NTNU
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Science and Technology

What Have We Learned from Ivar Aasen?

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Submission date: June 2017
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Preface

This master thesis presents research conducted during the spring of 2017 at the Norwegian University of Science and Technology, Department of Mechanical and Industrial Engineering, in the course TPK4920 Project and Quality Management. The master thesis is written in collaboration with Aker BP ASA, and is a contribution to the lessons learned initiative in the company. The aim of the research has been to review the Ivar Aasen project, its challenges and success factors, and provide lessons learned.

Working with this thesis has given me a unique opportunity to gain insight into an industry I find very interesting. Being able to write a thesis about something that interest me has given me motivation throughout the process, and the work on this thesis has been both interesting and challenging. I would like to thank Aker BP and Bjørn Sundfær for this opportunity.

I would like to thank my supervisor, Associate Professor Bassam Hussein for his academic assistance, support, and cooperation.

I would also like to thank friends and family for the support throughout the process of writing this thesis.

Trondheim, June 11th 2017

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Summary

This master thesis addresses the topics of lessons learned, success factors, and challenges or reasons for project failure. The aim of the thesis is to contribute to the lessons learned initiative at Aker BP by assessing the Ivar Aasen project. Its purpose is to investigate successes and failures that occurred during the project, and give recommendations to what should be retained and what should been done differently in subsequent projects. This was done by asking the question: *What have we learned from Ivar Aasen?*

The Ivar Aasen project was an oil and gas field development project operated by Det norske (now Aker BP). The goal of the project was to establish Det norske as operator on the Norwegian Continental Shelf, and to complete the project within time, cost, and quality, with zero HSE happenings.

The research has been conducted as a qualitative single case study, where the scope was to assess the entire Ivar Aasen project. Project managers from the subprojects of Ivar Aasen and other important representatives from the company participated as informants. There has been held 22 face-to-face interviews, based on questionnaires answered by the interviewees. The interviews were recorded, and transcribed afterwards, which resulted in 164 pages of text. The interviews have been semi-structured, which has enabled for an open dialogue between the researchers and the interviewees.

The literature review has made up the theoretical basis for discussing success factors and challenges in the project. With this basis it has been possible to identify the unique success factors for the Ivar Aasen project, and to give recommendations for improvements in subsequent projects. The most important success factors identified for Ivar Aasen are their good working environment, autonomy, determination and commitment amongst the employees, competent staff, clear priorities and expectations, and supportive management.

The findings suggest that there are some overreaching factors that have affected the project to the largest extent. These factors include soft aspects of project work, and the importance of understanding interdependencies and interfaces. The recommendation for the company is to emphasize the focus on these in particular.

This master thesis is important for the company, as it contributes to their lessons learned initiative. It gives a third party's objective opinion of the project and provides important lessons learned, useful for future project execution.

Keywords: Lessons learned, Success factors, Challenges, Oil and gas, Project, Ivar Aasen, Det norske, Aker BP.

Sammendrag

Denne masteroppgaven omhandler temaene lessons learned, suksessfaktorer, utfordringer og årsaker til at prosjekter mislykkes. Målet med oppgaven er å bidra til lessons learned-initiativet hos Aker BP ved å evaluere Ivar Aasen-prosjektet. Hensikten er å utforske suksesser og utfordringer som oppstod underveis i prosjektgjennomføringen, og å gi anbefalinger om hva som burde gjøres på tilsvarende vis i senere prosjekter og hva som burde gjøres annerledes. Dette ble gjort ved å besvare følgende spørsmål: *Hva har vi lært av Ivar Aasen?*

Ivar Aasen-prosjektet var et olje- og gassfeltutbyggingsprosjekt med Det norske som operatør. Målet med prosjektet var å etablere Det norske som operatør på norsk sokkel og å gjennomføre prosjektet innenfor tid, kost og kvalitet uten alvorlige HMS-hendelser.

Studien har blitt utført som et kvalitativt enkelt-case-studie, hvor hele Ivar Aasen-prosjektet har blitt evaluert. Prosjektledere for de ulike delprosjektene i Ivar Aasen i tillegg til andre viktige personer fra selskapet har deltatt som informanter. Det ble holdt 22 intervjuer, basert på spørreskjemaer besvart av intervjuobjektene i forkant av intervjuene. Intervjuene ble tatt opp og transkribert i etterkant, noe som resulterte i 164 sider med tekst. Intervjuene har vært semi-strukturerte, noe som har gjort det mulig å ha en åpen dialog mellom intervjuerne og intervjuobjektene.

Litteraturstudiet har dannet det teoretiske grunnlaget for å kunne diskutere suksessfaktorer og utfordringer i prosjektet. Dette grunnlaget har gjort det mulig å identifisere unike suksessfaktorer for Ivar Aasen-prosjektet og gi anbefalinger til forbedringer i kommende prosjekter. De viktigste suksessfaktorene identifisert for Ivar Aasen er deres gode arbeidsmiljø, autonomi, besluttsomhet og følelsen av tilhørighet og forpliktelse, kompetanse, klare forventninger og prioriteringer og støttende ledelse.

Funnene tydeliggjør at det finnes noen faktorer som har påvirket prosjektet i en større grad. Disse faktorene inkluderer myke aspekter ved prosjektarbeid og viktigheten av å forstå de gjensidige avhengighetene i prosjektet og grensesnittene. Anbefalingen til selskapet er å vektlegge disse.

Denne masteroppgaven er viktig for selskapet fordi den bidrar til deres lessons learned-initiativ. Den gir en tredjeparts objektive oppfatning av prosjektet, og samler viktige erfaringer som er nyttig for fremtidige prosjektgjennomføringer.

Nøkkelord: Lessons learned, suksessfaktorer, utfordringer, olje og gas, oljefeltutbygging, Ivar Aasen, Det norske, Aker BP.

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List of Abbreviations

FEED - Front End Engineering Design

PDO - Plan for Development and Operations

D&W - Drilling and Well

EPC - Engineering, Procurement, and Construction

SURF - Subsea/Umbilicals/Risers/Flowlines

E&P - Exploration and Production

T&I - Transportation and Installation

HSE - Health, Safety and Environment

PO - Purchase Order

1 Introduction

The purpose of this master thesis is to evaluate the Ivar Aasen project, and create an empirical foundation for improvements based on these previous experiences.

1.1 Background

1.1.1 Characteristics of the Oil and Gas Industry

Oxford Dictionaries (2017) define a characteristic as "a feature or quality belonging typically to a person, place or thing, and serving to identify them". Project characteristics are hence features that make projects what they are. The characteristics of a project can impact its performance (Olaniran *et al.*, 2015), and identifying these is therefor important when assessing a project. The characteristics of a project can also influence where the focus of the project management team should be (PMBOK®Guide, 2013).

Projects are set out to create unique results (PMBOK®Guide, 2013), and consequently all projects are to some extent unique. Projects are also unique in that they do not run solely on routine, unlike regular operations (PMI, 2017). As projects are to a smaller or larger extent unique, they are likely to have different sets of characteristics and factors that affect them. It is possible to name generic project characteristics, but the extent and impact of the characteristics will vary.

Projects are characterized by their temporary nature, as all projects have a decided start and completion date (Turner, 2014). Temporary is not equivalent to short (PMBOK®Guide, 2013), and some projects can therefore have very long time horizons. The set time frame of a project can impact its performance, as a deadline might induce time pressure.

Projects are also characterized by their cross-functional nature, as they can involve different departments in a business (Prince2, 2017), in addition to other actors, such as contractors and suppliers. Other project characteristics include scale, schedule, location, delivery process and site conditions (Olaniran *et al.*, 2015), type of contract, scope, and current state of the market (Songer & Molenaar, 1997), and project type (Liu *et al.*, 2016; Olaniran *et al.*, 2015).

Complexity is another important characteristic of projects (Hussein, 2016), and it occurs as a result of other project characteristics such as cross-functionality, scale and project type. With the aforementioned characteristics, projects can be summarized as complex, one-time endeavors, with a set of characteristics making them unique.

The scale of a project can be measured both physically or financially (Olaniran *et al.*, 2015). Projects exceeding \$1 billion are often characterized as megaprojects (Merrow, 2011). Other characteristics of megaprojects include high degree of complexity and risk, uncertainty, ambiguity, and long time horizons (Kardes *et al.*, 2013). Megaprojects are not just larger versions of smaller projects (Flyvbjerg, 2014), their characteristics put them in a different category. The size of megaprojects impact how difficult they are to manage. The scope might be very large, making it challenging or difficult to comprehend.

The characteristics of the oil and gas industry makes it possible to place many oil and gas projects in the category of megaprojects. The petroleum industry is incredibly cost intensive, with even small projects being comparable to large industrial investments on-shore (OED, 2014). Projects in the industry are driven by time, as delays can lead to production losses (El-Reedy, 2016). Oil fields are in most cases owned by a partnership, and there is a high number of stakeholders involved or affected by an oil field development project, which leads to high organizational complexity (Hussein, 2016). In addition, the technical and logistical complexity is high, due to a vast number of contractors, subcontractors, and other suppliers. Also, few other industries face as many rules, regulations, standards and laws as the oil and gas industry (Badiru & Osisanya, 2013).

The Norwegian oil and gas industry is characterized by long time horizons, with up to 15 years from awarding of the licence until production start (Norsk olje & gass, 2010a). The Norwegian Petroleum Directorate regulates the oil and gas industry in Norway, and have large authority in any matters concerning exploration and production on the Norwegian Continental Shelf (Norsk olje & gass, 2010b).

Norway is one of the leading countries when it comes to safety in the oil and gas industry, and there are strict environmental regulations, making Norwegian oil and gas amongst the cleanest producers in the world (Norsk olje & gass, 2010b).

Table 1: Characteristics of the oil and gas industry

Oil and gas industry characteristics		
Huge investments	Fast decision making	High complexity
Massive interfaces	Legal constraints, rules and regulations	High risk
Time driven	Long time horizon	

1.1.2 Det norske oljeselskap ASA

This master thesis is written in collaboration with Aker BP ASA, which was previously named Det norske oljeselskap ASA, from now on referred to as Det norske. Det norske and BP Norge AS merged in 2016, and became known as Aker BP during the fall of 2016. Due to the recent establishment of Aker BP, the company is referred to as Det norske in the thesis.

The company is a fully-fledged E&P company with exploration, development and production activities on the Norwegian Continental Shelf. Measured in production, the company is one of the largest independent oil companies in Europe.

1.1.3 The Ivar Aasen Project

Ivar Aasen is the first large oil field with Det norske as operator. The field was discovered in 2008, and in 2010 the partnership, consisting of Statoil, Bayerngas and Det norske, made a decision to move forward with the project.

The field is situated at the Utsira high, close to Lundin's field Edvard Grieg. Due to the close locations of the fields the government demanded coordination between the Edvard Grieg and Ivar Aasen platforms. This happened in 2011.

Det norske started working on the plan for development and operations(PDO) in May 2012. It was handed over to the authorities in December the same year, and got its final approval in May 2013. By then, many of the important contracts had already been awarded to contractors. During the year of 2013, the field grew considerably, with the discovery of the field stretching into the neighbouring license.

The project has been separated into several subprojects, and has experienced successes and important milestones throughout its lifetime. The milestones include the finalization and placing of the jacket in 2015, the world class drilling campaign, the completion and placing of the topside during summer 2016, and first oil in December 2016.

In the Ivar Aasen Project Mandate from DG3 to DG4, the list of project success factors, presented in table 2, was identified for the execution phase of the project.

Table 2: Ivar Aasen project success factors

Ivar Aasen project success factors
• Strong HSE commitment within the project management team, zero target
• Utilize best business practice to achieve a safe, aligned, predictable and cost effective project delivery – lessons learned and benchmarking from similar projects
• Experienced, competent and sufficient internal and external resources
• Motivated team, aligned with common goals
• No change philosophy
• Proactive interface, risk and contract management
• Integrated team execution model - build team culture

The company also set a list of project priorities, which were as follows:

1. HSE

2. Quality

3. Schedule

4. Cost

In figure 1, the main steps of the company's asset value chain is displayed. This thesis concerns the phase between DG3 and DG4 in the field development phase, which is the execution phase. This phase involves D&W construction, detail engineering, onshore construction and completion, offshore completion, preparation for start-up and handover to operation, management and coordination of execute phase, and performance of project close-out.

Figure 1: Aker BP's asset value chain

1.2 Research Objective

Ivar Aasen was the first large oil field development project done with Det norske as operator. It is therefore important for the company to be able to review the project, and identify where the project succeeded and where failures and challenges occurred, and what led to these successes and failures.

The overall research objective of this thesis is to answer the following question: *What have we learned from Ivar Aasen?* Through this question the challenges and successes of the project are investigated, in order to be able to identify the most important lessons learned from the project.

1.3 Thesis Structure

This thesis is separated into six sections.

In the first section of this thesis, the background for the thesis, and the research objective is presented. The second section presents the methodology used for the research of the thesis. A qualitative single case study with the use of questionnaires and interviews has been conducted.

In section three, theory relevant for the answering the research objective is presented, such as lessons learned, project success factors, success criteria, and project characteristics.

Section four consists of a representation of the results yielded from the interviews, divided into one subsection describing challenges and one subsection describing successes identified. In section five, these results are discussed towards relevant theory. Finally, a conclusion of the thesis is presented in section six.

2 Methodology

In this section the method used for the data collection and research will be presented, in addition to the research method's quality and limitations.

2.1 Research Approach

2.1.1 Qualitative Research

A qualitative study is characterized by its aim to describe events, situations, problems or phenomena (Kumar, 2005). Qualitative research emphasizes the interaction between the researcher and the informant, and tries to capture experiences and purpose that are difficult to measure through quantitative methods (Tjora, 2011). Qualitative research can also be described as interpretative research, as the goal of it is to interpret and understand what people have experienced, and what they ascribe to events, situations, and actions (Magnusson & Marecek, 2015).

Given the scope of this thesis a qualitative research approach was found appropriate. The research is a single case study, combining questionnaires and interviews. The answers from the questionnaires have made up the basis for the interviews.

2.1.2 Case Study

A classic case study involves a detailed analysis of a single case, and case study research explores the complexity and nature of the case being studied (Bryman, 2012).

Case study can be used to contribute to our understanding and knowledge of different phenomena, including phenomena related to individuals, groups and organizations (Yin, 2009). Case studies are analyses of individuals, events and projects, amongst other things (Thomas, 2011), and the method allows a holistic investigation. This can result in descriptions of characteristics and real-life events (Yin, 2009), that would be otherwise difficult to obtain.

2.1.3 Questionnaire

During the project, a lessons learned database was created and maintained by the company. This database gave insight into problems that have occurred during the project, and contributed to creating the basis for the questionnaires. The questionnaires were developed by the supervisor of this thesis.

Prior to the interviews, the interviewees received a questionnaire for them to answer. Some of the informants gave comprehensive answers, others gave only brief answers, and some informants did not reply. The answers from the questionnaires were used as a starting point for the interviews that followed. If the interviewers did not receive an answer to the questionnaire, the questionnaire was used as an interview guide.

2.1.4 Interviews

The interviews were conducted from December 2016 until January 2017, as face-to-face interviews. The interviews were recorded both as sound recordings and video, and were transcribed by me afterwards. A total of 22 interviews were conducted, where I was present during two of the last interviews. The reason for this late involvement was that the majority of the interviews were conducted prior to my involvement with this thesis.

The interviews have been of a semi-structured nature. Semi-structured interviews are used to enable the researcher to keep an open mind about what he or she is seeking the answer to (Bryman, 2012). As previously mentioned, the interviews are based on a questionnaire that was sent out prior to the interviews. As a result, the interviews vary in content, and the topics and focus are hence different from interview to interview. This has contributed to a broad overview of the project. The interviews have however been framed by the same objective, with focus on successes and challenges, and what should and should not be done again.

