitable equipment for vessels	# of satellite system	2	Investment plan Regulatory watch
		# “relative position reference” system	3 different systems	
		# ice detection system	1	
		Is winterization implemented?	Yes	
	Staff effectiveness	Training for operations in the Arctic	Year 1: 3 weeks Year 2: 2 weeks Year 3: 1 week Next Year: 1 week	Skills assessment Strategic skills plan Workshops Specific formations
		Cumulative arctic experience	Increase by 10% each year	
		Staff satisfaction rating (5 point scale)	Year 1: 3 Year 2: 4 Year 3: 4.5	Year 1: Satisfaction survey Next years: improvements + satisfaction survey
	Innovation and Research	Collaboration with research institutes	Increase by 20% over 3 years horizon	Arctic logistics needs analysis Agreements
		Arctic R&D ratio	Arctic R&D/total R&D	

Figure 16: The common Balanced Scorecard

Compared to the predictive Balanced Scorecard (Figure 15) many changes have been made after the analysis of the primary data. Some indicators have been removed, for example, for the strategic objective *process fluidity* the indicator *scheduling* has been removed because the four other indicators of this objective constitute the performance measurement of *scheduling*. On the other hand, some indicators have been added, for example, for the strategic objective *suitable equipment for vessels* the indicator *is winterization implemented?* has been added. In addition, some changes in form have been made.

Of course, targets related to the indicators have been added and their values have been given as an example to show the articulation between indicators and targets.

Initiatives come from interviewees’ comments and explanations. For example, for the internal business perspective and the objective *effective information system* the initiative *Operation*

support room/department working 24/7 within companies is associated to the indicator *is there an effective information system between all actors?* This initiative has been provided by interviewees who described the system which gives them satisfaction in their company:

“Statoil marine follows in real time, they have an overview of the position of the vessels and they also have this dialogue with the different installations, so they are coordinating vessels. Statoil operation is a 24/7 operation”, Principal consultant logistics.

“We have a operation support room, they are talking regarding the operational support on the rig and then you have for the maritime logistics on board the rig which is talking directly to the logistics here (they are located next to the support room). It is probably the same in all oil companies”, QHSE Oil spill adviser.

Lastly, this common Balanced Scorecard is composed of 21 indicators. Kaplan and Norton ([1996a](#)) believe that the number of indicators should be between 16 and 25. These indicators are usually macro-indicators. If necessary, each of them should be fuelled by a set of measurable indicators.

5.3. The strategy map

As Kaplan and Norton ([1996b](#):77) argue: “It is important to build a scorecard that accurately tells the story of a business unit's strategy”. For this purpose I verified the coherence of my Balanced Scorecard by drawing the strategy map (Kaplan and Norton, [2000](#)) representing the strategy's generic architecture. (Figure 17)

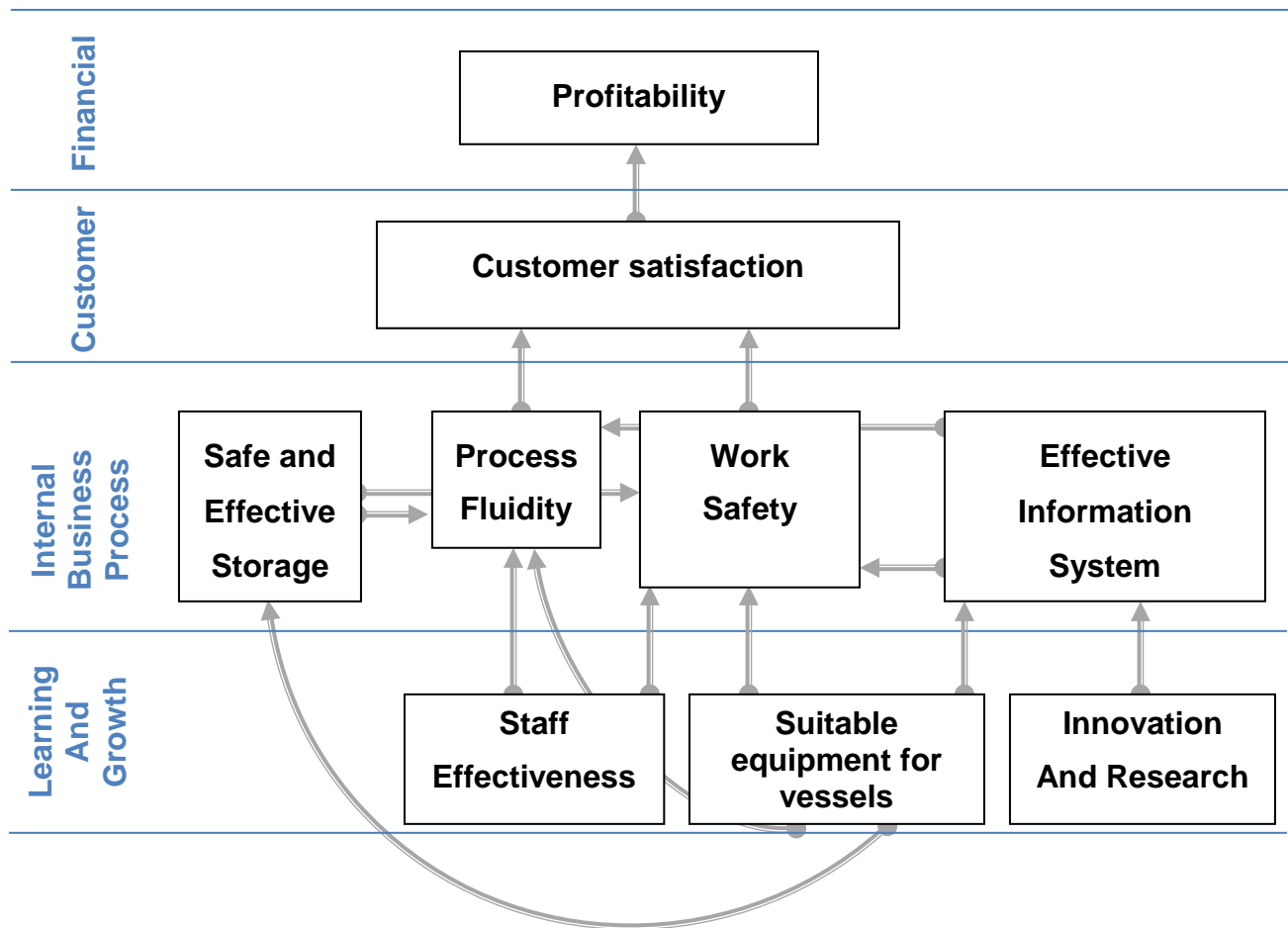


Figure 17: Strategy map

We can see that the objectives of the learning and growth perspective contribute to the objectives of the internal business process perspective. Those inter-relations reinforce the objectives. For example, in the internal business process perspective, the strategic objective *work safety* is fuelled by *staff effectiveness* and *suitable equipment for vessels* which are objectives of the learning and growth perspective, but also by *effective information system*, *Process fluidity* and *safe and effective storage* which are the objectives of the internal business process perspective.