The transcription off all the interviews was a comprehensive task, where I listened to or viewed each interview carefully. I was very meticulous with this work, and each interview has been reviewed three or four times in order to capture every word and detail. Each interview lasted between 40 and 60 minutes, and the transcription resulted in a total of 164 pages of text, with approximately 100.000 words. All the interviews were conducted in Norwegian, except for one conducted in English. None of the interviews have been translated from Norwegian to English in their entirety, only the quotes used in the thesis. The quotes used have been directly translated to English, which might have affected their content, as some expressions are not easily translatable.

Transcribing all the interviews has given me good knowledge and overview of the collected data. When reading each interview, I have looked for topics, challenges and successes that have seemed to be of significance to the interviewees, such as relationships to contractors. Because of the thorough work with the transcription I have also been able to identify the mood of the interviewees when discussing different topics, and keep this in mind when reviewing the interviews.

The interviews were conducted by two people: Torgeir Anda and my supervisor, Bassam Hussein. Torgeir Anda worked as a journalist until he was hired as director of communication in Det norske in 2008. From fall of 2014 until the conclusion of the project, he worked as a consultant for Det norske. He therefore has a close relationship to Ivar Aasen and the employees of the project. Bassam Hussein has been involved in the development and implementation of different programs for competence development regarding project management at Det norske. Hussein has also contributed to the development of the lessons learned initiative at Det norske.

Torgeir Anda's relationship to Ivar Aasen has given him good knowledge about the project and its inner life, dynamics, conflicts, and situations. Having an interviewer with good knowledge of the project has been valuable, but also challenging, as some of the questions have been leading to some extent. With these leading questions, I have had to consider which answers were colored by the questions from the interviewer and not.

2.1.5 Participants

When choosing the interviewees, it is important to consider what kind of information you seek to get from these informants (Magnusson & Marecek, 2015). In this research, we were looking for an overview of the Ivar Aasen project, with several thousand participants in total. It was therefore considered appropriate to choose people from managing roles as participants for the research.

The informants were chosen by the company and project management, in consultation with the supervisor of this thesis. This took place before I was included in the work for the thesis. The informants were chosen to create a broad and nuanced overview, and to include all deliveries in the project. The selection of informants consist of project managers, subproject managers, people in support functions and people responsible for main deliveries to the project. The selection of informants is presented in table 3.

Table 3: Roles of the interviewees

Role
CEO
Field director
Project owner
Project director Ivar Aasen
Contract & procurement manager topside
Project license & support
Deputy project manager & HSE manager
Project control manager
Hook-up manager
T&I manager
Operations manager
Project manager SURF
Site manager/deputy project manager jacket
Operations HSE lead
Site HSE lead Singapore/Batam
Project manager topside
PETEK manager
D&W manager
Contract & procurement manager
Operational preparations
Offshore installation manager
Offshore installation manager

2.2 Data Collection

Data can be categorized into primary and secondary sources. According to Kumar (2005) primary sources of data are collected through methods like observation, interviewing and the use of questionnaires, while secondary data can be collected from documents such as articles, journals, books, etc., to obtain historical and already collected data. Primary sources provide first-hand information, while secondary sources provide second-hand information (Kumar, 2005).

In this research, both primary and secondary sources of data have been used. The primary sources of data stem from the interviews and questionnaires, while the secondary sources are the contents used for the literature review, in addition to documents from the company.

2.2.1 Literature Search

The search for literature has mainly been conducted through Oria.no and Google Scholar. Oria.no allows access to NTNU's wide electronic collection of articles, books, journals, theses etc. In addition, it allows the user to search within the university library database. Oria.no is used to the widest extent, with supplementary use of Google Scholar, if for instance a search for a specific title did not produce results in Oria.no. Below, a list of key search words used during the literature search is presented.

List of key search words

- Lessons learned
- Project success
- Project success factors
- Critical success factors
- Project management

Other search words include interface, management, trust, complexity, oil and gas, megaprojects, uncertainty, commitment, communication etc.. These words have been used in combination with the key search words, as well as in combination with each other. Another method used for exploring relevant literature has been through the use of snowball referencing, reviewing references used in other articles. This has contributed to reducing the number of hits produced in Oria.no and Google Scholar. Some of the literature has also been recommended to me by my supervisor.

To the largest extent, the articles used in the literature review are not older than year 2000. Some exceptions have been made, such as when older articles are frequently cited in more recent research, or the author is considered to be an important contributor to the field of research. The number of citations has been used to verify the quality of the articles, but this has been disregarded for articles published after 2010, due to the recent publishing.

2.2.2 Other Data Sources

In addition to relevant literature and interviews, governing documents from the project have been used, as well as AkerBP's intranet. Information taken from these sources includes the project success factors of Ivar Aasen, and the history of the project and the company.

2.3 Ethical Considerations

The informants have been told that the conversations from the interviews will not be published. When citations have been used in the thesis they are presented without the name of the informant. If the interviewees have referred to persons in the project during their interviews, these names have been replaced with their role in the project.

2.4 Quality of Information

To verify the quality of the information gathered during the research, it is important to evaluate the reliability and validity of the research method. By commenting on the reliability and validity, it is possible to critically assess the method used for the research.

2.4.1 Reliability

The reliability of a research concerns the degree to which an experiment can be conducted several times, and still yield the same results (Carmines & Zeller, 1979).

The data in this research is well described, with high quality. The questions for the questionnaires are available, and the interviews are based on the answers from the questionnaires. All the interviews conducted have been transferred to written format, which makes the research easily reproducible. The reliability of the data is therefore high.

2.4.2 Validity

The validity of a research method is the extent to which the results produced gives the right answer, and how well the findings are interpreted (Kirk & Miller, 1986).

Since all the interviews were conducted face-to-face, the validity of the interviews are high, as this gives the opportunity to evaluate and consider the trustworthiness and honesty of the interviewees. The interviewees are considered to be very trustworthy, providing realistic descriptions of important events in the project. In addition, the selection of interviewees gives a broad overview of the project, as they include project managers from a variety of subprojects. There is hence no reason to doubt the validity of the data collected.

2.5 Limitations of the Research Approach

The interviews were conducted after the project was finished or very close to the conclusion of the project. The project started several years prior to these interviews, in 2012. The long time horizon may have had an impact on the memory of the interviewees. What they consider to be important events and not may have changed considerably over the years.

One of the interviewers was himself part of the project, and might have felt a sense of ownership towards the project. He had very good knowledge about the entire process, and some of the questions asked during the interviews might therefore be leading to some extent. This might have been demanding for the interviewees, as some of the questions may have been experienced as personal.

There have not been conducted interviews of project participants with no formal role in the project, all interviewees have had some management responsibility. The interviews might have produced other results if the composition of participants had been different.

3 Theory

Knowledge sharing between projects and the main organization is seen as an important factor in achieving organizational success (Cooke-Davies, 2002). Researchers, like Riege (2005) and Nahapiet & Ghoshal (1998) suggest that the focus on knowledge sharing contributes to the creation and maintenance of a competitive advantage. Due to the temporary character of project work, projects are more vulnerable to loss of knowledge after the project is terminated. The use of temporary employees, such as consultants also increase the risk of valuable knowledge being lost, as they are likely to leave the organization after they have completed their tasks (Schindler & Eppler, 2003). Hence, it is necessary to create good processes for capturing and storing this knowledge, both during the project and after. The information collected through such processes also needs to be made available for the next project. A widespread principle for capturing and retaining knowledge is to document it as lessons learned.

3.1 Lessons Learned

The need to learn form experience in a project is constantly emphasized by experts, as it is important in order to achieve continuous improvement (Crosby, 2014), and hence achieving or maintaining a competitive advantage. Companies who are able to use best practice and avoid practices that do not add value to their daily operations, will be able to respond quickly to market demands and increase their profits (Yang *et al.* , 2011). The main objective for lessons learned processes is to identifying project successes, and the drivers for these successes, and challenges experienced in the project, their cause, and effect (PMBOK®Guide, 2013).

Lessons learned means, as the name suggests, learning from lessons that one has experienced. There exists a wide set of definitions of what lessons learned are. In the PMBOK®Guide (2013) lessons learned are defined as "the knowledge gained during a project which shows how project events were addressed or should be addressed in the future with the purpose of improving future performance" (p. 544). Milton (2010) defines lessons learned as "a change in personal or organizational behavior, as a result of learning from experience" (p. 15). Another description is made by Pinto (2013) where lessons learned are described as "the learning gained from the process of performing the project. It can be considered a type of project record, which can be included in the lessons learned database" (p. 512).

Lessons learned is a way of transferring experience and knowledge from one project to a sequential project, or from one project to concurrent projects. It can be part of a post-project evaluation, and it should be done as a continuous process that involves both pre-project evaluation and mid-project evaluation (Frame, 2007). It is a form of project review, where the participants of a project collects information and discusses the things that happened during the project. The goal is to identify things that stand out, that could be done differently or that should be done in the same manner in a later project (Westcott, 2005).

Lessons learned can be of great value if they are utilized in the right way. If there is a focus on lessons learned within an organization, the result will be more effective work. By avoiding repetition of mistakes, and repeating the successes the results will be continuous improvement of performance (Milton, 2010). The goal of lessons learned and its utilization is essentially to avoid the reinventing of the wheel by exploiting knowledge and experiences acquired and experienced by others.

Learning from mistakes is a powerful way of learning, but it is important that project groups, when collecting lessons learned, remember to include both successes and failures (Rhodes & Dawson, 2013). If the lessons collected are solely based on mistakes and failures, it can have a demoralizing effect on the team (Rhodes & Dawson, 2013; Milton, 2010; Westcott, 2005).

In order to achieve an effective lessons learned process and collect valuable lessons, the collection of the lessons should be a continuous process, happening throughout the project (Schindler & Eppler, 2003). If the lessons learned collection is postponed, the project runs the risk of losing important aspects of lessons when and if they are collect at a later time. Especially in large and long term projects the importance of not postponing the lessons learned collection is present (Milton, 2010).

The collection of lessons learned can happen through different types of initiatives. Keegan & Turner (2001) lists several practices for capturing lessons learned, including databases, project end review, after action review, intranet, corporate level training programs, and quality procedures and process documentation. The purpose of having initiatives for lessons learned is to codify them, and make them available to other members of the organization, translating the lessons into a useful format for future reference (Greer, 2008).

3.2 Success

Project success is a widely researched topic (De Wit, 1988; Ika, 2009; Munns & Bjeirmi, 1996, and others). According to Ika (2009), the research on the topic can be separated into three categories: (1) research on project success criteria, (2) research on critical success factors, and (3) research linking success factors and success criteria together.

3.2.1 Success Criteria

According to Hussein (2013), deciding whether a project has been a success or a failure is challenging due to two main reasons :

1. The first problem is how project success should be defined. Meaning what criteria, dimensions or indicators that should be used when assessing if a project was a success or a failure. What is considered project success depends on the perspective and perception of the stakeholder (Ika, 2009). Who takes part in the evaluation of the project will have an impact on the evaluation. Success criteria are the measures used to determine whether a project is a success or a failure (Cooke-Davies, 2002), and Jugdev & Müller (2005) made a suggestion for establishing success criteria prior to the project initiation, in order to avoid disagreements during evaluation of the projects success. However, this presupposes that the context of the project is unchanged throughout its lifetime, that the correct assumptions and estimates have been made, and that the project has managed to identify and take all perspectives into account from the beginning. Hence, the model does not consider changes and challenges that arise in the project or in its context.

2. The second problem concerns which approach or method should be used in order to measure the indicators, and when they are to be measured (Ika, 2009).

    There are mainly two approaches for measuring success in a project. One is considering project success through objective measures. Traditional measures are time, cost, scope, and quality. Evaluating project success based on these measures alone has however been considered to be too simplistic.

    Project success can also be evaluated through a subjective approach. Different stakeholder have varying views on project success, and it means different things to different people (Dvir *et al.* , 1998; Shenhar *et al.* , 2001). It is therefore likely that different stakeholders will evaluate a project based on different criteria.

The definition of project success has changed over time, and has gone from considering only the implementation phase of the project, to including the entire life cycle of the project and the product. Pinto & Slevin (1988) point to the importance of regarding the project life cycle when assessing success, as the project characteristics are likely to change as the project evolves.

De Wit (1988) points to the importance of distinguishing between project success and project management success. This is important as one can be successful without the success of the other. A project may still be successful even though management has failed, or vice versa (Munns & Bjeirmi, 1996). According to Cooke-Davies (2002) project success is the measure of how successful the project is at fulfilling its objectives, while project management success is measured against project requirements such as time, cost and scope.

Cooke-Davies (2002) includes three dimension of success in his study, namely corporate success, project management success, and project success. He identifies success factors for the different dimensions:

- Project management success
  - Effective risk management processes
  - Clear responsibilities and roles
  - Configuration management and deviation handling
  - Performance measurement and reporting schedule
- Project success
  - Close cooperation between user/owner and the executive organization
  - Involvement and effective communication between all parts of the project
- Corporate success (succeeding in all projects)
  - Effective portfolio- and programme management practices for choosing the right projects
  - Indicators linking project success and corporate success
  - Arrangements for experience and knowledge sharing

Shenhar *et al.* (2001) presents four dimensions that can be used for measuring project success, described in table 4. Here, the iron triangle is represented as one of the four dimensions. The other three dimensions include benefits for the customer and the performing organization, and also a long-term dimension.

Table 4: Project success dimensions (Shenhar *et al.* , 2001)

Project success dimensions	
Project efficiency	Meeting time, budget, and requirements goals. Success in this dimension may not result in overall result of the project
Impact on the customer	Benefits to the customer. Often considered one of the most important dimensions.
Business success	Benefits to the performing organization, the direct impact the project has on the owner organization.
Preparing for the future	Long-time dimension, questioning how the organization is preparing for opportunities in the future

The type of project affects what is considered to be most important to success. In some projects, a large budget overrun could be acceptable, while a delay would be unacceptable. In other projects, delays can be accepted, and in some cases even expected.

Hussein (2016) introduces process success into the project success term. Process success concerns how project participants perceive the project execution. Even though a project delivers on time and cost, it can still be considered a failure by some of the stakeholders due to a non-successful process.

3.2.2 Success Factors

The term "success factors" often refers to a set of factors a projects adopts in order to achieve desired results. They include actions taken to respond to challenges that arose during the project.

Many studies have been conducted to explore and map critical success factors in projects (Mišić & Radujković, 2015; Pinto & Slevin, 1988; Cooke-Davies, 2002; Alias *et al.* , 2014, and others), and there exists a common understanding of the existence of some success factors that are common to all projects (Dvir *et al.* , 1998). There does however not exist a complete list of factors that have to be in place in order for the project to succeed. One

of the reasons for this is that challenges that arise in projects often have a soft character, that are difficult to generalize.

Studying the critical success factors is considered to be one of the most important means of improving the effectiveness of a project, and determining critical success factors will help companies stay competitive (Alias *et al.*, 2014). Success factor research is focused on product, project and business unit level (Dvir *et al.*, 1998).

Belassi & Tukel (1996) point to the impossible task of identifying all critical factors that may have an impact on the outcome of a project. Instead, they suggest grouping factors together into four different areas. These areas are factors related to:

- The project

- The project manager and the team members

- The organization

- The external environment

Factors from one group may have an impact on factors in other groups, and hence there can exist interdependencies.

From the perspective of the project manager, critical success factors are variables, conditions, or characteristics that can impact the success of the project (Alias *et al.*, 2014), and that contribute to the results of the project (Ika, 2009). What can be considered to be critical success factors will depend on the characteristics of the project evaluated.

Identifying success factors and reasons for failure of a project is very useful to both project owners, contractors and other stakeholders as it provides lessons learned (De Wit, 1988). Used correctly, the identified successes and challenges can help ensure continuous improvement for the organization.

In table 5, success factors identified by Munns & Bjeirmi (1996), Pinto & Slevin (1988), and Mišić & Radujković (2015) are presented. Other authors, like Alias *et al.* (2014) and De Wit (1988) have presented similar lists and tables.

Table 5: Success factors

Munns & Bjeirmi (1996)	Pinto & Slevin (1988)	Mišić & Radujković (2015)
Realistic goal	Project mission	Clear objectives
Competition	Top management support	Pre-project planning
Client satisfaction	Project schedule/plans	Top management support
A definite goal	Client consultation	Stakeholder satisfaction
Profitability	Personnel	Risk allocation
Third parties	Technical tasks	Front end review
Market availability	Client acceptance	Plan
The implementation process	Monitoring and feedback	Benefits
The perceived value of the project	Communication	Information
	Trouble-shooting	Communication
	Characteristics of the project team leader	Community
	Power and politics	Leadership
	Environmental events	Design
	Urgency	Training
		Mission
		Charismatic project manager

3.3 Project Characteristics and Success

Olaniran *et al.* (2015) found that the characteristics of a project can have an impact on its performance. It is therefore important to understand these characteristics, and take these into account when assessing a project's success.

3.3.1 Project Context

Through his study, Hussein (2016) identified five characteristics that need to be taken into consideration in order to lead a project towards success. These characteristics are:

1. Organizational complexity

2. Change

3. Business perspective

4. Constraints

5. Uncertainty

Organizational Complexity

The term complex is, according to Hussein (2012), a collective description of a system of interrelated subsystems. Understanding complexity is important in order to be able to cope with difficulties that might occur as a result of the complexity present (Hussein, 2012).

Organizational complexity is considered to be one of the contributors to complexity and complications in projects (Hussein, 2016), and is assumed to be related to organization structure, project team, and actors involved and their interests (Bosch-Rekveldt *et al.* , 2011). The product or result of the project is often very large or complicated, with many components and subcontracts involved, and many people, different departments, and organizational units that have to perform (Hussein, 2016).

With the increasing size of a project, the complexity can be expected to increase. Megaprojects are characterized by extreme complexity. Several factors, in addition to size, contribute to this. These factors can include scope of international megaprojects, number of project participants, and multi-nationality (Kardes *et al.* , 2013). With high complexity follows high risk and uncertainty. Projects with high complexity will face challenges and situations that need to be managed in order for the project to evolve and succeed. Hussein (2012) points out that the understanding of the complexity in a project is firstly a way

to prepare for the situation caused by complexity, it is not a way of trying to limit the complexity.

Being aware of the complexity in a project is important, and can contribute to effective risk management early in a project's life cycle, and hence avoid problems at later stages (Thamhain, 2013).

Thamhain (2013) presents nine lessons for effective risk management:

1. Early recognition of undesirable events is a critical precondition for managing risk

2. Unrecognized risk factors are common in complex project environments

3. Unchecked contingencies tend to cascade and penetrate wider project areas

4. Cross-functional collaboration is an effective catalyst for collectively dealing with threats to the project environment

5. Senior management has a critical role in conditioning the organizational environment for effective risk management

6. People are one of the greatest sources of uncertainty and risk in any project undertaking, but also one of the most important resources for reducing risk

7. Project leaders should have authority to adapt their plans to changing conditions

8. Testing project feasibility early and frequently during execution reduces overall project risk

9. Reducing work complexity and simplifying work processes will most likely reduce risk

One of the main contributors to organizational complexity in projects is a high number of stakeholders. This is equivalent to a high number of interfaces. Wren (1967) defines interface as "the contact point between relatively autonomous organizations which are nevertheless interdependent and interacting as they seek to cooperate to achieve some larger system objective"(p.71). If interfaces are disregarded in a project, it can lead to severe problems during execution or after completion (Pavitt & Gibb, 2003). It is therefore important to identify and understand interfaces in the beginning of a project, in order to avoid a bad project process or unfortunate project outcome.

Interfaces can be either internal or external (Chua & Godinot, 2006). However, in order to address all types of interfaces they should be analyzed at three levels, namely (1)inter-project interface: between parties directly involved in planning and execution,

(2)intra-project interface: within the organization of each independent party involved in the project, and (3)extra-project interface: between the project and other parties not directly involved, such as government (Shokri *et al.* , 2012).

Al-Hammad (2000) lists common interface problems among various construction parties, under separate categories, shown in table 6.

Table 6: Common interface problems (Al-Hammad, 2000)

Financial problems
Delay in progress payment by owner
Accuracy of the project cost estimate
Owner's low budget for construction relative to requirements
Prince changes of materials and laborers during construction
Inadequate contract and specification
Insufficient working drawing details
Insufficient specification
Violation of contract conditions
Poorly written contract
Change order
Environmental problems
Weather conditions
Geological problems on site
Other common interface problems
Lack of communication between the construction parties
Slowness of the owner in decision making
Delay in completion of the project
Lack of management supervision
Skills and productivity of laborers
Poor quality of work
Poorly done planning and scheduling
Unfamiliarity with local laws of related governmental agencies

By applying interface management, industry leaders believe that the alignment between stakeholders can be improved, and hence contribute to reducing conflicts in the project (Shokri *et al.* , 2012). Effective interface management is critical in several areas including technical- and overall detail design, procurement, programming, and logistics, and it is essential to project success (Pavitt & Gibb, 2003).

Pavitt & Gibb (2003) categorize interface management into three categories:

- Physical - actual, physical connections between elements or components

- Contractual - occurs where there is grouping together of work elements into distinct workpackages

- Organizational - interaction between different parties involved in a project

Change

Change is about changing the entire or parts of a present situation, into another desired state (Gareis, 2010). Change can mean changes in work routines in order to streamline existing processes, or the development of new processes or products to improve services or products (Hussein, 2016).

Business perspective

The business perspective of a project concerns how large the impact of the project is on the organization. How important a project is to an organization can vary with how big an impact the project has on the business (Hussein, 2016). Some projects are crucial for future operations of a company, and hence have to succeed, while others are less important.

Constraints

Constraints in a project are internal and external conditions that limit the project managers ability to manage certain situations (Hussein, 2012). These constraints include time pressure, lack of funding, lack of clarity, lack of experienced resources, lack of support, lack of clarity regarding roles and responsibilities, and lack of knowledge

Uncertainty

Lack of knowledge about the project or the product, methods for producing, or about the project's context are factors that contribute to increased levels of uncertainty in projects (Hussein, 2016). Uncertainty can be both foreseen and unforeseen (De Meyer *et al.* , 2002). While foreseen uncertainty can be taken into account during project planning, this is not possible for unforeseen uncertainty.

Uncertainty is closely related to complexity, and Williams (2005) claims that uncertainty is one of the two dimensions the make up complexity, together with structural complexity.

Uncertainty present in a project can be handled through uncertainty management. Good planning practices, coordination, setting milestones, and changing control procedures are all measures for trying to manage uncertainty (Atkinson *et al.* , 2006).

Atkinson *et al.* (2006) present different types of uncertainty that can be present in projects, shown in table 7. In addition, they mention uncertainty associated with stages in the project life cycle, and include a comprehensive list of uncertainties that may arise at the different stages. Some of the uncertainties mentioned by Atkinson *et al.* (2006) related to project life cycle include, amongst many other factors are:

- Difficulty carrying out design and plan stages leading to insufficient production specifications.

- Design changes during execution phase

Table 7: Uncertainties in projects, adapted from Atkinson *et al.* (2006)

Uncertainty in estimates
Lack of clear specification
Novelty, or lack of experience
Complexity
Limited analysis of the processes involved
Possible occurrence of events of conditions
Initially unknown factors
Bias exhibited by estimators
Uncertainty associated with project parties
Uncertainty about the level of performance that will be achieved
Objectives and motivation of each party
Alignment of each party's objectives
Actual abilities of the party
The quality and reliability of work
Availability of the party

People contribute to uncertainty in projects, and building trust is hence a way of mitigating uncertainty (Atkinson *et al.* , 2006). Smyth & Edkins (2007) use the following definition of trust in their article: "trust is a disposition and attitude concerning the willingness to rely upon the actions of or be vulnerable towards another party, under circumstances of contractual and social obligations, with the potential for collaboration" (p. 233). Building trust is expected to contribute to better communication, stronger organizational commitment behavior, lower degrees of competitive behavior in negotiations, lower conflict levels, and greater job satisfaction (Langfred, 2004).

Atkinson *et al.* (2006) lists several benefits of using trust to reduce uncertainty:

- Higher accuracy of risk calculation

- Reduction of control costs

- More effective teams

- Better planning

3.3.2 Contextual Factors and Project Success

There has been an increasing focus on linking project success to the characteristics of the project or its specific context. Recent studies show that in order to succeed it is necessary to adjust the leadership style, and adapt it to the projects context.

According to Shenhar *et al.* (2007), projects are not always unique, but have different characteristics and degrees of them. Every project therefore requires different approaches and strategies (Hussein, 2016; Shenhar & Dvir, 2007; Williams, 2005). Shenhar & Dvir (2007) have developed a conceptual model for describing projects based on four different attributes; novelty, complexity, technology, and pace, as shown in figure 2.
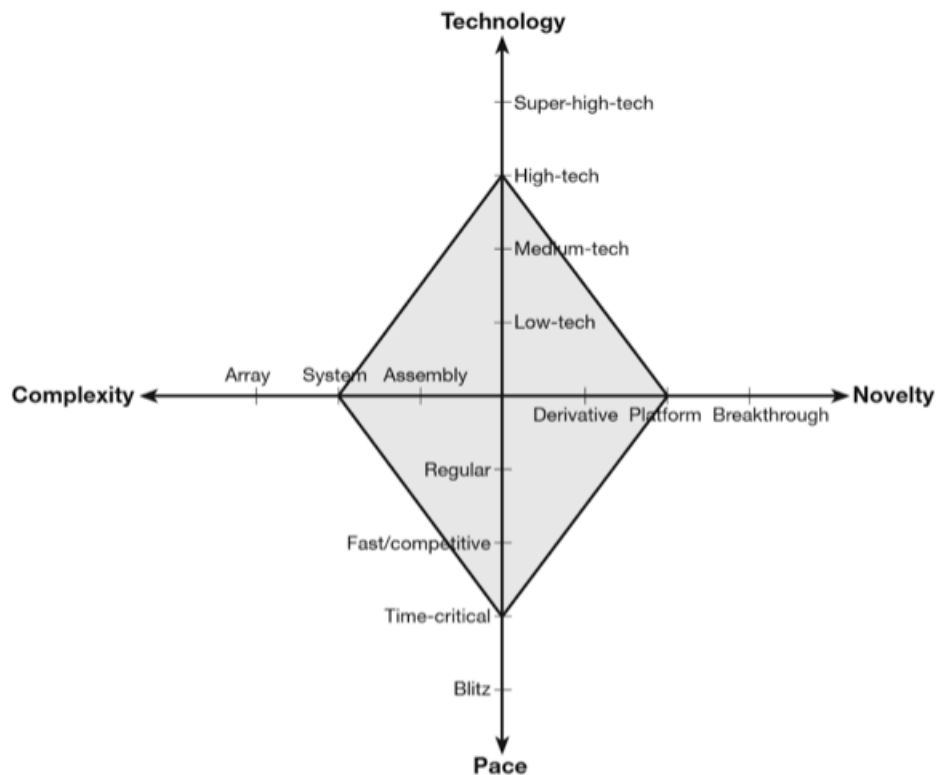
Figure 2: The diamond model (Shenhar & Dvir, 2007)

Shenhar & Dvir (2007) claim that projects fail as a result of underestimating the importance and degree of one or more of these attributes. Projects with high complexity demand other forms of management than projects with lower complexity. They also claim that projects under time pressure call for more efficient, integrate and autonomous project teams.

Understanding a project's characteristics is crucial in order to understand the challenges that these characteristics entails. This understanding is decisive for making choices on flow of information, implementation model, and project organization structure, amongst other things. As an example, Hussein (2016) points to the importance of proper interface management as a success factor when the project faces a high degree of organizational complexity. In table 8, the connection between project characteristics and critical success factors is presented, adapted from Hussein (2016).

Table 8: Project characteristics and critical success factors (Hussein, 2016)

Characteristic	Critical success factor
Organizational complexity (implementation of projects demands effort, competence, and resources from several organizational units or individuals.)	- Good information flow - Clear distribution of roles and responsibilities - Project manager authority
Changes (the project is initiated to change the way the end user works. Can also involve changes in attitudes, practices, behaviour, routines and processes)	- Clear goal - Including project processes - Project manager and professional knowledge - Proper composition of project participants - Motivated project participants
Business perspective (projects have impacts on the owner/organization in terms of financial gain, market position, reputation or opportunities)	- Anchoring of the project up and down in the organization - Clear project mandate - Top management support and follow-up
Constraints (eg. time pressure or strict requirements)	- Early phase planning - Effective/efficient team - Proper routines for handling of deviation - Clarity of limitations, guidelines, and specifications - Good requirements processes
Uncertainty in project and operations context	- Structured and systematic risk management processes - Problem solving abilities - Flexibility - Professional competence

4   Results

In this section the main findings from the interviews and questionnaires are presented. The section is separated into two subsections. The first contains findings concerning challenges that occurred in the Ivar Aasen project, while the second subsection concerns the success factors for Ivar Aasen.

4.1   Challenges

The project experienced a series of challenges throughout the execution phase. Many of the challenges have been interconnected and results of several different factors. The main categories identified that have led to challenging situations are challenges connected to interface, internal challenges in the project organization Ivar Aasen, and contractor and subcontractor relationships.

4.1.1   Interface

Interfaces and managing interfaces has been challenging for the project. These challenging interfaces have had several different dimensions including technical interface, organizational interface, time-related interface, and geographical interface.

The main reason for the challenges concerning interface stem from the high complexity of the project. There was, as mentioned, many stakeholders in the project that needed managing and attention.

Interface problems have occurred as a result of

- high number of stakeholders

- the size of the project

- the geographically distributed character of the project

- lack of compatibility between IT-systems

- delays in engineering, that propagated to topside

- operations were included late in the planning of the topside

4.1.2 Organizational Interfaces

The project had a high number of stakeholders, and several of the relationships with these were both complex and tense, and led to difficulties with organizational interfaces.

Aker

One of the most prominent stakeholder relationships that has been difficult for the project was the relationship between Aker, Det norske's board and the project organization Ivar Aasen. During the project, and especially in the earlier stages, there was a lack of trust from the owner and the board.

> *One of the board members went out and said "They will never make it, this is going to hell, they have screwed up, Det norske have made a fool of themselves, this is a complete disaster."*

> *Our investors did not really have any faith that we were going to be able to deliver.*

This explicit mistrust, and the high pressure from the board members led to a nervous management team in the project.

> *People in our management were jumpy, they were very stressed out about all of this going wrong.*

> *The project director and field director, working closely together, were incredibly stressed out about how this was going. Very tense.*

To cope with the situation and show that things were progressing, the project started writing reports about everything. This was very time consuming for the project, which was already under a lot of time pressure.

> *We spent a lot of time on that, it has taken a lot of our time that we could have spent on other things. At a time I felt like we were drowning in reports*

In order to know that the project was on track and progressing, the CEO was at the building yard in Singapore a total of 16 times. Sometimes it felt necessary to the employees, sometimes it felt more like surveillance.

> *It is a little bit of a balancing act, because sometimes the visits were very useful, sometimes we got help that was very useful. [...] It is a balancing act, but at times it was too much.*

Especially during the contracting period, the pressure from the owners and the board was high. Aker is the owner of several companies who participated in the tender for the

contracts that were to be awarded from the project. The topside contract is highlighted by informants as problematic to place due to pressure from the board.

> There was a fairly large pressure for reevaluation and looking at changes, and maybe specifically trying to treat Kværner in a better way than some of the other contractors.

> There is no doubt that Aker ASA as main owner, and the main owner of Aker as a board member, they were not happy with the topside contract being awarded SMOE.