Kaplan (2009:4) argues: “The strategy map thus provides a natural framework for identifying, mitigating, and systematically managing the risks to a company’s strategic objectives in an integrated and comprehensive manner”.

5.4. The related risks

As shown with the strategy map, the customer satisfaction and the finance are the results of both the internal process perspective and learning and growth perspective. Kaplan and Norton (2000:69) argue that “the strategy map describes the process for transforming intangible assets into tangible customer and financial outcomes”. Thus, the work on the risks will focus on the learning and growth perspective and the internal business process perspective. About the customer perspective and financial perspective, the unwanted events come from the learning and growth and internal business perspectives. The following Tables 4, 5, 6 and 7 have been built based on interviewees’ comments and explanations.

Table 4: Risks related to the objectives of the learning and growth perspective

Strategic Objective: Innovation and Research						
Risk	Cause	Effect	P	S	C	Risk mitigation
R1- Budget reduction	Context: oil and gas prices	Reduction of the innovation and research	4	3	12	Focus on strategic topics

P= Probability; S= Severity; C= Criticality

Strategic Objective: Staff effectiveness						
Risk	Cause	Effect	P	S	C	Risk mitigation
R2- Difficulty to recruit personnel with significant Arctic experience	Few workers available with a significant arctic experience	Threats on process fluidity and safety	4	3	12	Organize an attractive recruitment policy (Financial incentives, benefits, etc.).
R3- Turnover	Workers with significant Arctic experience are highly wanted.	Loss of money due to training and threats on process fluidity and safety	2	3	6	C < 9 no mitigation action

Strategic Objective: Suitable equipment for vessels						
Risk	Cause	Effect	P	S	C	Risk mitigation
R4- Not having the best equipment	Cost	Threats to process fluidity, safety and staff satisfaction	2	3	6	C < 9 no mitigation action

Table 5: Risks related to the objectives of the Internal Business Process perspective

Strategic Objective: Work safety						
Risk	Cause	Effect	P	S	C	Risk mitigation
R5- Danger for personnel working outside	Weather conditions	Threats to physical integrity of workers Process interruption	3	4	12	Winterization which increases personnel safety

Strategic Objective: Process fluidity						
Risk	Cause	Effect	P	S	C	Risk mitigation
R6- Process interruption	Technical problem Weather conditions Planning errors	Snowball effect Dissatisfied customer Increase of the cost Delays	4	4	16	Good planning Better weather forecast Higher focus on maintenance

Strategic Objective: Safe and effective storage						
Risk	Cause	Effect	P	S	C	Risk mitigation
R7- Unsafe storage	No compliance with established procedures	HSE incidents	4	4	16	Quality insurance HSE audits
R8- Non effective storage	Poor planning Poor assessment of needs Poor stock management	Snowball effect Dissatisfied customer Increase of the cost Delays	4	4	16	Formation/training for operators

Strategic Objective: Effective information system						
Risk	Cause	Effect	P	S	C	Risk mitigation
R9- Network interruption	Technical problem	Process fluidity affected Safety affected	3	4	12	Multi systems Higher focus on maintenance

Table 6: Risks related to the objectives of the Customer perspective

Strategic Objective: Customer satisfaction						
Risk	Cause	Effect	P	S	C	Risk mitigation
R10- Not OTIF	Technical problem Weather conditions Planning errors	Dissatisfied customer	4	4	16	Good planning Better weather forecast Higher focus on maintenance

Table 7: Risks related to the objectives of the Financial perspective

Strategic Objective: Profitability						
Risk	Cause	Effect	P	S	C	Risk mitigation
R11- Less profitability or even losses	Dissatisfied customer Extra costs	Dissatisfied shareholders	4	4	16	Improve process fluidity and work safety to obtain customer satisfaction and to avoid extra costs

The questioning about risks has been sometimes difficult despite the best effort of the interviewees. All are not used to this kind of exercise, and the analysis of the risks gives better results when done within a group of person. Nevertheless, from their experience they could give me very useful answers. For example, according to the secondary data I had identified the risk of turnover as a critical risk to the strategic objective *staff effectiveness*. Interviewees have been unanimous in telling me that it is not the case because the turnover is low and that leavings can be offset.

5.5. The common enhanced Balanced Scorecard

The fifth and last finding is the enhanced Balanced Scorecard. It brings together and arranges all the previous findings. It shows what could be performance measurement combined with risk management for the offshore upstream logistics. (Figure 18)

	Strategic objectives	Strategic measures		Initiatives	Risk (KRIs)	Causes	Effects	P	S	C	Risk mitigations
		Indicators (KPIs)	Targets								
Financial	Profitability	Deviation of planned budget	Decrease by x%	All initiatives taken in internal process and learning and growth	Less profitability or even losses	Dissatisfied customer Extra cost	Dissatisfied shareholders	4	4	16	Improve Process fluidity and work on safety to get customer satisfaction and to avoid extra costs
Customer	Customer satisfaction	% of customer complaints escalated to management	Decrease by x% each year	Quality management Pre-defined indicators based on feedbacks All initiatives taken in learning and growth and internal process	Not OTIF	Technical problem Weather conditions Planning errors	Dissatisfied customer	4	4	16	Good planning Better weather forecast Higher focus on maintenance

	Strategic objectives	Strategic measures		Initiatives	Risk (KRIs)	Causes	Effects	P	S	C	Risk mitigations
		Indicators (KPIs)	Targets								
Internal business process	Work safety	Is there Risk analysis for each main operation	Yes	HSE management HSE workshops between actors	Danger for personnel working outside	Weather conditions	Threats to physical integrity of workers Process interruption	3	4	12	Winterization which increases personnel safety
		Are there prevention plans?	Yes								
		Incidents and accidents rate	Decrease by x%								
	Effective Information System	Is there an effective information system between all actors?	Yes	Operation support room/department working 24/7 within companies.	Network interruption	Technical problem	Process fluidity affected Safety affected	3	4	12	Multi systems Higher focus on maintenance
		Are there well-defined procedures on how to exchange information?	Yes	Quality assurance							

	Strategic objectives	Strategic measures		Initiatives	Risk (KRIs)	Causes	Effects	P	S	C	Risk mitigations
		Indicators (KPIs)	Targets								
Internal business process	Safe and effective storage	Is there compliance between base capacity (physical and operational) and cargo and fluids?	Yes	Examine the compliance of onshore base capacity related to the inbound and outbound logistics	Unsafe storage	No compliance with established procedures	HSE incidents	4	4	16	Quality insurance HSE audits
				Examine compliance between vessels and harbor and wharf and quay cranes	Non effective storage	Poor planning Poor assessment of needs Poor stock management	Snowball effect Dissatisfied customer Increase of the cost Delays	4	4	16	Formation and training for operators
	Process Fluidity	Is there a pre-established coordination system?	Yes	Between onshore base, vessels and installations	Process interruption	Technical problem Weather conditions Planning errors	Snowball effect Dissatisfied customer Increase of the cost Delays	4	4	16	Good planning Better weather forecast Higher focus on maintenance
		On Time In Full	Increase by 10% each Year								
	Rate of rescheduling less than 48 hours before start-up	Decrease by 10% each year									
	Are there systematic briefing and debriefing?	Yes	Briefing during planning, before start-up, during operations Debriefing after the end of the operation								

	Strategic objectives	Strategic measures		Initiatives	Risk (KRIs)	Causes	Effects	P	S	C	Risk mitigations
		Indicators (KPIs)	Targets								
Learning and growth	Suitable equipment for vessels	# of satellite system	2	Investment plan	Not having the best equipment	Cost	Threats to process fluidity, safety and staff satisfaction	2	3	6	C < 9 no mitigation action
		# “relative position reference” system equipment	3 different systems	Regulatory watch							
		# ice detection system	1								
		Is winterization implemented?	Yes								
	Staff effectiveness	Training for operations in the Arctic	Year 1: 3 weeks Year 2: 2 weeks Year 3: 1 week Next Year: 1 week	Skills assessment Strategic skills plan Workshops Specific formations	Difficulty to recruit personnel with significant Arctic experience	Few workers available with a significant arctic experience	Threats on process fluidity and safety	4	3	12	Organize an attractive recruitment policy (Financial incentives, benefits, etc.)
		Cumulative arctic experience	Increase by 10% each year		Turnover	Workers with significant Arctic experience are highly wanted.	Loss of money due to training and threats on process fluidity and safety	2	3	6	C < 9 no mitigation action
		Staff satisfaction rating (5 point scale)	Year 1: 3 Year 2: 4 Year 3: 4.5	Year 1: Satisfaction survey Next years: improvements + satisfaction survey							
	Innovation and Research	Collaboration with research institutes	Increase by 20% over 3 years horizon	Arctic logistics needs analysis Agreements	Budget reduction	Context: oil & gas prices	Reduction of the innovation & research	4	3	12	Focus on strategic topics
		Arctic R&D ratio	Arctic/total R&D								

Figure 18: The common enhanced Balanced Scorecard

5.6. Summary

The first finding is the predictive Balanced Scorecard and the way to build it. I also took the opportunity to do a preliminary work on the risks. The second finding is the common Balanced Scorecard with the strategic objectives. For each strategic objective, several indicators which allow measuring performance have been found. For each indicator, targets have been defined as well as the initiatives necessary to carry out the performance. The third finding is the strategy map which shows the generic architecture of the elaborated strategy is my second finding. The strategy map shows the inter-relations between the various strategic objectives in the several perspectives of the Balanced Scorecard. The fourth finding is the risks related to the strategic objectives. They have been identified as well as their causes and their consequences. Each of those risks has been assessed. Each risk with a criticality higher than the threshold level has been associated to an action to mitigate the risk. The fifth finding is the common enhanced Balanced Scorecard which combines Key Performance Indicators and Key Risk Indicators.

6. DISCUSSION

This chapter reviews the findings presented in the previous chapter. Links with the current theories are examined and I show how the findings answer my research question. The discussion follows the same structure as my findings and thus includes the following themes: Predictive Balanced Scorecard and related risks, Common Balanced Scorecard, Strategy map, Related Risks, and Common Enhanced Balanced Scorecard. Then, I discuss the limitation and weaknesses of my study with their causes and their consequences. After that, I present the recommendations for future research which could extend my study. Lastly, I conclude by presenting the major theoretical contributions and empirical implications of my study.

6.1. Discussion

Predictive Balanced Scorecard and related risks

This first Balanced Scorecard, built from secondary data, has allowed identifying the strategic objectives as well as the related indicators. This is a preliminary result but it is very important because it allows a first verification of the feasibility to build a Balanced Scorecard for the logistics chain being studied. This predictive Balanced Scorecard is academically aligned with what Kaplan and Norton propose: Strategic objectives as well as their related indicators fit well in the four perspectives according to the theory presented in chapter three. On the other hand, the top-down approach as defined by Kaplan and Norton (1993) is supposed to start by defining the strategy of the business unit. This could not have been done for practical reasons, for example the limited timeframe. Nevertheless, the strong coherence between the strategy highlighted by the secondary data and the strategy which will be featured by the primary data valid all the strategic objectives.

About the risks related to the strategic objectives, here again this first finding allow to verify it is possible from the strategic objectives to carry out a risk analysis as recommended by Kaplan (2009). In a broader perspective, the work on the risks has been carried out based on the theory of Kaplan and Garrick (1981) which states that the risk is “a triplet of scenario, probability of that scenario and consequence of that scenario” (Kaplan and Garrick, 1981:12-13). The ranking of the probability and the severity to assess the criticality has been done as recommended by the FMECA (Failure Modes Effects and Criticality Analysis) which became a standard for the American Army (Military Procedure MIL-P-1629).

These preliminary findings are the basis for all my findings but they also facilitate the acquisition of the following findings.

Common Balanced Scorecard

This second Balanced Scorecard has been built from the predictive Balanced Scorecard and the primary data collected through interviews I conducted. This common Balanced Scorecard adds the operational dimension to the academic dimension of the predictive Balanced Scorecard. To do so, it completes the strategic objectives and their related indicators with targets and initiatives in order to propose a goal to achieve and the actions necessary for achieving it. This type of Balanced Scorecard is aligned on the Balanced Scorecard presented by Kaplan and Norton (1996b) and used by Kaplan and Norton (2000) in their case studies in the industry and services. This operational dimension is also driven by interviewees. Indeed, thanks to their experience they bring this common Balanced Scorecard to life. About the “common”, its reality can be seen by the like-mindedness of the interviewees, both interviewees from the secondary data and primary data. This can be demonstrated with a simple example. The strategic objective “staff effectiveness” is present in the statements of five (out of eight) interviewees of the secondary data (see section 5.1) and in the statements of each of the three interviewees of the primary data (see section 5.2). The notion “common” is important as Kaplan and Norton (1996a:173-175) develop the idea to establish a common Balanced Scorecard in the case of joint-ventures and alliances which have a common strategy. In my study, the various companies are simply linked by customer - supplier type contracts, which do not presume of a common strategy. Thereby, my findings go further than the current theory.