> Det norske initially recommended Kværner and Aker Solutions for the contract, but the partnership, the owners thought they were too expensive and that is why we chose alternative number 2, SMOE and Mustang.

The next sentence gives a descriptive presentation of the situation and tension in the relationship between the stakeholders:

> Luckily we formally presented that we were overruled by the partnership, otherwise I think there would have been a lot more trouble.

A pressure was also present during the awarding of the hook-up contract. Some wanted the contract to be awarded Aker Solutions. However, the project ended up choosing Aibel.

> There was also a pressure, it was pretty close between Aker Solutions and Aibel, there was no big difference in price, but there was quite a lot of commitment, where Aker was not willing to commit key personnel.

SMOE and Mustang

The topside contract was awarded SMOE in Singapore, with Mustang in Woking, London as the engineering contractor. Det norske had chosen an EPC contracting strategy, but SMOE lacked experience for handling such a contract. This was something Det norske was aware of, but chose to work around.

> We knew that SMOE first and foremost was a building yard, and that it was the C they were good at, not the EPC. But we thought that... They had just completed another EPC project, and we thought that they would be better than they proved to be.

Det norske were optimistic about the cooperation with SMOE, which proved to be a challenge.

> *We knew we could mitigate some of SMOE's weaknesses. But we also knew that they were a reliable construction contractor. So it was an overall evaluation of what was the best alternative.*

The need for management and supervision from Det norske was huge, and the project ended up having approximately 120 people from Det norske in Singapore, in order to accommodate SMOE's EPC contract challenges.

> *We did not get an EPC contractor, we got a building contractor that were capable, but they did not take on the EPC responsibilities.*

There was made an overall evaluation of SMOE before they were awarded the EPC contract. Even though Det norske were aware of the challenges SMOE had with handling such a contract, they decided it was possible to accommodate these issues. What Det norske were not aware of and not able to properly evaluate was the capabilities of Mustang, SMOE's engineering contractor.

> *There is no doubt looking back that there were many things we underestimated, thinking about the extra complexity of having it in Asia. What definitely disappointed us the most was Mustang.*

One of the reasons why it was difficult for Det norske to foresee the difficulties that were to arise with Mustang was that they did not deliver on their promises of resources and available systems.

> *I saw some of the presentations Mustang had given during the tender, about how they were going to use engineering tools and IT systems that they had. It looked really good, because the systems existed in Mustang, but they were not used to using them in Woking.*

> *We felt that Mustang had the resources and at that time they were also able to document that they had systems. But now we see that they maybe only had these systems on paper, and there was not a well defined plan for the execution model.*

> *Mustang bid on one thing and ended up doing something completely different.*

> *Mustang completely lacked planning, and what surprised us the most was that they did not have any databases where they did the engineering.*

In addition, the placing of the topside contract was delayed several months due to reevaluations. SMOE and Mustang were therefore surprised when they were awarded the contract. As a result of the surprising contract, Mustang's staff in Woking was mainly consultants, who lacked ownership and knowledge about processes and procedures in the company.

> *They were very surprised that they got the contract, so in the meantime they had gotten other jobs, and a lot of the people who were going to work at Aasen had disappeared to other projects. So they started a large hiring campaign in London in order to get enough people. [...] Mustang started hiring consultants, and they hired anyone and everyone.*

The relationship between Det norske and Mustang was difficult, and is frequently mentioned in the interviews. There was a lack of trust between the two parties, and Det norske had difficulties including the engineering contractor into their one team philosophy.

> *We worked closely and integrated with all the contractors. London has been the challenge all along, they did not want that. [...] Mustang was managed from Houston, and they wanted to keep us at an arm-lengths distance.*

> *We had to check everything Mustang presented, we were not sure about it. So we used a lot of people, and externally we had Aker Engineering doing revisions 3-4 times.*

Another factor that contributed to a difficult relationship with the engineering contractor was that Mustang did not fully comprehend their task. They did not have enough people for the different parts of the engineering process, and Det norske had to push in order for them to hire more people and prioritize the project in an appropriate manner.

> *We realized we had to do something, otherwise we would not have progressed, because they did not understand what they had taken on. We had discussions about staffing, e.g. on process, which is fundamental for all design, to get the process in place. They had 7-8 people, and we meant they needed twice as many. They meant they were enough people, but a week later they wanted to withdraw that, because they understood that they did not have enough people. We ended up with 40 people on process. It was a little out of control.*

Lundin

The relationship with Lundin and Edvard Grieg is another stakeholder relationships that was very challenging for the project. The communication and cooperation with Lundin concerning the tie-in to Edvard Grieg was very complicated. Both Lundin and Det norske

were in the same situation, doing their first big project as operator, and were dependent on the success of their projects. The cooperation between the two companies was forced by the Norwegian government, who decided that the two platforms had to be connected, and that Ivar Aasen was to have only first step separation. The forced cooperation resulted in a difficult and demanding relationship between the two companies.

> They were forced to cooperate, which maybe they did not want in the first place. It was not a good cooperation, there was skepticism.

> It has been an incredibly demanding task, we have had to work really hard for every millimeter of action.

All the oil and gas from Ivar Aasen is sent to the Edvard Grieg platform. In order to get this in place, a tie-in job had to be done. One of the informants started working on this task in 2014, and he quickly discovered that the importance of the contract with Edvard Grieg was underestimated.

> Out of many things, this was something they had not focused properly on. I actually do not think that they thought of it as a tie-in as much as a pipe line or two and power-in. But actually, it is technically quite a large job.

One of the main causes for the strained relationship between the two parties was the timing of the cooperation. The majority of the communication took place during hectic times in the two projects, especially for Lundin, who were completing Edvard Grieg in 2015.

> When we were starting working together in 2015, they were probably in their most hectic and intense phase on their field, in order to get things completed and started up.

They were terrified of mistakes that could postpone their start-up. As a result, the process of being allowed to work in their 500-meter-zone was a complicated and demanding task for the team, with a lot of frustration. Lundin wanted to postpone the pipeline installation until 2016, and that would likely have postponed the production start at Ivar Aasen, making it impossible to reach the goal of first oil 4th quarter 2016.

> We were laying out pipelines, we were going to work within the 500 meter zone of Edvard Grieg. And they were very difficult. They wanted to postpone all the SURF work planned for 2015 until 2016. Just to get it out of the way. And I remember that meeting. We based it on facts. We were super professional. It was boiling internally with frustration. I do not think I can remember a meeting until 2016 where there has not been any bad mouthing. In all the

> *meetings. We got a lot of strange things towards us. But we said "we are going to be factual, professional, tidy, predictable, decent, all the way. And that actually worked.*

Through a professional and decent dialogue with Lundin, Det norske were able to handle the organizational complexity and complete the tie-in without any happenings.

In addition to being an organizationally complex task, the tie-in to Edvard Grieg also proved to be technically complex. The lack of understanding of the task also led to the designing of the platform without proper consideration of the tie-in job. This has led to results that only now are becoming evident.

> *One did maybe not take a proper look at the system. And now they are experiencing slugging in the pipe. That shows how important it is to understand this.*

Challenges in the Project Organization Ivar Aasen

Inside the project organization Ivar Aasen as well, one experienced challenges concerning communication. During challenging times in 2014, an informant describes a situation where there was lack of openness and honesty about what was going on. This resulted in uncertainty amongst the project staff.

> *Things were being wrapped. A little bit of the same communication strategy that was used towards the stakeholders, outwards, was used within the team as well. So the team felt like they did not know, they did not have enough facts. They saw that something was wrong, but not what it was.*

One of the factors that contributed to SMOE being offered the contact for the topside was their communication style. They had good English fluency and communication skills. However, even though language was not a challenge in the project, there were other challenges connected to communication.

> *They tell you what they think you want to hear, and they do not see that as lying. [...] When you tell them they have to do something a certain way, and then you take a closer look and discover that they are not doing it the way you told them to.*

This uncorrelated way of communicating led to the need of close follow-up from Det norske, in order to get knowledge and facts about status and progress from the contractors.

There was also a lack of communication between the different geographical locations in the topside subproject, which led to difficulties.

> *The package engineer was positioned in London, an Englishman, and the commercial leader was positioned in Singapore, and was Chinese. And when we sent out PO's, engineering did not get a copy of the PO's so they did not know what was sent out to the suppliers.*

Ivar Aasen was a large and complex project, with several hundred contractors and sub-contractors having deliveries into it. It was hence difficult to ensure that all of the sub-contractors felt ownership towards the project.

> *[...]I discovered that we had a lot of contractors who did not care about anything else than that they were going to deliver some sort of product. They did not know where they were, who we were, what they were there for.*

An informant describes a lack of cooperation and openness in the team in 2014.

> *I entered a team, a wing here where it was completely silent. Everyone was sitting completely quiet and working. It was a little dispirited, a little tense and low energy levels in what I met at the time.*

> *One Team was not in place in 2014, it was not properly in place in 2015 either, we had to work on removing the anxiety for telling the facts, the anxiety for being open and sharing what was going on with the team.*

One of the subprojects in particular also experienced internal conflicts that had an impact on relationships and the working environment. This has not been emphasized by many, but an informant describes a situation where there was bullying, harassment, people talking behind other people's backs, people taking credit for other people's work, and blaming others. The informant also describes that the top management did not consider this to be a reality.

> *We had a working environment survey, and all of that came up, in the leader group, by top management, that there was bullying and harassment. But they did not do shit about it. [...] They though people had misinterpreted the questions, because "this is not the reality here?" [...] One of the leaders looked at me and said that this is bullshit, that people did not understand a thing. And he told me to talk to HR and do a new survey where we changed the questions so that everything was crystal clear.*

The informant describes a situation where especially top management was a challenge for the team.

> *The biggest challenge has been top management, and that is not only to me, at a time some of the employees considered quitting and moving back to Norway.*

Some subprojects experienced success with the One Team philosophy, while other parts of the projects struggled to convey the concept to the contractors. The project was very complex, with several hundred subcontractors, and including all of these contractors in the one team philosophy, creating a feeling of ownership towards the project, and its success, was challenging.

Other Contractor and Subcontractor Relationships

With the difficulties present at the engineering contractor in Woking, Det norske had close follow up to handle the situation.

> *We have been very close, when we have seen things moving in the wrong direction we have been quick to correct our course.*

Usually the living quarter would be part of the topside contract, but in the case of Ivar Aasen, Det norske decided to have a separate contract for the living quarter.

> *I think the decision to separate the living quarter was correct. That made it possible for us to talk directly to Apply, and manage Apply directly*

They had a complicated relationship, where Det norske felt like they had to fix problems that Apply created, and in addition had to pay for them.

> *We have gotten quite a lot of added costs because they messed it up with procurement for instance, and they have been unprofessional in placing their procurement packages, and not following up and paying attention. And when you have a contract where we cover the procurement costs it has resulted in added costs.*

> *We saw weaknesses in Apply's organization, and felt we had to put in more resources and do more of the job ourselves, at least be the driving force on some of the things that you expect a contractor to take care of.*

> *It was a very big thing at the living quarter, the commercial aspect, it got a little stuck because they kept sending us a lot of variation orders. It was an important experience, to clean up underway, get it out of the way so they continue doing their job. We noticed that once there was a lot of them, the cooperation became very difficult.*

> *We got a good living quarter, and in that way it was a success. But we spent way too much time and money on follow up.*

To begin with, the project had approximately 140 purchase orders, which is comprehensive and complex. However, several of the subcontractors Det norske dealt with outsourced their scope without the initial knowledge of Det norske. Some of the subcontractors had a hard time following up on their own subcontractors, with lack of proper quality systems.

> *One of the biggest problems was that they were not properly prepared for outsourcing their scope, they did not have sufficiently good quality systems in place towards their own subcontractors. We had our requirement towards them, and everything was OK during the sales phase, you know, where they were trying to look good. But when we were starting to follow up on the deliveries we started noticing that they had a lot of subcontractors they did not have control over. And that image gradually became clearer and clearer, but we did not see it, I was not part of the contracting period, but I do not think they saw that picture.*

This became an issue for the company when dealing with the packages, as they were not in the position of going straight to the subcontractors. The subcontractors lacked overview of their own subcontractors, and consequently follow up became challenging. Due to the scope being outsourced it was difficult for Det norske to track the progress of the different packages.

> *They become quite angry if you contact a subcontractor directly. If you try to go through the backdoor and try to push their subcontractors, they are not happy.*

During the project, the market situation led to the contractors and subcontractors being stretched on capacity, with many simultaneous orders. As a result the project was not prioritized by many of the subcontractors. If the client was not present, they were not prioritized. One of Det norske's strategies in order to keep track of what was going on in the project, with so many contractors, was to pay visits to the contractors and subcontractors. As previously mentioned, there were approximately 120 people from Det norske present in Singapore during the project. These representatives paid visits to the subcontractors, in order to make sure that the deliveries would be on time.

> *Since we were not client number one [with many subcontractors], we had to make sure that they had a sense of loyalty towards us. [...]When problems arose, we were there. It is not the traditional way of doing things, but with the situation in the market it was necessary.*

Such a simple thing as getting people to visit the sites [...] we could probably have solved it with a lot of e-mail correspondence back and forth, but it was much more effective to pay a visit.

The visits to the contractors and subcontractors had a positive impact on the commitment to the project and the progress of the package deliveries.

If you expect to receive an e-mail, but after a couple of hours you have the customer at the door. Of course, when you have done that a couple of times, it is extremely disciplining. For a subcontractor to get a visit from the end customer is quite special.

Having such a large staff in Singapore was expensive for the company. However, it was an effective way of mitigating the risk of delays.

It has cost an incredible amount of money, but I think that it has been a part of the success too, that we have had people at the subcontractors.

HSE

The said priorities of the project were (1) HSE, (2) Quality, (3) Schedule, (4) Cost. During the project there were no serious HSE events in the total of 15-16 million working hours. However, as the time pressure increased, and milestones were coming up, the HSE manager experienced that management had to be reminded of this.

When we were getting closer to a milestone and they were writing reports and saw that they were not where they were supposed to be, there was a high pressure on getting things done.

He also experienced that as the organization grew, it became more difficult to convey the message of HSE being number one priority. There was lack of a common HSE culture in the project, and sometimes the HSE culture could be described as forced. In a way, to the informant, it felt like HSE was competing with the progress of the project.

When it came to HSE, especially when we grew, and we were staffing up in the leader group, the focus shifted more towards schedule, to get things in place, and strong words about having to get things in order and get on. So every now and then I had to remind about HSE being first priority. [...] I often felt it[HSE] took the back seat a little.

Even though HSE was said first priority, I understood in meetings and such that now it is so important to get this done that we just have to push forward.

One of the reasons it was difficult to establish a common HSE culture, especially in Singapore, was that SMOE's subcontractors hired staff according to the job that was being done at the time. They recruited from other countries, and there was no guarantee that they would hire the same worker twice. In addition the workers could be completely inexperienced before they came to work for SMOE.

A lot of them did not have any experience, they came from the country side, they were farmers, and they went through training, tests and exams, and then they were allowed to work there. They were trained at the yard. [...] You can imagine what the individual employee thought about HSE and what they considered important.

In Singapore, one of the things that worked well for the HSE culture was an informal hierarchical structure. The HSE manager also describes a move he made in order to engage everyone in the HSE culture in the project.

I forced the workers on the yard to do their duty, to be busboys. I created a program that ran several rounds and changed each week. It was like this: one week it was your HSE week, in parallel to your regular duties, that forced you to be engaged. You had to go out on the rig, to the different areas, talk to people, participate in the morning meetings, and present an HSE case or safe moment at the HSE meeting.

Communication has been one of the biggest challenges concerning HSE.

There are several things that have not been handled well by the project concerning the few HSE happenings we have had. They have been exaggerated. One thing is important when you work with emergency preparedness, and that is that all information must be confirmed before you move on, and the project has been exceptionally bad at that.

This communication never had any real consequences for the project, but it created discontent at times. In order to handle happenings better, without things escalating, an informant gives the following recommendation

Everyone in a management role could very well have gotten an imprinting on communication in crises and roles in such situations.

Technical interface challenges

Transferring information from the topside contractor to the hook-up contractor was a technically challenging task, that could be said to increase the complexity of the project. There was a lack of proper interface between the two contractors, and as a consequence the transfer of the information had to be done manually.

> *It was a manual establishment, then a manual transfer, and someone had to sit there and punch everything into a system instead of everything being automatic. It was time consuming, and we spent resources on that [...] It has contributed to increased cost since we actually did not get what we should have.*

There was also a challenging technical interface between the topside subproject and D&W, with changes being made during construction without consulting D&W in advance. These changes led to the need for rework.

> *When the project was moved from Woking to Singapore to start construction we took it for granted that our demands had made their way into the functional requirements, which are followed up during construction. But when we got down to Singapore, some time after the construction started, we noticed that several of our requirements were simply cut out or not done.*

4.1.3   Market Situation

When the project started in 2012, the market in the oil and gas industry was very heated, with several large project ongoing at the same time. This resulted in a challenging contracting period for Det norske. With a limited amount of contractors available and willing to give offers, Det norske was in a difficult position, and there was a lot of uncertainty.

Several of the large contracts were placed before the PDO was handed in, in order to make sure they were able to get available resources for the planned progress, completion and start-up of the platform

> *The market was very heated, and that was why we tried to be early.*

The size of the company also contributed to difficulties, as they were a small and relatively new actor on the market. The large, experienced contractors would rather prioritize larger oil and gas companies. This led to them being placed in the back of the line, not being prioritized, and not being able to choose who they wanted to have as contractors.

> *We were out at a time where there were five large projects out on the market at the same time, and no one had any preference working for a small newcomer like Det norske, so we were at the back of the line and could definitely not choose from the top shelf.*

In addition, Det norske were concerned about choosing a larger building yard in Asia for the construction of the topside. As a small client, they would likely not be respected if they wanted something changed. SMOE was a smaller yard in Asia, and Det norske was at the time their only client. This enabled Det norske to make suggestions, have an open dialogue with the contractor and influence decision making.

> *One of the factors was personal relations. During the evaluation phase we had met the SMOE management several times, and visited the yard, and they spoke English as good or better than us, so they were easy to understand. [...] And they had a sense of humor that was easy to relate to and that was similar to ours.*

> *SMOE and their management were fairly easy to relate to communication vice, and we felt that when there would be issues during the project implementation it would be much easier to relate to the leaders we met at SMOE.*

> *If you had made those suggestions to Samsung or another big yard they would have just laughed at you and said "we do not do it like that here."*

For Det norske, choosing a smaller building yard felt like a safety measure, and it enabled them to follow the progress and make comments, adjustments and changes to SMOE's work.

4.1.4 Time Interface Challenges

Time pressure was the biggest constraint for Ivar Aasen. Due to the forced tie-in with Edvard Grieg, Det norske saw the opportunity to set the start-up date to 4th quarter 2016. If they were going to be able to reach this goal, they would have to initiate the project as soon as possible, and have good progress.

> *During the winter 2011-2012 we negotiated a solution for Ivar Aasen where we were doing the tie-in with Edvard Grieg, and one of the things that became clear was that we could get access to production October 1st 2016.*

As a result of this time pressure, the FEED for Ivar Aasen ended up having varying quality. Aker Solutions in London, which was a newly established organization, did the

FEED work, and that led to challenges. The placing of the FEED work in London was a result of the time pressure in combination with the market situation. No one in Norway offered to do the FEED.

> *Aker Solutions, who recently had established their London office, had not yet managed to get their personnel to follow their systems. When we asked questions if they used the PEM[project execution model] and the execution model, the English consultants did not even know what it was. They did not manage to do a FEED according to their own systems, and in retrospect we see that there were holes in it, that led to us losing quite a lot of time, because it was not as easy to transfer things as we initially thought.*

> *I think the FEED was a characteristic of the time pressure. One wanted to come to a fast conclusion.*

The time pressure of reaching 4th quarter 2016 also led to parallel processes, which led to increased risk of rework.

> *In order to reach our goal we had to decide to go out bidding on the job while we were doing the FEED. Statoil and Bayerngas were against it, but if we had done it the way they thought was right we would not have started production until late 2017.*

> *The FEED was too short compared to what a regular FEED should be. In addition we had a lot of parallel activities in the beginning of the execution phase, and I think... It cost money, of course, but it also cost a lot of time, due to all the rework.*

The insufficient FEED work ended up being one of the reasons for the large staff present in Singapore.

> *If we should have done it differently, we would have needed to be a lot more specific about what we were actually ordering. The specs should have been in perfect detail, and the FEED should have been 100% mature. If that was the case, then we could have had a lot less people. But this has evolved underway.*

The topside contract went several rounds back and forth, before it was finally landed. The contract was supposed to be placed in December 2012, but did not land until February 2013, three months late.

> *We asked the CEO for advice, and he checked with the chairman of the board, and if we were going to make first oil in 2016 we had to get started. We were in February, and the contract was supposed to be placed in December. We got*

"OK" for picking number two on the list.

At one time during the project, engineering was as much as six months delayed.

During fall 2013, we were probably 3-4 months delayed, and it became even more towards the 30% review and 60% review that was supposed to be in May 2014, and happened in September, October 2014. Almost half a year.

Even though the delays were large, they managed to get the project back on track. This was however not solved by engineering in Woking, but rather at SMOE in Singapore, with SMOE's ability and willingness to adapt and change their building sequence.

The reason we solved this was that SMOE changed their building sequence[...] which made it possible for equipment to be delayed.

Initially, the plan was different.

They wanted to build the entire steel structure, and then skid all the equipment in afterwards.

The new building sequence resulted in SMOE building each deck, and then lifting them on top of each other afterwards, when the equipment was placed in position.

4.1.5 Organizational Complexity

Organizationally, the project was complex for the company. With a high number and diversity of stakeholders, in addition to commercial conditions, dealing with the complexity in the project was an important and difficult task.

Det norske was a tiny company, and the company was being built parallel with this development project. And in that way it might have been one of the most complex projects I have ever been part of.

In addition, there were many complicated commercial relationships in the project, that had to be managed and negotiated.

[...] Things moved a lot before the PDO was delivered. There were all these commercial relationships with Lundin and the Grieg-group, Wintershall and the drilling of that well [exploration well in the neighbouring licence], and the authorities due to the fact that we were going to deliver a PDO without a unit agreement in place.

4.2   Success Factors

The company considers the project to be an overall success. In this section, the most important factors contributing to this success are highlighted.

4.2.1   Determination and Motivation

Motivation has been highlighted by many as one of the main critical success factors of the Ivar Aasen project. Several informants describe a motivated team, which was also highly determined to succeed with the project, and had both the desire and drive for success.

> *Not delivering was not an option.*

> *If you want to succeed you get a special drive*

Through the interviews it has become evident that the team had a feeling of having to succeed. The future of Det norske was highly dependent on the success of the project, and if the project was to fail, it would have impacted the entire organization.

> *We had to succeed, we did not have a choice. There was an incredible drive in the project to succeed and make this happen.*

> *There has been an incredible will and guts to succeed, and a feeling of having no other option but to succeed, we had to make it.*

The motivation of Det norske's employees has been tremendous, and people have been willing to work hard to reach their common goal. In the beginning, Det norske was a small company, with few employees, who felt an ownership towards the success of the project.

> *We have had a lot of skilled people, great ownership to the project, people have worked a lot and sacrificed a lot.*

> *The team has been dedicated, and worked hard.*

> *We were lucky, as an entrepreneurial company. You probably attract a special kind of people.[...] We were lucky with the people we got on board and the ones driving the project. People willing to take a chance and thinks it is fun to take part in something new, willing to go the extra mile to get it done.*

The following quote gives a descriptive image about the morale of the team.

> *[...] The guy that got notified about losing his job in Aker BP before Christmas. Even with this message he jumped on the first flight to Singapore with an hours*

notice, and he was there for a week.

Internally in the project organization there has been little time wasted on conflicts.

> *There has never been used a lot of energy on conflicts between positions or people who think that this should be mine and not yours and all of that. We have not wasted time on such things, and that is important.*

Not only the employees of Det norske have contributed with motivation and drive for success. Some of the subprojects had motivated contractors, with the same desire, and need for success, as Det norske's own team. An example of this is EMAS, the SURF contractor.

> *EMAS were inexperienced and small, and together we had the will and the motivation to achieve success. [...] We had a company who really wanted to deliver a successful project, and we were in the same boat, so we thought it was a perfect match.*

Despite all the challenges Det norske faced with the topside, it is still considered a success. One of the reasons for this can be said to be SMOE's motivation. The workers at the yard were highly motivated, and were willing to work hard for the project.

> *SMOE has had a tremendous drive to actually finish the project. They have not really been especially commercial, but they have wanted to get the job done.*

The success following the new building sequence for the topside, with the lifting of one deck on top of another gave motivation and drive to the subproject.

> *57 individual points had to connect, and they did. They were so impressed and stoked. It was damn good.*

Sticking to the initial plan of the project has contributed to maintaining the drive that has been present in the project. It has given less room for slack, and demanded hard work from the project and its suppliers.

> *We were recommended to drop the first lifting window and go for the second one, and communicate that. I said "hell no, just forget it... It is not going to happen." Once we go out and communicate that we do not have faith in our own plans both suppliers and our own technical managers will lose foothold, and we will struggle for an additional six months to get the new plan in place.*

4.2.2 Competence

There is agreement amongst the informants that the members of the project have been highly competent and skilled, and that they have contributed to the success of Ivar Aasen. Det norske were able to hire a lot of competent people with vast working experience from the industry.

> *From my point of view that is what saved Ivar Aasen, there was an incredible amount of competence.*

> *We were lucky, we got a lot of very talented people.*

4.2.3 Project Management

During the interviews many of the informants have expressed high thoughts about Ivar Aasen's project director [project manager], and he is by several considered to be an important success factor for the project.

> *He is damn good at getting people to join him, he has put together a fantastic team, and that is also why this has been a success.*

In addition to building the team, he managed to trust people to do their job, and let them do it. He was also supportive and built relationships with his project staff.

> *We have been given trust to do the job we were supposed to do, it was "this is your task, you do it." The project director was particularly good at that.*

> *I was directly reporting to the project director, and I believe I had a very good relationship with him. I was able to tell him anything, you know, on both personal and project level, and he was always quick to support me.*

> *He has always trusted us and had faith in us. I have never been part of a project where the team and the cooperation has been this good.*

In his description of himself he says the following:

> *I have the ability to change and learn, change behaviour and learn.*

He also describes himself as an authoritarian person, but without the need to make decisions only to do so.

> *In order to be able to handle a job like mine, you need to be persistent, and you can not be worried about not reaching the project objectives. That creates anxiety in the organization.*

The project manager of Ivar Aasen considered his most important job to talk to people

> *My most important task was to be the storyteller, talking to people "this is how it is, this is how we are going to do it."*

The project had many highly competent project managers in the subproject as well. They managed to create trust within their team. They delegated tasks, trusted in their teams, and gave responsibility to the team members.

> *To me it was very important to delegate responsibility. They did not only get responsibility, but also authority to make decisions.*

4.2.4 Top Management Support

The top management in Det norske and Ivar Aasen has also been very supportive. They have been committed to the project in a way that has contributed to the progress of the project.

> *If there has been a need for the CEO or the chairman to contribute, even the main owner of Aker, it has not been an issue.*

> *The top management worked a lot on stakeholder management, information to the partnership, internal management and all of that.*

From the moment the current CEO joined the company in 2014 he was very engaged.

> *I think I have been closer to this project than many others in my position. Both participating in meetings with subcontractors, and follow-up on the project with quite a detailed KPI-set.*

Having an involved CEO was a success factor. The project had contractors from all over the world, with different approaches to culture and organizational culture. Some were more concerned with hierarchy, and the position of the person giving orders.

> *The first time I met Mr.Ho and summed it up in an action list and sent it to him I did not think of it as something other than a good summary of the meeting. But I underestimated what that meant to the project management down there. And he took the action list very literally.*

> *[...]It worked, but what you reflect over then is the cultural difference, because it was exactly the same point some of the project managers had tried to convey in Woking, without being heard.*

4.2.5 One Team

Many of the informants emphasize the importance of the One Team philosophy in the project, and that the focus on having an integrated team was the single most important success factor. One of Det norske's own success factors was *Integrated team execution model - build team culture*. This included both all of Det norske's full time employees in the project, but also the consultants and contractors. Even though it was challenging to get this mentality across to the entire project from the beginning, several subprojects managed to implement this at an early stage.

Several of the informants describe contractors willing to be part of the integrated team, cooperating and sitting together with their subprojects at Det norske's locations, and eager to work together in order to achieve success.

> *We managed to create a commitment to succeeding together. Most members of the team wanted to succeed in the team.*

Some of the subprojects experienced greater success with One Team, and had better communication and cooperation than others. An example of good cooperation was between D&W and the PETEK team.

> *It was incredibly important that D&W and PETEK worked closely together, both during planning and execution. PETEK tells us what we will find down there.*

The two departments had a good working relationship throughout the project. They were collocated, which enabled them to have close cooperation with good professional discussions, getting the best information possible from each other, making decisions and compromise. The managers from both departments were located together with their own teams.

> *We were sitting in the office landscape together, D&W and PETEK, and the leaders were there. I think that was effective.*

Parts of the Ivar Aasen management team wanted the D&W and PETEK managers to sit together with the rest of the management. However, D&W and PETEK wanted it differently, and ended up sitting together with their own teams.

> *The field director had demanded that the D&W and PETEK project managers were to sit together with him, and not their own team. It ended up with them sitting together with their team, and that might have been the start to One Team. That is when it started, when the managers were allowed to come back*

and sit together with their own teams.

[Sitting together was a] very simple adjustment, nothing big, very basic, but incredibly important in order to get the crew to function properly.

Not only was the internal cooperation from Det norske's D&W and PETEK staff good, D&W and PETEK were able to include contractors into their team. Staff from the contractors was located at Det norske's headquarters together with Det norske's own staff. That way, the contractors became part of the Ivar Aasen project in a more direct way, and it created a sense of belonging

We said that we wanted a person from each of the four most important segments sitting in the organization together with a coordinator.

It definitely led to a completely different ownership.

Other subprojects were also successful in integrating their contractors into the team, and create the One Team spirit. One of them was the SURF team, who had a very strong focus on team building, not only internally, they were also preoccupied with including their contractors.

We managed to build an incredible team spirit, I have never experienced anything like it. [...] We did a lot of team building. We had gatherings. We called it One Team.

The unity and spirit in Det norske SURF, Ivar Aasen SURF. And we managed to integrate EMAS, ABB and Kongsberg, they became a part of that spirit.

Another team that experienced success with having an integrated team was the T&I team. It was composed of two full time employees, and several other team members who only worked part time on this part of the project. Even though the team was not working together at all times, the team manager was still focused on getting a team spirit.

[...] We got together, we had team dinners and we had self assessment workshops. We worked together as a whole team, trying to make the project successful.

One of the main reasons why the One Team philosophy has been a success in the project is the people of Ivar Aasen, who have had the ability to cooperate.

There are really no super strong personalities that take up a lot of space, who needs all the light and for everything to hang on them. It has been really humble, almost social democratic, where we have lifted together. There has never been a high, dark boss that takes all the light.

The project was as mentioned large and complex, with many contractors and subcontractors. It was therefore a comprehensive task to implement Det norske's own success factor, *Integrated team execution model - build team culture.* Some informants describe building relations to their contractors as a key to achieving success. Building relations created a sense of ownership with the partners, which resulted in a wish to succeed. Hence, they were able to include the contractors into the One Team philosophy.