Strategy map

“A strategy map describes the process of value creation through a series of cause-and-effect linkages among objectives in the four Balanced Scorecard perspectives” (Kaplan and Norton, 2008:98). The representation of the strategic objectives in the Balanced Scorecard organizes the performance measurement through indicators (KPIs) but this view is static. In presenting the inter-relations between strategic objectives, the strategy map gives a dynamic view. The strategy map provides the opportunity to verify the consistency of all strategic objectives by establishing between them logic links that run through the four perspectives. All strategic objectives must be

included and all must participate to the logical links which from the *learning and growth perspective* lead to the *financial perspective*. My third finding, the strategy map complies with these criteria. This strategy map is built and organized as recommended by Kaplan and Norton ([2000](#)).

Related Risks

This fourth finding is the final result regarding the risks which threaten the achievement of the strategic objectives and thus the performance. As said before, this work has been carried out in accordance to the classical risks analysis method. The great interest has been to be able to accomplish this work with the interviewees which, given their experience, have supported the identification of the risks but also the ranking of their probability and severity. This is all the more noteworthy because, according to Gentry Lee, the chief systems engineer at Jet Propulsion Laboratory: “Risk mitigation is painful, not a natural act for humans to perform,” (Quoted by Kaplan and Mikes, [2012](#):52).

These risks will represent the Key Risk Indicators (KRIs) and thus will “help predict the events that could impede or reverse the company’s progress in reaching its strategic destination” Kaplan and Mikes ([2011a](#):5). The cause-and-effect relation for each risk led us to the same relation establishes by the strategy map. For example, an issue of process fluidity (internal business process) may appear to be caused by a technical problem related to the suitable equipment (learning and growth perspective) and may lead to a customer who is dissatisfied (customer perspective). This cause-and-effect linkage is the same that the strategy map shows between strategic objectives. This explains why it is easy to combine KRIs and KPIs in the enhanced Balanced Scorecard which is my fourth.

Common Enhanced BSC

This is the final finding of my study. It presents a comprehensive overview of the strategic objectives and related indicators (KPIs), the targets and the initiatives. In addition to this, the risks which threaten the achievement of the objectives (KRIs) are outlined as well as their effects and causes. These risks are assessed and when necessary, actions to mitigate them are implemented. Therefore, this common enhanced Balanced Scorecard complies with the model proposed by Kaplan and Mikes ([2012](#)) even if available models are rare because the combination

of performance measurement and risk management is rather new. The use of this type of tool in a process of performance's improvement can bring a lot of benefits. In our case, where actors are many, it can have a unifying role. In addition, for each company it is a very good vehicle for internal communication. Kaplan (2008:141) argues that "Communication of mission, values, vision, and strategy is the first step in creating motivation among employees. Executives can use the strategy map and Balanced Scorecard to communicate strategy... This new representation of strategy communicates to everyone what the organization is about: how it intends to create long-term value and how each individual can contribute to organizational objectives."

The field of study is the offshore upstream logistics, thus, it is tempting to compare the use of a common enhanced Balanced Scorecard to the Supply Chain Risk Management (SCRM). The Supply Chain Risk Management covers a much wider field and is interested into many aspects. For example, Singhal, Afarwal and Mittal, (2011) consider that attention must be paid to five categories of risks, those related to: operational characteristics, market characteristics, business/strategic characteristics, product characteristics and others. This approach is extremely exhaustive while the approach proposed by Kaplan, Norton and Mike goes directly to the essential. It starts by identifying the strategic objectives, and then looks at how to measure the performance to achieve the strategic objectives and it also ensures the mitigation of the risks which threaten the achievement of the strategic objectives. The aim of this discussion is not to compare one approach the other, but simply to shed lights on their mains differences.

6.2. Limitations

I have to mention the limitation related to my work. First of all, concerning the strategy I could not interview top management whose function, among other, is to define the strategy. I was therefore led to propose a strategy for the virtual business unit in order to build the Balanced Scorecard. Given the context, I have chosen the differentiation focus strategy and this choice has subsequently been validated (see above).

Moreover, the customer perspective and the financial perspective have not been processed with the same intensity as the learning and growth perspective and the internal business perspective. The reason is that I could not interview the right people, like for example staff working in the financial department. But we should keep in mind that customer and financial are outcomes from

learning and growth perspective and internal business perspective. The customer perspective and the financial perspective do not have an active role in the strategy of the company.

Lastly, the sample could have been larger. It is not easy to get interviews and without the help of the OpLog project it would have been even more difficult. However, we can consider that the size of my sample is balanced by the large number and the variety of the secondary data.

6.3. Recommendation for Future Research

Further works could go deeper in defining the strategy and related strategic objectives. For that purpose it could be necessary to get into all layers of the companies involved in the offshore upstream logistics, from top management to operators. The work on indicators should also be further developed and deepened, especially to set up more realistic targets related to the context. Quality department within companies could of course provide a very valuable contribution. For this purpose it could be necessary to conduct a full action-research over a longer period of time.

6.4. Conclusions

In this section, I present the conclusions based on my findings. I show how my findings contribute to the theory and what their empirical implications are. These conclusions relates to my research question:

Offshore upstream logistics in the Arctic: what Balanced Scorecard can improve performance measurement and manage risks and how to build it?

The main conclusions of my study are as follows,

The Balanced Scorecard which improves the performance and controls the risks for the offshore upstream logistics in the Arctic is a Balanced Scorecard including strategic objectives with the following characteristics:

- ✓ Common to all actors of the logistics chain,
- ✓ Supported by both Key Performance Indicators and Key Risk Indicators.

This is why it can be qualified as *common enhanced Balanced Scorecard*.

To construct this common enhanced Balanced Scorecard, it is necessary:

- ✓ To model the offshore upstream logistics chain composed of various actors as a business unit,
- ✓ To draw a common strategy for these various actors, that is to say, to define a set of common strategic objectives and to show the inter-relations between them in a strategy map,
- ✓ To connect indicators, targets and initiatives to these common strategic objectives,
- ✓ To identify the risks threatening the achievement of the strategic objectives, to assess these risks and to implement actions to mitigate them.