> *I built relations to my counterpart. We ended up with a partnership, they had ownership to the success of Det norske.*

In Singapore, through persistent work, they managed to create a sense of ownership and commitment to the project from all the employees at the yard. The workers could address issues that they had, and there was an open dialogue between the management and the workers. Through the establishment of relationships and mutual respect it was possible to get the One Team philosophy across to all of the employees at the yard.

> *The topside project manager's expertise was building relations, that is what he is best at. And that is what I think we needed in Singapore.*

> *The first times I was out there no one looked at me, because I was the boss and from the West. [...] But after a while they started warming up, and we communicated through an interpreter. They were able to bring up things, and we fixed it. It became an incredibly powerful organization. To get 2300 on board. They walked through fire to get this done.*

Det norske also had a large staff travelling around, visiting subcontractors. These visits were a way for the company to get information about the progress of the packages being delivered, as SMOE were not capable of handling this responsibility on their own. Building relations was a critical success factor in order to get the packages in place. By visiting the subcontractors, the project was able to build relations to the subcontractors, and get them to prioritize the orders.

> *We had quite a lot of packages that were critical, so we used the chairman and the project director where they had most relationships, and talked to the people there.*

Building relations also made it easier to contact suppliers when something was not satisfactory.

> *When you create good relationships when times are good, and we agreed on delivering quality at a certain time, it was a lot easier to pick up the phone when we were struggling.*

In addition to building relationships, another factor that has impacted the ability to cooperate is the clear common goal of the project.

> *I think one of the reasons we have managed to get a good team is that most of the project participants have worked towards a common goal*

The common goal in the project was always first oil, and from project initiation the goal was 4th quarter 2016. This goal has helped the implementation of the One Team philosophy, and helped ensure that everyone felt responsible for the results of the project. Working towards a common goal also limited the subproject's incentives to deliver something that was not of high quality.

> *In the project, I mean the reason we succeeded in Singapore, with Saipem, in London. Everyone has their opinion about the company, and maybe they have stories about how they are. But we manage to create a good working relationship between us and the contractor, and nobody is out to get the other[...] we have a common understanding of where we are going, and we have a common understanding of when we are disagreeing and how that should be solved. Common understanding of the goal.*

4.2.6 Turning Points and Subproject Success

Several subproject had limited amounts of challenges, especially related to contractor relationships and internal conflicts. The contracts were good, and the contractors were committed and had ownership to the project.

One of the subprojects that experienced success was the D&W and PETEK team. They managed to implement the One Team philosophy at an early stage in the project, and several informants are under the impression that this subproject is where One Team had its origin. In addition to the integrated cooperation in the subproject, Det norske had a nontraditional contract for the drilling services. In the contract they gathered all the necessary services, which typically would be 12-14 different contracts.

> *There was an immense pressure in the industry, and we understood that in order to get the attention from the big contractors like Schlumberger and Halliburton, we wanted to gather all the services in one contract.[...] We firmly believe that that has given us better results. That, combined with our demand of having one person from the four most important segments sitting inside the organization together with a coordinator.*

Det norske has one of the best drilling departments in the world, and the drilling campaign at Ivar Aasen was very successful throughout. One of the reasons for this was that they were very ambitious during their planning phase. In addition, they were highly competent, and were able to work as an integrated team.

> *They were of course a very competent team, professionally. They worked hard on establishing the One Team approach, and that did not mean One Team within the drilling department, they also included PETEK, and especially the inclusion of the two main contractors.*

Another reason for the success of the D&W was the nontraditional way of working and cooperating with their contractors.

> *Traditionally, in the drilling industry, the operator's engineers find the solutions to problems, and then you go to the supplier and order the components needed to solve the problems. But here Schlumberger were included in the problem solving, and afterwards they found the necessary components.*

The drilling of the wells was successful from the first well, and it gave confidence to the entire project.

> *All of a sudden we went from "we do not know where we are and where this is going" to "we are part of something that is best in the world". That lifted everyone. Maersk Interceptor[the drilling rig] gave a confidence boost one maybe thought one would never get. That was a big turning point for the project. Very big.*

Another subproject that experienced a limited amount of challenges was the jacket team. They had a highly professional and experienced contractor, that had control over their activities throughout the project.

> *We had a professional contractor. Saipem impressed me throughout the entire project, both concerning tidiness, agreements, clean up and fixing. Even if they made problems for themselves, they handled it along the way.*

> *The jacket, that part of the project went very well. We had a small organization who followed up, but we met a contractor who had full control from day one.*

The jacket was put in place summer 2015, and was delivered on both time and cost.

> *[...]In spring 2015, when the jacket arrived, completed on time and cost. The next big milestone.*

These two subprojects and their success became milestones in the project, and lifted the spirits of the entire project. This has contributed to maintaining the motivation within the team.

> "Yes! We are succeeding with Interceptor, we are succeeding with it [the jacket]." And then people started feeling like we have to make this. All of it.

Another milestone in the project was set by the CEO. He went out publicly and promised that they were going to deliver the project.

> And then something happens, right? Both in the project and the contractors around us, because you have placed a pole in the ground, and you say "here, but no further, this is not working." And that creates a robustness, and through 2015 I experienced that the organization became stiffer and stiffer, and more and more robust, and handled problems better and better.

4.2.7 Ability to Mobilize

Another important success in the project was Det norske's ability to mobilize people and handle problems that arose, quickly.

> The project has adjusted well, "oh, we are falling behind, let us put in some effort to get back on track." Dynamic adjustments have been made throughout.

The project managers were given mandate to handle things as they occurred, without the need of top management approval.

> The project director and the field director had a very large mandate and freedom to do things, to take action fast

In the project, things were not postponed and problems were not allowed to evolve. Issues were handled immediately, and the visits to the subcontractors is an example of this.

> If something was discovered on a Thursday it was not put on hold until Monday, it was fixed tomorrow, even though tomorrow was a Friday. Things were not allowed to just remain the same.

> We succeeded in handling challenges once they occurred.

> Our presence with follow up of the packages was probably one of the success factors that got us across the finish line

They also made tactical moves to put pressure on the suppliers. An example is the decision to mobilize a transport vessel for transportation of package deliveries. This contributed to minimizing the risk of delays and further delays.

> *In January 2015, the project mobilized a large transport vessel that was to leave from the Netherlands, and that was supposed to carry many of these deliveries from subcontractors. And what happened was that the subcontractors managed to mobilize heavily in order to get their equipment on that vessel.[...] So that mechanism of arranging common transportation was an effective driving mechanism to motivate the subcontractors to deliver on time.*

The organization has had a flat structure with few levels of reporting. This has enabled them to take action fast, and it has contributed to an open dialogue.

> *Technical issues were solved on a professional level, unbureaucratic, without the need for formal management decisions.*

> *[...] People were allowed to use their competency and initiative, without having to go through four different departments for approval.*

5 Discussion

All projects are to some extent unique. Consequently, different factors impact their success and failures, and there does, as mentioned, not exist a complete list of generic success factors that are present in all projects that experience success. Due to the unique nature of projects it will not be possible to develop such a list. The reason for identifying success factors and causes of failure is that it can provide project owners, contractors, and other stakeholder with useful lessons learned (De Wit, 1988)). Dvir *et al.* (1998) recommends a project-specific approach for research on project success factors, and this will be applied in the following section.

The following discussion is based on what I consider to be the most important challenges and successes throughout the project, with connections to elements of relevant theory. The reason I consider these challenges and successes to be most important is that they have been prominent in many of the interviews, both directly and indirectly. Many of the challenges and successes that have occurred in the project have common origins, and by exploring these, valuable lessons can be identified.

Prior to the discussion of the project's successes and challenges, the project characteristics of Ivar Aasen are presented, as understanding these is important when assessing a project.

5.1 Project Characteristics

All projects, regardless of industry, have important characteristics that separates project work from regular operations. Understanding these characteristics is crucial in order to understand the challenges that these characteristics entails (Hussein, 2016).

The findings suggests that Ivar Aasen had the following characteristics, based on the dimensions of project characteristics identified by Hussein (2016),

5.1.1 Organizational Complexity

Ivar Aasen was a large and comprehensive project, employing over 5000 people. Many contractors and subcontractors were involved, with approximately 200-300 different sites and locations all over the world. A total of 140 package deliveries were ordered, and contracts for the main components were placed in Italy(jacket), Singapore (topside), and Stord(living quarter). The project also consisted of many subprojects, that were dependent on the information flow between them, and each others progress.

The project had many stakeholders, which contributed to high organizational complexity. Det norske is the operator of the Ivar Aasen field, and in 2013 the partnership consisted of Statoil and Bayerngas together with Det norske. In 2015, after the unit agreement with the neighbouring licence, the partnership consisted of Wintershall, VNG, Lundin and OMV, in addition to the previous licence partners. Det norske's main shareholder was Aker ASA. They tried to pressure Det norske into placing contracts with other Aker owned companies. As the price of these services from Aker were higher than other offers, the partnership would not accept this. Having Aker as the main shareholder in Det norske hence complicated the stakeholder relationships in the project.

Another complicated organizational relationship in the project was the relationship between Lundin and Det norske. Ivar Aasen is positioned close to Lundin's Edvard Grieg field. Both companies have their own platform, but the government decided that there had to be cooperation between the two platforms. The main reason for the complicated relationship between the two parties was the timing of the cooperation. Lundin were completing their platform at the same time as Det norske wanted to do the tie in. Hence, Lundin were terrified of something not going according to plan, which could delay their own production start. Today, Det norske does first step separation on Ivar Aasen, before the oil and gas is sent to Edvard Grieg for further processing. In addition, Edvard Grieg supplies Ivar Aasen with power.

5.1.2 Change

There has been some changes in organizational structure and employments during the project. Det norske got a new CEO during the project, and the organization map was at times difficult to understand and hence had to be changed. However, these few changes never affected or changed the goal of the project, and the project has otherwise gone through very limited amounts of change.

5.1.3 Business Perspective

The success of Ivar Aasen was crucial for Det norske. It was their first project as operator on a larger oil field, and they invested huge amounts of resources in the project. During the project, Ivar Aasen and Det norske were in ways acting as one organization, with little separating the daily operations of the two. If the project was to fail, it would have had a massive impact on the company.

5.1.4 Constraints

In Ivar Aasen, time was the main constraint. The project experienced high time pressure throughout. The forced cooperation between Ivar Aasen and Edvard Grieg resulted in an opportunity to expedite the start-up date for first oil. The project was initiated in 2012, with contracting and establishment of the project organization, and had a deadline for first oil 4th quarter 2016. Even though the project experienced delays, it was never an option to postpone the deadline for first oil.

There were few other constraints during the project, who can be said to have had almost unlimited resources available, especially with regards to financial resources.

5.1.5 Uncertainty

Det norske has throughout its lifetime as an organization gone through several large changes, with acquisitions and mergers. At the initiation of the project, Det norske was a new organization, which contributes to uncertainty. There were newly hired employees, and lack of common processes. There were also structural challenges present in the organization. The organization map led to confusion in the project as to who reported to who. This too contributed to increased uncertainty.

When the Ivar Aasen project was initiated, the oil and gas market was very heated, with high uncertainty for the companies who were out looking for contractors. There

were many projects competing for contracts, which led to a limited access to attractive contractors. This resulted in the need for fast decision making and awarding of contracts.

The awarding of the contracts was not always successful, and decisions were made based on the high time pressure present in the project, in addition to excessive optimism. Several of the contractors chosen for the project proved to be inexperienced, or lacking competence. They lacked understanding and knowledge about the project and their own tasks, and its complexity. This too contributed to increased uncertainty.

Project characteristics chart

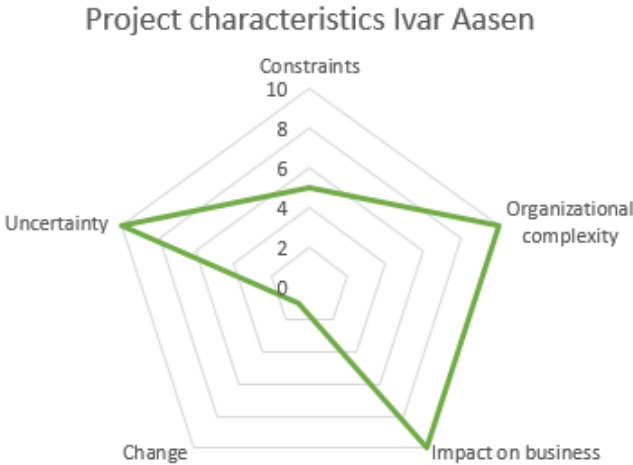In figure 3, the characteristics of the project are presented in a radar chart.

Figure 3: Project characteristics of Ivar Aasen

5.2 Challenges

The project characteristics and the partly insufficient handling or understanding of these led to challenges in the Ivar Aasen project. These challenges are summarized in table 9, and elaborated in the sections below.

Table 9: Challenges identified in the Ivar Aasen project

Challenges	
Relationships to contractors	Lack of trust
	Lack of commitment
Interface challenges	Technical interface
	Organizational interface
	Interface management
	Other
Other challenges	Lack of experience with EPC contracting
	Newly established organization
Time pressure and market situation	
Integrated team	

5.2.1 Relationships to Contractors

Several of the informants describe challenging relationships to contractors in the project. Especially the relationship between Det norske and Mustang, the engineering contractor, has been highlighted. In addition, relationships to subcontractors are frequently mentioned. The relationship with Apply Leirvik has also been described as challenging.

Drexler Jr. & Larson (2000) mention several factors affecting contractor relationships, including changes in scope or schedule, failure to perform, trust deterioration as a result of poor performance, failure to do what was promised, and failure to keep the other party informed. In addition, lack of alignment between contractors and owners objectives and goals, lack of trust between the owner and contractor, and lack of commitment from the contractor towards the project are factors that can affect owner/contractor relationships (Drexler Jr. & Larson, 2000).

Lack of trust

Trust has proven to be essential in achieving project success, and it is considered to be a critical component for establishing and maintaining good, cooperative partnerships in projects (Pinto *et al.* , 2009). With low levels of trust, the owner/contractor relationships are likely to be affected.

Trust can take several different forms, according to Pinto *et al.* (2009), including *competence trust*, *integrity trust*, and *intuitive trust*. Especially competence trust and integrity trust issues were present in the project. An example of lack of competence trust is evident in the relationship between Mustang and Det norske. Det norske were not able to trust Mustang's engineering capabilities, and felt they needed to monitor and review the work Mustang had completed. Such behavior can be damaging to a relationship, and if either party is suspicions of the actions and motives of the other, it can also affect the probability of successful project completion (Drexler Jr. & Larson, 2000).

Det norske's relationship towards the contractor of the living quarter, Apply Leirvik, was characterized by a lack of integrity trust, where the question to be answered is "will you consistently look after my interests?" (Pinto *et al.* , 2009, p. 640). In the interviews, the relationship has been described as commercial, and the contractor seemed more concerned with looking after their own interest than cooperating with Det norske in order to achieve their common goal.

In the beginning of the project there was also expressed distrust from the owners of Det norske towards the project, and the project organization Ivar Aasen's ability to complete the project successfully. This distrust contributed to uncertainty in the project. It also resulted in nervous project managers demanding reports in order to please the owners, which was time consuming.

The establishment of trust is a way of mitigating uncertainty in projects. Ivar Aasen was a project with high levels of uncertainty, due to many factors, and it would have been very beneficial for the project to have more focus on establishing trust earlier on. One of the benefits of establishing trust is that the team will become more effective (Atkinson *et al.* , 2006).

Lack of commitment

In addition to lack of trust in relationships, there was also a lack of commitment towards the project from several contractors and subcontractors. It is important that there exists mutual trust and commitment between the parties, as the two are core elements for

establishing and maintaining favorable relationships (Coyle-Shapiro & Morrow, 2006). The project organization Ivar Aasen experienced the project not being prioritized by subcontractors, and there was a lack of ownership and understanding of the importance of the project. Ng *et al.* (2006) point out that weak organizational commitment may result in less productive employees, and this proved to the case in Ivar Aasen. Hannevik *et al.* (2014) states that "Lack of cooperation and commitment in the project organization is critical to project success, and the most common cause of project failure" (p. 693).

After the realization of the lacking commitment from the contractors and subcontractors, Det norske started visiting the different sites. This was unconventional, but effective. The effect of the visits was expedited and timely deliveries of important packages, in addition to improved relationships with their contractors and subcontractors.

A factor that might have had an impact on the degree of commitment towards the project, was the large percentage of consultant in the project. Both Mustang and Aker Solutions had many consultants employed in their organizations. With both organizations being newly established, the consultants might have lacked organizational commitment towards their employer, and hence felt even less commitment towards the project. Felfe *et al.* (2008) assumes that temporarily employed workers show lower levels of commitment due to low investment in the organization.

5.2.2 Interface Challenges

The amount of interfaces increases with the number of stakeholders in a project. As pointed out by Shokri *et al.* (2012), the application of interface management in a project is believed to improve alignment between stakeholders, and hence contribute to lower conflict levels and uncertainty.

Many of the problems and challenges present in the Ivar Aasen project are results of challenging interfaces. These include subproject interfaces, organizational interfaces, such as the one with Lundin/Edvard Grieg, and technical interfaces. Through proper interface management, many of the problems that have occurred could have been more easily resolved, or been avoided completely.

Proactive interface, risk and contract management was one of Det norske's own success factors for the execution phase of the project. With the high number of stakeholders, the number of interfaces was equally high, which resulted in a comprehensive task of managing the interfaces. Pavitt & Gibb (2003) claim that if interfaces are disregarded in a project, it can lead to severe problems during execution or after completion, and according to Crosby (2014) it is important that the project management understand the complexity of

the project, and focus on establishing collaborative interfaces. Interface management is a way of managing the organizational complexity present in projects, and Hussein (2012) point to the importance of this. It is not possible to minimize organizational complexity, but awareness can contribute to mitigating challenges connected to complexity by taking preventive actions. During the interviews it became evident that a high number of the challenges that occurred, occurred as a result of challenging interfaces and inadequate interface understanding and management. Interfaces were not disregarded, but some were not recognized as important. This led to problems during execution, that could have been avoided if the interfaces had been considered.

Several of the common interface challenges identified by Al-Hammad (2000) can be recognized in the Ivar Aasen project, including skills and productivity of laborers, poor quality of work, poorly done planning and scheduling. All of these interface problems were mainly connected to the topside subprojects. In addition, the project experienced both technical and organizational interface challenges.

Technical Interface Challenges

In order to avoid technical interface challenges, good communication is essential. It is also critical for the successful completion of a project that the client or end-user is involved (Hussein & Hafseld, 2014). This should be practiced from the first stage of the project, and be continuous throughout the project life cycle (Dvir *et al.* , 2003).

Interdependent parts of the platform, such as the jacket, topside module, and living quarter, were produced at different locations, and construction was simultaneous. According to Chua & Godinot (2006), simultaneous work on separate and interdependent modules, done by autonomous teams, increase the likelihood of interface problems. Coordination of activities and good information flow is essential in order to avoid challenges with physical interface. Also, the dispersed geographical locations of the construction sites, as well as time differences, added an extra dimension to the importance of well functioning and clear communication.

An example of bad interface was the interface between topside and the D&W department. D&W set functional requirements for equipment needed during drilling operations on the platform. This was done in cooperation with engineering, where D&W had a representative present at the engineering office. During execution, the staff doing follow up during topside construction lacked understanding of the requirements set by D&W. As a result, changes to the required functionalities and equipment were made without D&W's consent and knowledge.

D&W can be considered to be one of the clients for the topside, as they are one of the end users of the platform. Consulting the client is an important success factor in projects (Cooke-Davies, 2002; Pinto & Slevin, 1988), and Pinto & Slevin (1988) describe client consultation as "communication, consultation and active listening to all impacted parties" (p.67). It is important that the end user is involved in the planning and execution, as client satisfaction is essential for the perceived success of the project. If the client is not involved in the planning and execution, it is likely that they will be less satisfied with the end product.

Another example of an inadequate interface in the project was the transfer of information between the topside contractor, SMOE, and the hook-up contractor. The two parties used different IT systems, and as a consequence the transfer of data had to be done manually. Had the two contractors used the same IT system, the transfer would have been automatic, and saved resources for the project. In addition, manual transfer of data is likely to have increased the risk of transfer errors.

There was also a late involvement of operations in the planning of the topside, as the operations department was not fully established at project initiation. If there is lack of involvement and communication with the client or end-user, it can result in rework, and in the case of oil and gas, if the rework has to be done offshore it can become very expensive. Operations are the main end-user, and should therefore be involved as early as possible to ensure well functioning technical interfaces.

Organizational Interface Challenges

Ivar Aasen was a complex project, with many stakeholders. Some of the most challenging organizational interfaces were Det norske - Lundin/Edvard Grieg, Det norske - Aker, and Det norske - SMOE/Mustang.

One of the most prominent organizational interface challenges in the project was the relationship between Lundin/Edvard Grieg and Det norske. The complexity and importance of the relationship with Edvard Grieg was underestimated by the project at an early stage. There was a lack of understanding of the interface between the two parties. Det norske were completely dependent on cooperation and a good working relationship with Lundin in order to reach their goal for first oil. The underestimation of the importance of the relationship and cooperation with Lundin led to the project not prioritizing the tie-in subproject. The cooperation between the two parties happened at a point in both organization's projects where the time pressure was high. The time pressure put strain on the relationship, that was not well established at the time of the cooperation.

The lack of understanding of the interface and its complexity was the main reason for the challenges Det norske experienced. If both parties are able to develop a collaborative working relationship, disagreements can be handled, and the parties can cooperate to enable project success (Drexler Jr. & Larson, 2000). If the stakeholder relationship had been prioritized at an earlier stage, it would have been possible to develop the relationship and establish trust, which would have improved the cooperative relationship.

Other Interface Challenges

- **Lack of competence**

    Skills and productivity of laborers can, as mentioned previously, contribute to interface challenges. Several of the informants describe a situation where it was difficult for the contractors to acquire competent staff. The lack of competence impaired the supplier's abilities to deliver. Drexler Jr. & Larson (2000) note that failure to perform will affect the owner-contractor relationship in a negative way, which in turn can result in challenging interfaces.

    Especially the engineering contractor, Mustang, has been highlighted by the informants as a company with lack of competent employees. This was a result of the market situation at the time. The contractor was stretched on capacity, and there was a lack of available competence to be hired. What might have affected the competence level even more, in this situation, was the lack of common processes and a sense of belonging to their parent organization and the project. Many of Mustang's employees at the Woking office were newly hired consultants, in the newly established organization. With the lack of common processes, procedures, and a sense of belonging it is difficult to achieve success. To achieve the common goal of project success there is need for a motivated project team (Brenner, 2007), not only skilled individuals.

    Another issue that created challenging interfaces was the subcontractors placing their scope to other contractors. Informants describe a lack of competence from these subcontractors in handling their contractors, and this both increased the amount of interfaces the project had to manage, in addition to complicating the interface between the subcontractors and the project. It also became increasingly difficult for the project to get an overview of all the deliveries to the project.

- **Lack of planning from contractor**

  The importance of planning in a project is underlined by Dvir *et al.* (2003), claiming that even though a project is not guaranteed success through sufficient and good planning, the lack of it is likely to result in project failure. Planning reduces the amount of uncertainty, while increasing the probability of success (Dvir *et al.* , 2003).

  An informant describes that especially Mustang completely lacked abilities for planning. Without a proper plan, it is difficult for the project participants to follow their own progress towards the overall project progress. Det norske also lacked some planning capabilities, but tried to accommodate the contractor's planning issues after their best abilities. It was still difficult, as the contractor was skeptical to cooperating closely with Det norske.

- **Interface Management**

  Acknowledging and managing interfaces between different parts of a project is important for project success (Pavitt & Gibb, 2003). Even though challenges with interface were handled, Det norske did not sufficiently manage to practice proactive interface management. Instead they resorted to reactive problem solving. Rather than taking measures to ensure that good work processes and procedures were in place before work was initiated, problems with quality were discovered afterwards. This resulted in the need for rework, and loss of time. If there had been a better understanding of the complexity and the interfaces present, it is likely that many problems could have been avoided. Had there been awareness concerning possible issues and weaknesses at the contractors, these could have been solved in advance or Det norske could have assisted with competence and procedures.

  Even though it might have been possible to disclose some of the challenges and lack of competence sooner, it is reasonable to assume that it would not have been possible to avoid all the problems that have occurred. One of the reasons for this is the offers given during the tender. As an example, the engineering contractor bid on completely different terms than what ended up being the reality of the project. They were able to prove what competence, procedures, systems and tools they had, on paper, within the company, but these proved to be unfamiliar to the employees at the Woking office, where engineering for Ivar Aasen took place. Hence, the terms the contractor was evaluated on were different than what became reality. Competent contractors are an important success factor in projects as they contribute to a project reaching its objectives. It is paramount that the contractors are being awarded contracts on the correct basis, and consequently essential for the

company that the contractors, during tender, are able to prove their competence with physical evidence of what has been accomplished at the relevant office.

The project experienced challenging interfaces both with contractors and subcontractors, but also internally in the project, between subprojects. Pinto & Prescott (1990) state that communication is important in order to have productive interfaces between function units in the project. At times the information flow in the project was less than adequate, and it was difficult to obtain relevant information. With the subprojects being interdependent, it is essential that they communicate well, in order to avoid misunderstandings and enable for successful completion.

HSE experienced difficulties because of communication issues. There was lack of a common HSE culture, and as a result the HSE priorities had to be communicated frequently. In addition, due to poor communication, when happenings occurred they were often exaggerated and given more attention than necessary. In this situation, a common procedure for handling information and communication could be helpful, in order to avoid misunderstandings.

5.2.3 Time Pressure and Market Situation

Felfe *et al.* (2008) suggests that the market situation might affect the degree of organizational commitment. The market situation reflects the availability of work, and during the beginning of the project, the market situation was characterized by companies being stretched on capacity. Companies were understaffed, and as a consequence there was a demand for increased manpower. Several informants describe a situation where contractors were desperate, and would be less critical of who were employed and their competence. The high availability of jobs might have contributed to lowering the commitment the employees felt towards the project.

The market situation during the contracting period led to challenges for Det norske, trying to get competent and experienced contractors. It was difficult getting contractors to place bids, as they were already stretched on capacity. The complicated relationship between the project organization Ivar Aasen and Aker also contributed to a challenging contracting period, with disagreements and several rounds of evaluation in order to be able to award the contracts. In addition, the contracting happened parallel with the FEED, which resulted in a lack of clear specifications.

Time pressure was present throughout the entire Ivar Aasen project. With some of the contracts not in place until the beginning of 2013, there was not a lot of time available for the project. Time pressure may cause negative effects on project results, as time pressure

can create constraints, hinder cognitive capacity, and weaken performance (Moore & Tenney, 2012). Even if the time pressure was high it appears that quality was of actual higher priority in the project, which is in compliance with the set project priorities, especially during construction. Rework and deconstruction was done when necessary, in order to ensure safe construction and high quality.

As previously mentioned, the project organization Ivar Aasen to a large extent resolved to problem solving after problems had made an impact on performance. According to Thamhain (2013) this is frequently observed, and can be explained by time pressure in the business environment. Hence, had the time pressure been lower in the project, it would likely have resulted in better management of risks, leading to fewer challenges. The focus might have been shifted towards identifying the root cause for challenges and proactive interface and risk management, instead of problem solving.

During the project, efforts were made to save time and maintain momentum. One of the strategies chosen by the management was to expedite the FEED. This was thought to save time, and enable for faster decision making. Instead it became a cause for challenges. Insufficient specification is by Al-Hammad (2000) pointed out as a common interface problem, and it is a source for uncertainty (Atkinson *et al.*, 2006). The FEED makes up the basis for the engineering phase, and it is therefore important that it is of a certain quality.

There was a lot of uncertainty connected to the FEED work. First of all, a newly established Aker Solutions office in London did the FEED, and they were in a process of increasing manpower. A consequence of this manpower increase was lack of team spirit and employees used to working together, and common procedures. Secondly, there was uncertainty connected to whether or not the FEED was going to be transferred to another company, or if Aker Solutions would be assigned the contract for detailed engineering. The cause of this uncertainty was the high degree of parallel activities in the project, which also was a measure to save time.

When the FEED was handed over to the engineering contractor, the destination was another immature organization with lack of routines and common procedures. Several of the informants point to the poor quality of the FEED, and believe it to be one of the reasons why engineering had large difficulties from the start. Ivar Aasen was initially a project with high levels of uncertainty, and doing an insufficient FEED contributed to increasing these levels. It is likely that a more thorough FEED would have contributed to lower uncertainty.

During execution, the project experienced extensive delays. At one time they were six months delayed. This long delay was a product of two separate factors. One was the complicated relationship between Det norske and Aker during the tender, which delayed the project due to the late placing of the topside contract. The other was due to delays in the engineering work.

The delays and their magnitude were handled in a good manner by Det norske. As previously mentioned, they resorted to problem solving in many cases, and in some cases this was effective. When the delays during engineering and risk of delays from package deliveries became a reality, good decisions were made in order to minimize these delays. An example that had a large and positive impact on both engineering and package delays was the topside subproject's ability to influence the contractor. As described in section 4, they were able to influence the contractor's way of doing construction, which enabled for the construction of the topside parallel with completion of the engineering. It also lowered the importance of the on-time delivery of package and equipment.

As previously mentioned, trust is essential in good cooperative relationships. The management on the topside subproject were able to establish trust and a good working relationship, and this proved to be a very important success factor for the on-time completion of the topside, and platform. Had the topside's sail-away been delayed, it would have had a cascading effect on the entire project. Hence, the management's ability to identify and handle the situation was an effective means of risk management.

5.2.4 Integrated Team

Working after an integrated team execution model was another of Det norske's own success factors for the execution phase of the project, where the goal was to build a team culture. Later in the project the success factor became known as One Team. This success factor is supported by literature, and highlighted as critical for project success (Yang *et al.* , 2011; Peterson, 2007). Stronger team communication and collaboration, as well as cohesiveness, can contribute to project success in terms of both time, cost, quality, and stakeholder satisfaction (Yang *et al.* , 2011).

Even though Det norske had set this as a success factor, they had difficulties implementing it. Especially on project level there were challenges with the implementation of One Team, and as mentioned previously, the interfaces between subprojects were not always sufficient. Poor communication and collaboration led to difficult interfaces and affected the progress in the project.

One of the important reasons for integrating Det norske, the Ivar Aasen project, and the contractors into One Team, is that common goals can more easily be achieved with closer cooperation between contractors and owners (Dozzi *et al.* , 1996). According to Pinto & Pinto (1990) "cooperation is necessary to link interdependent functions together and assure their contribution to the overall goals of the organization" (p. 204). Also, if the team members feel a sense of belonging, the result may be more effective team performance (Yang *et al.* , 2011).

When developing team culture, one of the things that can contribute to positive results is fostering trust, teamwork and open communication (Peterson, 2007). This can contribute to better cooperation and cohesiveness, and promote motivation in the team. When there is developed a positive team culture, where team members are allowed to contribute in discussions, and give constructive feedback, it can be assumed that they feel a greater sense of belonging, and experience a greater motivation to contribute in the team.