The practical implications of the common enhanced Balanced Scorecard on an offshore upstream logistics chain are of interest. Indeed, first, the strategic objectives and related indicators would be defined in the customer and financial perspectives by the top management. Then, the actors of the logistics chain would define the strategic objectives and the related indicators. Of course, the top management would be implicated in this process to validate the requirements. That is why the Balanced Scorecard appears to be a tool which encourages relationships within companies, and increases the motivation. About inter-relations between companies which compose the logistics chain, this work around the Balanced Scorecard should allow a better understanding of the other actors and thus enabled the success of the whole logistics chain. Lastly, the work on the risks related to the strategic objectives and especially these from the internal business perspective is extremely interesting because the risk analysis allows the whole logistics chain to benefit from the experience and competencies of the operational staff.

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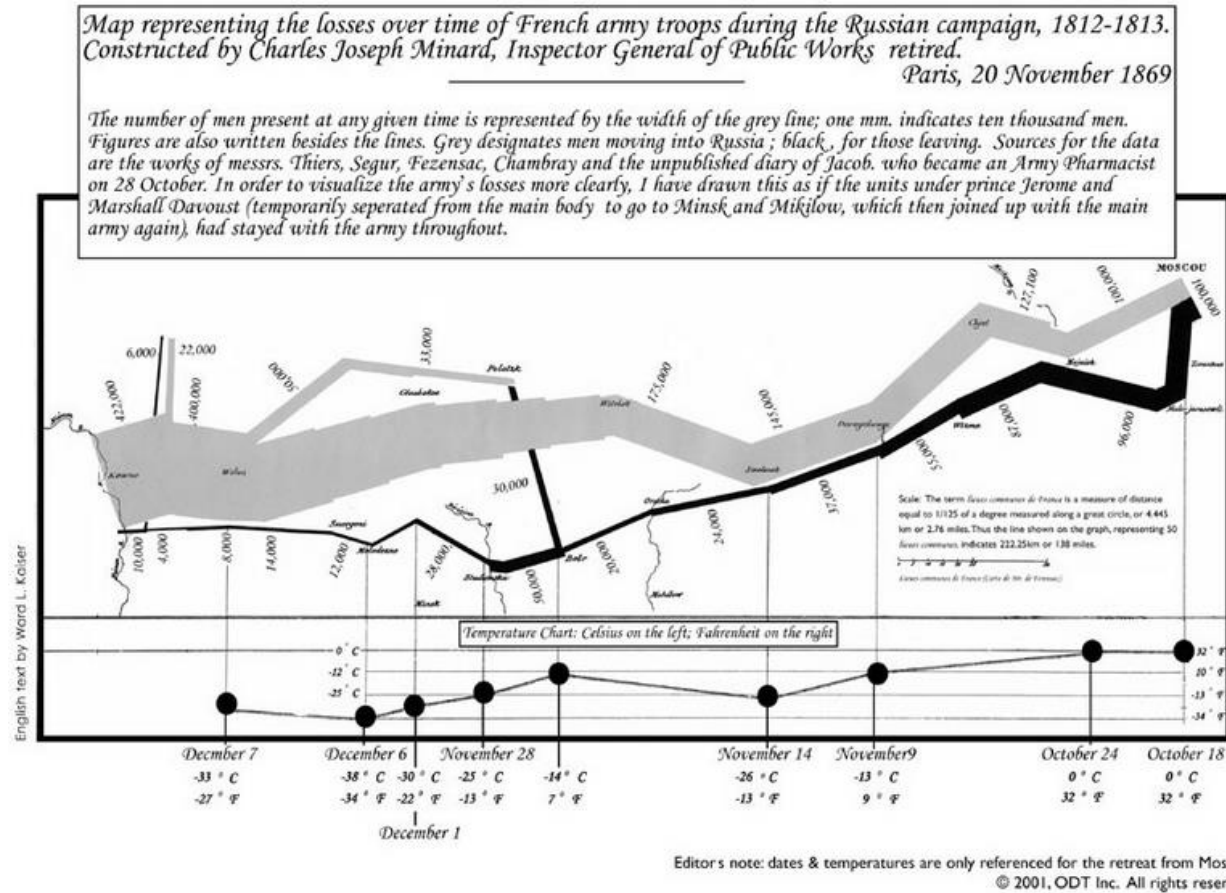
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APPENDIX

Appendix 1: Minard's map of Napoleon's Russian campaign. This graphic has been translated from French to English and modified to most effectively display the temperature data.



Source: <http://www.datavis.ca/gallery/minard/minard-odt.jpg>

This graphic shows that heavy human losses of the Great Army have been proportional to the distance from the base and to extreme temperatures of the Russian winter.

Appendix 2: Offshore supply vessels

- ✓ Tug: whose function is to tow. They have powerful engines



Maerks Tender (source: Marine traffic + nom photographie)

- ✓ Platform Supply Vessel (PSV)*:



PSV allow the transportation of equipment, materials (1000 m³ liquid mud for the Bourbon Calm), drinkable water (500 m³) and personnel between onshore and offshore installations.

*Offshore Supply Vessel (OSV) for other authors. See previous explanations.

Bourbon calm (source: Marine traffic + nom photographie)

- ✓ Anchor Handling, Towing, and Supply vessel (AHTS):



With their powerful engines and winches, AHTS are suitable for operations which require a lot of power as towing and relocating drilling rigs.

Maerks achiever (source: Marine traffic)

- ✓ *Fast Support Vessel (FSV)*: Their capacity to navigate fast allows them to transport offshore workers. As said before, this function is not really usefull in the Barents Sea as the crew transportation will be done by helicopter (INTSOK, 2014)
- ✓ *Mini-supply vessel (MSV)*; and Lift boat. These two categories will not be part of my study.
- ✓ Diving Support Vessel



Other authors like for example Rowbotham (2014) distinguishes Diving Support Vessels (DSV) which are useful for the development phase of subsea installations and decommissioning.

Technip Deep Explorer (delivery in 2016)

Appendix 3: Interview guide

1-Interviewee

Main questions	Additional questions	Clarifying questions
<p>1.1-Job position What is your job? Can you briefly describe your main missions?</p> <p>1.2-Experience Can you briefly talk about your Arctic experience?</p>	<p>Have you ever been involved in logistics operations with several actors in the workable arctic and the stretch Arctic</p> <p>What was your specific role?</p>	<p>How many times?/Total number of years of company experience in such operations?</p>

2-Learning and Growth (innovation)

Main questions (depend on the interviewee)	Additional questions (if necessary)	Clarifying questions (to be defined during interviews)
<p><u>2.1-Equipement and technologies :</u></p> <p>For logistics operations, what is the necessary specific equipment to operate and work under the best possible conditions in the workable (Goliat) and the stretch arctic (Bear Island)?</p>	<p>2.1.1-What about the extra vessel characteristics/capacity when going to High Arctic areas</p> <p>2.1.2-I have read that vessel’s captains would like to have “relative position reference system” equipment (like RADius) and that more than one satellite system on their vessels are necessary. Do you consider it necessary?</p> <p>2.1.3-if it would be necessary to navigate in icy water, do you consider that Growlers detection systems must be obligatory?</p> <p>2.1.4- what about Personal Protective Equipment?</p>	<p>2.1.1.1-if yes, could you precise? If not, why?</p>
<p>We have just looked at the appropriate equipment for operations in this region. According to you, what are the events that could jeopardize the acquisition and using of this equipment? <i>Risk assessment, probability (1 to 5) and severity (1 to 5) the Cost??</i></p>		
<p><u>2.2-Staff effectiveness</u></p> <p>a- According to you, what are the best ways to improve administration staff effectiveness (and crew on board)?</p> <p>b- According to you, what are the best ways to improve crew on board effectiveness?</p>	<p>2.2.1-Do you think that a first arctic experience is an advantage?</p> <p>2.2.2-Do you think that specific arctic trainings/formations would be necessary?</p> <p>2.2.3-What are the “elements of comfort” which would contribute to a better effectiveness of the staff?</p> <p>2.2.4-Do you think it is useful to implement a satisfaction survey of the staff during and after operations?</p>	<p>2.2.1.1-If yes or no, why?</p> <p>2.2.2.1-Especially for new equipment?</p>

We have just examined best ways to improve the effectiveness of the staff. According to you, what are the events that could annihilate this Human Resources investment?

Risk assessment, probability (1 to 5) and severity (1 to 5) HELP_Turnover!

<p><u>2.3-Innovation and research</u> Does your company active in innovation and research to improve the logistics side?</p>	<p>2.3.1- With who are you cooperating? 2.3.2- Is the company taking initiative for improvements?</p>	
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3-Internal process

Main questions	Additional questions (if necessary)	Clarifying questions
<p><u>3.1-Processes fluidity</u> What are for you the key success factors for fluid/smooth logistics operations?</p>	<p>3.1.1-Do you think it would be interesting to focus on a precise scheduling? 3.1.2-Do you think it is necessary to pre-establish a coordination system between operational actors? (Defining each roles, and interactions between each other) 3.1.3-Do you think that systematizing briefing and debriefing is necessary? 3.1.4-Do you think that a measure representing On Time, In Full (OTIF) is pertinent?</p>	<p>3.1.1.1-According to you what are the characteristics of a good planning? 3.1.3.1-if yes, how often then?</p>

We have just identified key success factors for fluid logistics operations. According to you, what are the events that could affect this dynamic?
Risk assessment, probability (1 to 5) and severity (1 to 5) HELP_Take one of the four additional question and make a risk assessment

<p><u>3.2-Work safety</u></p> <p>In addition to technical and human elements already discussed, do you see what could improve and reinforce the safety of operations?</p>	<p>3.2.1-Do you make a risk analysis for each sensitive operation? (sensitive because of the environment or interactions)</p> <p>3.2.2-Do you have a shared incident/accident data collection system?</p>	<p>3.2.1.1-if not, Do you think that it would be pertinent to make?</p> <p>3.2.1.2-Do you usually implement a “prevention plan” for this kind of operations?</p> <p>3.2.2.1- if not, do you think it would be interesting to implement one?</p>
<p>We have just saw how to reinforce the safety of logistics operations. According to you, what possible reasons could reduce our action? <i>Risk assessment, probability (1 to 5) and severity (1 to 5) HELP_Don't you think that companies' unequal security approaches could jeopardize our action?</i></p>		
<p><u>3.3-Flow of information :</u></p> <p>According to you, what are the characteristics of an effective information system for logistics operation in the workable (goliath) and the stretch arctic (Bear Island)?</p>	<p>3.3.1-According to Marintek and DNV, Above 70°N (ENI licenses 716 and 717), there are problems with satellite and radio transmissions (ref doc 13p47). What is your opinion?</p> <p>3.3.2- What are the contact points between onshore base, vessels and the platform?</p> <p>3.3.3- What would be an efficient information network between onshore base, vessels and the platform?</p> <p>3.3.4-Do you have a well-defined procedure on how to exchange information during and about operations? (Example: in case one of the vessels encounters a difficulty, it could communicate the issue to others, to inform them.) (here real time)</p>	<p>3.3.4.1-Under what procedures?</p>
<p>We have just outlined an efficient information system. According to you, what are the events that could jeopardize the implementation of this system? <i>Risk assessment, probability (1 to 5) and severity (1 to 5) HELP_identify one solution or characteristic then risk assessment</i></p>		

<p><u>3.4-Safe and Effective Storage</u></p> <p>What are the characteristics of a safe and effective storage on the onshore base?</p>	<p>3.4.1-For a specific operation, do you think it would be relevant to examine the compliance of onshore base capacity related to the inbound and outbound logistics?</p> <p>3.4.2-Do you think it would be relevant to examine the compliance between vessels and harbor and wharf</p> <p>3.4.3-From a storage point of you, do you think it is relevant to look into measures for protecting the environment (e.g. fluids spill)</p>	<p>3.4.1.1-If yes, what would you implement to do so?</p>
<p>We have just identified the characteristics of a safe and efficient storage. According to you, what are the conditions that could prevent from having a safe and efficient storage?</p> <p><i>Risk assessment, probability (1 to 5) and severity (1 to 5) HELP_Greenland case</i></p>		

4-customer

Main questions	Additional questions (if necessary)	Clarifying questions
<p><u>4.1-Customer satisfaction</u></p> <p>According to you and your role within the company, what is the best way to collect and communicate the customer satisfaction to all actors?*</p>	<p>From the perspective of the customer, do you think that:</p> <ul style="list-style-type: none"> -Reliability, -Price, -Range of services on offer <p>Are important?</p>	<p>About “technical points” Do you think that:</p> <ul style="list-style-type: none"> -Carrying capacity which characterizes the capability to transport cargo in bulk, in tanks, in offshore containers or directly on the deck for bulky elements like pipes, -Sailing capability which characterizes the capacity to navigate safely specific weather conditions (wind force, wave height, temperatures...), -Loading/unloading capability <p>Are important?</p>
<p>We have just seen that it is interesting to collect customer’s opinion. According to you, what could stop us from collecting customer opinion? <i>Risk assessment, probability (1 to 5) and severity (1 to 5) HELP_Questionnaire? Is it really effective??</i></p>		

*According to Kaplan, in the customer perspective the measure of the customer satisfaction is the result of learning and growth perspective and internal process perspective. In-depth analysis of the customer satisfaction is part of the diagnostic which help to establish the strategy. But the diagnostic is not the strategy. This is why, in the Balanced Scorecard, all customer indicators are lagging indicators. This also applies to the Financial perspectives. Thus, the question related to the customer satisfaction is about the way to get the feedback from the customer.

5-Financial

Main questions	Additional questions (if necessary)	Clarifying questions
<p>5.1-Financial objectives</p> <p>According to you what are the most pertinent indicators to measure the financial performance of activities taking place in Arctic?*</p>	<p>About financial indicators, which indicators are the most important? ROA, ROCE, profit margin, other?</p>	<p>How about costs? Which are the most important cost-related elements?</p>

ROA: Return On Assets

ROCE: Return On Capital Employed

**About the financial perspective, indicators have to take into account financial objectives and look if they are met.

Appendix 4: Primary data

Learning and growth perspective:

Suitable equipment

“Identification of the right equipment is very important.” I3

Heating system

“They need heating system, it is mandatory for the vessels now up there.” i1

Winterization

“What I think will be the most important is the winterization so you could have safe access for the crew and personnel. It could come snow so you have these tents; ice and ice block or snow falling on containers or equipment, we want no falling objects. It could be a dangerous when we are lifting the containers.” i2

“But I know that for PSVs we will definitely need some winterization for safe access, you can use stairways, and every area safely. So personnel don’t fall and neither objects. We need some de-icing systems.” i2

“relative position reference system” equipment

“the thing that we are afraid the most is the collision between a vessel and an installation.” I2

“They want to have some extra features like RADius, equipment like this because the GPS will not be so reliable when they are going further north.” I1

“All the vessels we are operating which need to do some stand-by, we have a requirement that their vessels should be DP2, dynamic position 2. The requirement there, it is that you have 3 independent reference systems and what is typical today that is you have 2 DGPS (Differential Global Positioning System) and another system based on laser, sending lasers and which reflect back, and the third system is the RADius system. So vessels that we will be hiring must have this equipment, and this apply for all new projects.” I2

More than one satellite system on vessels

“Yes or Galiléo, that’s also correct, because if you have more than one gps system, it is not more precise but if one doesn’t work you can rely on the other system.” I1

“The requirement there, it is that you have 3 independent reference systems and what is typical today that is you have 2 DGPS (Differential Global Positioning System)” i2

Growlers detection

“We have not decided yet what kind of system we will have on board but of course we will have to install something that will give them the good information while navigating in icy water.” I2

“If you’re far north it could be a requirement to have ice detection system. But also, a better forecast and ice prediction are very important” i3

Risk:

“About the events that could jeopardize the acquisition and using of this equipment, of course, costs is one question but another is that is it related to regulatory or not? if it is not I don’t think that everybody would be willing to invest into it, so I think they have to put it in requirement. Specific technologies need to be in requirements in order to make all vessels using it.” I3

Staff effectiveness

“Regarding the arctic, the best way is that they have knowledge about the Arctic, you need to have like we have trying to do here, we had some workshops and we go through this with the administration personnel so they know what they should expect when they talk about the people working outside.” I1

“we need people who have the mission of surveillance (ice, weather etc.), in this case they would need to have very good knowledge about the Arctic region. How to read this kind of satellite data for example. Me for example, I am working in direct contact so I need to know the requirements, types of vessels etc.to have a dialogue as good as possible with the actors on field.” I2

“Some of the people in the company need to have it [first arctic experience]” i1

“In different categories of personnel, for example medical personnel need special arctic training, navigators; all crews should have a sort of introduction to the arctic. I3

“They definitely need to go on specific training about the arctic, because if ice occurs then they need to have knowledge on how to deal with it. Training, training, training, to have the preparedness for Arctic conditions and of course to know how to use the good equipment, to know how to deal with the cold and the darkness.” I2

“Yes some formations are useful, to understand the challenges and talk the same language.” I2

“It [satisfaction survey of the staff during and after operation] is not necessary but it could be useful.” I3

“Yes, maybe they should have something like that [satisfaction survey of the staff] as well.” I1

“We have already a good dialogue with them in real time...and yes it would be useful to get some kind of feedback and so understand what they experienced.” I2

Risk:

“The turnover would happen all the time, there is a need to raise the competences of the personnel anyway and even if they are going to another company the next moment you will have them back. Up here the turnover is really low but I don't know how this is in other companies” i1

“So I don't think that turnover will be a specific issue” i3

“it wouldn't be a big problem, if someone is quitting, or get hilled or having a baby, they are enough people to take care of their job, if they are on the leave they will come back and if not you have the time to hire a new person.” i1

“So far it hasn't been a big problem. But if we meet ice, up there it would be a big impact, because we would need really experienced and qualified people with knowledge about ice. Without ice it is not a big problem as people can be changed easily.” I2

Innovation and research

“We had special programs where we have been in lead on the north area issues.” I1

“Yes, we are cooperating with several institutions. We have several programs related to the arctic, Barents Sea and many are related to logistics.” I3

“We are having lots of project with institutes regarding arctic challenges.” I2

Process fluidity

“That's good planning, you need to have a very good planning especially when you're going further north where you have long distance to sail.” I1

“It is good plans, especially in drilling operations.” I2

“Good planning again, and good support because you need to be able to also to get support in the operational phases, so good planning is essential, good equipment is essential and also that you use vessels that handle the situation or environmental factors where you operate.” i3

“A good planning is that people are telling in advance, sharing information, and involving the right personnel at the right time.” I2

“A good planning is that the person that needs the equipment is telling as early as possible the person which is delivering the equipment that he is going to need this type of equipment. You know when you’re up there, for example to Johan castberg there is 12 to 15 hours sailing. If they are sailing out without the good equipment or the right amount then you need to take another vessel because they didn’t tell early enough. So the person that is on board, which is planning the drilling operations or the operations on board they need to see what do they need 4 or 5 days ahead because of the long distance to sail you need to plan this very precisely, so you know when the vessel is leaving harbor they have the equipment you need for the next days but on the other side you don’t want to take too much on board because you have a limited space on board. So you need to have a very good overview how this is going to be the next days so you are ready to plan, so you can do the operation until an the vessels comes next time with another equipment.” I1

“Risk identification, and also have correct competences during the planning phase but also during the operation, that are key factors. Identification of right equipment it is very important.” I3

Coordination system between operational actors.

“Yes definitely, because the personnel on the rig they need to know what they need to have on board and they have to give this order to the logistics and the logistics needs to have the equipment on board and they need to check the weather and everything like this they know when they are sending out the vessels they know the vessels will come the installation at the time you have decided that you need the equipment. Because you know an oil rig, if you’re doing drilling operation you have a daily cost between 6 and 8 million Norwegian Kroners. So you need to have the logistics at a very high level. You shouldn’t be waiting for the vessel.” I1

“Between onshore base, vessels and platforms, yes, pre-establish a coordination system between operational actors is essential for the coordination.” I3

Systemizing briefing and debriefing

“Of course it is important to have this dialogue and share information. We take problem when they occur and threat them at once we don’t want to wait to see. But again in case of ice management situation I think debriefing is very important. In normal operation we don’t need it but if it is a very special operation then we should have it.” I2

“Yes, during planning, before start-up, and during the operation you need regular coordination meetings and debriefing after the end of the operation” i3

On time, In full (OTIF)

“Of course it is very important.” I2

“Yes, that is of course very important. But depends on what the vessel is handling and what type of operation it is. If it is necessary equipment, or personnel or emergency preparedness related then you need to be on time with what is needed.” I3

Risk

“I think you need good planning software on board. So you need to rely on the person but also on good planning equipment to do the planning. You can rely just on the person; you need the equipment to help you.” I1

“if you get on technical break because that could take some time to replace the vessel or fix it. If something happen in Bergen or Stavanger, it is ok, because the harbor is close and we have everything to fix it, but up there it is another story, so boat could be 2 or 3 days away from the base. So failures up there would have a higher impact.” I2

“Weather for first and foremost and also if you have problems on the vessel, technical problem, with are talking long distance, so it can take time to get fixed.”

Weather:

Probability: 5

Severity: 4

Technical problem:

Probability: 3

Severity: 4”

Internal Business process:

Work safety

In addition to technical and human elements already discussed, do you see what could improve and reinforce the safety of operations?

“No I don’t see, because we have very good systems, maybe we could make some small adjustments but what we have now is very good.” I1

“Safe working area, not slippery for example, the right focus, a good environment on board the vessel with open dialogue, the right to stop to work, this kind of things. I2

“Personal protective equipment, winterization solutions on vessels are key factors to protect. And of course right ice class and so on.” I3

3.2.1-Do you make a risk analysis for each sensitive operation? (Sensitive because of the environment or interactions)

“If we have special operation, of course we have this type of detailed risk analysis.” I2

3.2.1.2-Do you usually implement a “prevention plan” for this kind of operations?

Yes i1

“The ship owner is taking care of it, we indicate of requirements in our contracts. But then again for specific condition we will have a dialogue regarding all the particular things that could occur.”

Yes i3

3.2.2-Do you have a shared incident/accident data collection system?

“Yes we use Synergi Life software. Synergi is the equipment that almost all oil companies use.” I1

“We have synergi. Normally with ship owners that we have on long term contract we have two meeting every year with them, where we do some sharing, especially incident. We have also HSE meetings where we invite all HSE manager of the ship owners that we have in contract, here we do exchange of incidents and experience and every year we have something called captain forum where we invite all the captain or master to a 2 days gathering where we have high focus on HSE, we have also sharing information of incidents.” I2

Risk:

Maybe I can help you, for example Don’t you think that companies’ unequal security approaches could jeopardize our action?

“Yes they will have a different approach but you know we do an audit on all the company that we are working together with. We are very clear about what we expect from them in this matter and you know when the oil company has a contract with a supplier, it also has the responsibility to see if they are following regulations and that the persons that are working for us have the right education and everything so that is our responsibility.

Probability: 1 to 2

Severity: it depends on what would happen but we have seen for example people falling asleep on supply vessels because they have been too tired. But on a normal basis I would say 1 to 2. But small things can make a big problem but it is not often that it is happening. Normally I think everyone is trying to do the best and I see with the suppliers we have in contract with us they are doing their best and we do regularly audit on them to see if they have the systems in a proper way and we almost don't find anything. If they do something wrong they can lose their contract or get penalties, so once again they really do their best.” I1

Flow of information

According to you, what are the characteristics of an effective information system for logistics operation in the workable (goliath) and the stretch arctic (Bear Island)?

“Statoil marine follow in real time, they have an overview of the position of the vessels and they also have this dialogue with the different installations, so they are coordinating vessels. Statoil operation is a 24/7 operation.” I2

“We have a operation support room, they are talking regarding the operational support on the rig and then you have for the maritime logistics on board the rig which is talking directly to the logistics here (they are located next to the support room). It is probably the same in all oil companies.” I1

“Regularly reports, status report are important, communications with VHS and so on are essential, status coordination meeting are important” i3

3.3.1-According to Marintek and DNV, Above 70°N (ENI licenses 716 and 717), there are problems with satellite and radio transmissions (ref doc 13p47). What is your opinion?

“You can go to spitzberg area and you have communication but the problem is that you have very slow speed. Very low transfer rate.” I1

Risk:

“Some of these vessels we have they are going to several installations, so if one installation is not following the plan, then the whole plan could be interrupt for the next installation. So this is one of the issues that could occur and destroy a good plan.” I2

Probability: 4 very often

Severity: 3-4

“If you don't follow the procedure, if you don't comply with requirements, that is the main risk.” I3

Probability: 4

Severity: 4

3.4-Safe and Effective Storage

What are the characteristics of a safe and effective storage on the onshore base?

“The size of the warehouse, it needs to be big enough; it is I think the main issue for onshore base. It has to be with good quay cranes, and all unloading and offloading facilities.” I3

Risk:

“The risks are that you don’t have necessary equipment in the storage, poor planning. Risks related to all the operational aspects during offloading and unloading of equipment on the vessels. Risks that you don’t comply with established procedures so that you get HSE incidents.” I3

Compliance with established procedure:

Probability: 4

Severity: 4

Operational risks:

Probability: 4

Severity: 4”

Customer

4.1-Customer satisfaction

“It’s to do the job I think. You need to do the job. What people expect you to do.” I1

Yeah, I think we use a questionnaire, and I think it is effective, I never heard something bad about it. I think they are having a good cooperation. I1

“We have tried to send this questionnaire out to installations to get feedback and we have figured out that it is not really useful, and it was not a big success. Instead, if they are happy they give us a note and of they are not happy they give us a note.” I2

“We have pre-defined indicators based on reports.” I3

Financial objectives

“Working up in the high north is very expensive, you need special equipment, vessels, extra education on the crew and personnel when you’re up in this area, so it’s a really high cost. And everyone wants to have the money back as fast as possible. On the financial side because you’re going for more expensive equipment, it is more expensive do to the operation, you have a higher cost on the loan because of the conditions. You need 15 years to write it off. And insurance are higher as well. Everything is going higher.” I1