One of the main challenges with establishing the One Team philosophy was integrating the entire project. On subproject level, many of the informants describe well functioning teams with good communication and cooperation, both between Det norske's employees and with the contractors. However, due to the interdependencies in the project, it is important that all subprojects and project participants are integrated. One Team is about the project participants realizing that all parts of the project work towards a common goal and are dependent on each other. This is important in order to establish good interfaces in the project, and it becomes increasingly important with the increasing number of interfaces. The lack of successful implementation of an integrated team culture from the beginning of the project was one of the main contributors to the lack of good interfaces.

One of the teams who succeeded with the One Team philosophy was the subproject consisting of the PETEK and D&W departments at Det norske. They were able to integrate their contractors, had a highly motivated and well functioning team, and experienced a lot of success. One of the initiatives that led the team to success was the collocation of the teams. Physical proximity is said to be a good way of enhancing cooperation and informal communication (Pinto & Pinto, 1990). This was considered a success factor by the project managers in the teams, who were located together with their teams. This enabled rapid decision making and conflict resolution, as the managers were always available to give input or make decisions if necessary. They managed to establish a good cross-functional working environment, and according to Pinto & Pinto (1990), teams who manage this spend less formal meeting time resolving interpersonal difficulties and conflicts. Thamhain (2013) state that "cross-functional collaboration is an effective catalyst

for collectively dealing with threats to the project environment" (p. 31).

Even though the One Team philosophy was not well established in the beginning of the project, this evolved and improved throughout the project life cycle, and contributed to reducing the interface challenges the project was facing. Many of the interface problems that occurred in the project could have been mitigated with the successful implementation of the One Team philosophy at an earlier stage. Having a more intense focus on the cooperation between all the subproject from day one would have enhanced the communication and cooperation within the entire project organization Ivar Aasen. By learning from the success of the well-functioning collaborative relationship in the D&W/PETEK departments, it is likely possible to enhance the overall integrated team model.

5.2.5 Other Challenges

Lack of Experience With EPC Contracting

According to Zaghloul & Hartman (2003) the contract type chosen affects how easily and successfully the owner's goals are reached. Det norske chose an EPC contracting strategy for several of the large and important contracts in the project. For some of the subprojects, like the jacket, this was successful, and they got a highly professional, experienced and capable contractor. On the other hand, the EPC contract for the topside module was a choice which contributed to high risk and uncertainty in the project.

SMOE, who were awarded the topside contract, lacked experience with handling EPC contracts. However, they had recently completed another EPC contract, and Det norske were optimistic about their abilities. They were aware of the weaknesses the contractor had regarding EPC contracting, but Det norske believed they could accommodate these. Optimism can contribute to actors putting less emphasis on possible warning signs (Williams *et al.* , 2012), and accommodating SMOE's weaknesses proved to be a more comprehensive and demanding task than what they initially imagined.

Even though Det norske had chosen an EPC contracting strategy, it is likely that this was not the most appropriate strategy, as the contractor lacked experience. Det norske ended up having to contribute with a lot of resources to both the engineering and the procurement part of the contract, even though this was not their responsibility as project owner. However, the consequence of not accommodating the contractor would probably have been large delays, and possibly lower quality.

While some of the contracts were difficult to place, one subproject decided to be non-traditional during the tender. Relle & Gilge (2014) claim that being smart about con-

tracting strategies can help mitigate or eliminate project risks, and one of the subprojects managed this. D&W chose a nontraditional contracting strategy for the industry, and combined several tasks into one comprehensive contract. By making this decision, they were able to attract large and highly competent companies for their contracts, and were able to make requirements towards the contractors.

Newly Established Organization

At the initiation of the Ivar Aasen project, Det norske was a newly established organization that had grown considerably over a short period of time. The company was being built parallel with the project, which contributed to increased complexity. There were many new employees and there was a lack of structure. Things were unclear, there was a lack of procedures, and the organization map was difficult to understand in the beginning, which by some informants has been said to have caused confusion. These factors contributed to both complexity and uncertainty in the project.

In addition, both the age and the size of the company contributed to challenges in attracting the most desirable contractors, as they would rather prioritize bigger, experienced companies with larger projects. In some cases this resulted in the contracting of less desirable or experienced contractors.

To minimize the effects the age of the company can have on a project, it is important to have clear procedures and structure in place as early as possible.

5.3 Success Factors

The project organization Ivar Aasen managed to reach their goal of first oil on time, within budget and quality, with zero serious HSE happenings, despite many challenging situations during the project. The main critical success factors that have contributed to the success are summarized in table 10, and further discussed in the section below.

Table 10: Critical success factors identified in the Ivar Aasen project

Success factors
Working environment
Autonomy
Determination and commitment
Competence
Clear priorities and expectations
Decision making
Visible and supportive management

5.3.1 Working Environment

The informants talk warmly about the working environment at Det norske and in the project. "Project culture is related to successful collaboration in complex projects" (Van Marrewijk *et al.* , 2008, p. 592), and several informants describe a culture based on trust and responsibility. It is important to establish trust between both departments and different hierarchical levels in an organization (Pinto *et al.* , 2009), and according to Smyth *et al.* (2010) "Trust tends to develop quicker and to deeper levels in environments of equality" (p. 118). The organization has by informants been described as flat, with short distances from team members up to top management, and this has probably contributed to the high levels of trust in the organization.

Several informants talk about the environment at Det norske as a very positive, supportive and open working environment. However, an informant describes occasions where openness and honesty about what was going on in the project was lacking, and this was something they had to work on in order to achieve. Openness about organization-related information may contribute to the employees feeling ownership and belonging towards the organization, which can help the organization reach its goals (Ng *et al.* , 2006). It is therefore important that openness and honesty is emphasized in subsequent projects.

The working environment in the company and the project was also based on giving responsibility and encouragement. The employees were encouraged to challenge current practice, voice their opinion and share their competence. In addition, the employees working on a task were given the opportunity to present the results themselves, and informants have also said that people were not looking to take credits for other peoples work. The employees and subprojects have also been given room to act and make decisions on their own, without tiresome bureaucratic processes.

The open and trusting work environment in the project has probably been one of the main success factors in the project.

5.3.2 Autonomy

One of the things that has contributed to the good working environment in Ivar Aasen has been the autonomy of the project. The management of Ivar Aasen has been clear throughout the project, but there has always been room for personal maneuvering. Autonomy and influence is necessary in order to maintain employees' goals and interest, and can also be considered crucial for performance and development of competence (Jønsson & Jeppesen, 2013). People have been able to think for themselves and give their opinion. Management have succeeded in giving the employees mandate to make decisions when appropriate, and they have awarded team members with responsibilities.

The project manager has been able to delegate tasks and trust subprojects and project staff's ability to handle their assigned responsibilities. In subsequent projects it is, however, important to remember that there should be a balance between autonomy and control, as too much trust in self-managing teams in some instances can be damaging (Langfred, 2004).

5.3.3 Determination and Commitment

The determination and motivation of the project staff, and especially Det norske's own employees, have been two of the success factors most frequently highlighted by the informants. Several informants have pointed out that the people of Ivar Aasen are the main reason for the successful completion of the project. Ivar Aasen faced many challenging situations, and it is likely that the motivation and determination of the project members have been major contributors to the success of the project, despite all the challenges.

Whether a project is successful or not can to a large extent depend on the motivation and morale of the team (Brenner, 2007). Consequently, a motivated team is essential for

project success. The Ivar Aasen project has had many highly determined and motivated members. Several informants have talked about the desire and need for success. Failure was never an option, and there was always a drive for the successful completion of the project. There were high levels of affective commitment towards the project amongst Det norske's employees. Affective commitment refers to the emotional attachment and involvement in a project, and it is critical for project success (Leung *et al.* , 2004). With the high business impact failure of the Ivar Aasen project would have on Det norske, employees felt a drive and motivation to contribute to the success of the project.

"Motivation can inspire, encourage, and stimulate individuals and project teams" and "create an environment that fosters teamwork and initiatives to reach common goals" (Peterson, 2007, p. 60), and motivation can happen between coworkers and peers (Brenner, 2007). In the case of Ivar Aasen it is likely that the highly motivated and determined staff contributed to motivating their peers, both from Det norske's own organization and contractors.

The determination of some of the subprojects, such as D&W, contributed to increased motivation in the project. D&W were ambitious and determined to achieve success from the beginning of the project. When they experienced success with their drilling operations, this gave confidence to the entire project. This confidence contributed to increasing and maintaining motivation.

5.3.4   Competence

Competent personnel is critical for project success (Pinto & Slevin, 1988). Det norske grew considerably during the beginning of the project, and the market situation, as previously discussed, was challenging in terms of getting competent contractors. Under these circumstances, Det norske were still able to acquire highly competent staff for the Ivar Aasen project. Many of the new employees had vast experience from other well known oil and gas companies. They brought with them valuable knowledge and experiences acquired through other projects, that they could share with the other employees at Det norske. Hence, these employees were able to apply previous lessons learned.

Several informants describe another of the success factors in the project as being able to ask for help and accept it. When there was lack of competence in Det norske's own organization, they were able and willing to acknowledge their own limitations. This may have contributed to higher quality work and saving of time.

5.3.5 Clear Priorities and Expectations

The goal of completing the project within the set time frame remained the same throughout the project. A clear project mission, project goals or objectives are considered to be important success factors in the project success literature(Munns & Bjeirmi, 1996; Mišić & Radujković, 2015; Pinto & Slevin, 1988). The clear goal and deadline has contributed to lowering the uncertainty in the project, as the goal of the project was always clear to all the project participants. Also, when a clear image of what needs to be done, within a set deadline, is provided to the team, it can lead to improved performance (McDonough & Pearson, 1993).

A no-change principle was enforced during the project. In practice this was a form of strict change control, where the goal was to keep the number of changes as low as possible. This expressed a clear expectation to the project members, as everything had to be carefully considered and evaluated in order to gain acceptance of a change.

As mentioned, there were periods during execution where the Ivar Aasen project experienced delays, and there were made suggestions to give the project more time. However, the project manager was not willing to postpone deadlines in the project. Postponing the deadlines would send a message that the project was less urgent, and it might have resulted in undesirable effects on the progress.

Urgency is by Pinto & Slevin (1988) described as "the perception of the importance of the project or the need to implement the project as soon as possible" (p.69). A sense of urgency can amongst the employees hence contribute to increased motivation and drive for progress. In Ivar Aasen, the time pressure for completing the project on schedule was present throughout the entire project life cycle, and this was clearly communicated to the project staff. It can be assumed that to a certain extent, the time pressure and the perceived urgency of the project contributed to a positive drive for progress amongst the employees. The perceived urgency was high, and the time pressure in the project was positive in terms of motivating staff.

Another way clear expectations was communicated to the project, was through the milestone set by the CEO. He went out publicly and told the industry that they would deliver a successful project on time. This sent a message to the project that there was no other option, and that top management had faith in the success of the project. This contributed to lowering the uncertainty, as the project knew they had support from top management.

Having a clearly defined goal from the beginning of the project has contributed to the success of the project. There have been challenges and misunderstandings concerning

orders from subcontractors, but through cooperation and building of relationships they have been able to communicate the goal, and contribute to creating a sense of ownership towards the project.

5.3.6 Decision Making

Even though the project organization ran into many difficult situations, they were able to solve them. One of the reasons for this was their ability to make decisions when problems occurred. Decision making concerns identifying problems, and choosing the right approach or alternative to accomplish the desired end results (Rolstadås *et al.* , 2015), and decisions concerning engineering and construction should be based on good technical knowledge (Fischer & Adams, 2011).

In Ivar Aasen decision making was distributed through the different levels of the project, and the significance of the decision determined whether or not higher levels in the project organization should be involved. This non-authoritarian style of decision making enabled for fast decision making, especially in less decisive situations. In addition, by letting the subprojects and technically competent staff make decisions, the quality of the decision was likely higher.

The project organization's ability to make decisions contributed to mitigating and likely also preventing delays. In addition it probably contributed to a smoother project execution. It is therefore an important success factor.

5.3.7 Visible and Supportive Management

Many of the informants describe the project manager of Ivar Aasen as a critical success factor. He was able to create a good team, was supportive, positive, enabled and enhanced cooperation, and created trusting relationships with subproject managers, team members, contractors and subcontractors. The project manager was not preoccupied with being "the boss," he was easy to reach and the distance from the project up to the project manager was short.

If the project manager is entrusted with authority, this has a positive effect on the internal measures of success (Dvir *et al.* , 1998). This was the case in Ivar Aasen, where the project managers was given a large mandate by top management, and he passed it on to the project as well. He trusted his team and was able to let people do their job. He had the ability to delegate tasks, and did not have to do everything himself. He did not feel like he needed to have the detailed knowledge about everything, and this gave him time

to focus on the most important challenges and happenings in the project. He also had the ability to lift up his subproject managers, and give them responsibility.

The support and commitment from the parent organization is essential in order to achieve project success (Munns & Bjeirmi, 1996). Initially, the relationship between the project manager and the owners was complicated, and there was a lack of support. This made the project manager's task challenging. As the project evolved and the project manager proved his capabilities, the relationship grew stronger.

One of the lessons presented by Thamhain (2013) states that the project leader should have authority to adapt their plans to changing conditions. The project manager was given mandate to act and make decisions, without having to go all the way to the top every time a decision had to be made. Top management was very supportive in the Ivar Aasen project, and was visible to the project and its participants. They were supportive in providing necessary resources, and were also willing to contribute with personal effort when needed, which is important in order to achieve project success (Pinto & Slevin, 1988).

The CEO was preoccupied with establishing trust upwards, towards the board and owners, which he succeeded in, and he describes the relationship with the board and owner as good and characterized by trust. He also describes a good cooperative relationship with the project manager of Ivar Aasen, and this enabled the project to progress and ultimately succeed.

6 Conclusion

The objective of this thesis was to answer the question *What have we learned from Ivar Aasen?* by assessing the Ivar Aasen project's success factors and challenges. This has been done in order to obtain valuable lessons for Aker BP. Learning from experiences in previous project is a powerful way of learning, and should therefore be emphasized by the company.

In summary, the project has been successful in terms of the company's own project priorities, as well as customer satisfaction. However, it has become evident through the assessment of the project that there are some key elements that should have been in place for a smoother, more successful project execution process. This gives room for learning.

In subsequent projects similar to Ivar Aasen, there should be focus on establishing soft values such as trust, commitment and ownership, in order to ensure project success. Efforts should be made to make sure that all employees, contractors and subcontractors are included. This will contribute to the early introduction of an integrated team model such as the One Team philosophy of Ivar Aasen.

The focus on establishing an integrated team culture should be present from project initiation. This will contribute to the avoidance of an owner/contract mindset, and limiting incentives for low performance. The owner/contractor mindset can be avoided by clearly conveying to an integrated team that they are working towards one common goal.

I want to emphasize the importance of focusing on well functioning interfaces in subsequent projects. Understanding the importance of cohesion and interdependence between the subprojects is essential in order to achieve timely and continuous information flow. This is paramount in complex projects similar to Ivar Aasen. Measures should therefore be taken to ensure this. In order to clearly convey the message of the importance of interdependencies and cohesion, the message should be demonstrated in actions. The success of D&W and PETEK can be viewed as a good example of this.

Another important lesson that can be learned from the Ivar Aasen project is that autonomy in balance with other success factors is of great importance. Balance between autonomy and decision making enables for a more effective project execution, as decisions are made at the relevant level. This is also closely linked to management. There should be a balance between management and autonomy. Too much management might negatively affect the creativity in the project, while lack of management might contribute to the project participants forgetting the importance of interdependencies in the project. There also needs to be a balance between clear priorities and expectations, and autonomy. The

balance is important in order to reach the project goals. The priorities and expectations should be clearly conveyed in order for the project participants to know the direction of the project. With a balance between this and autonomy, there is still room for personal maneuvering and creative solutions.

It is essential that all project participants understand the importance of the project, and the impact it has on the company. By conveying to the project members that all projects are important to the company, it sends the message that their work and role is important. In the Ivar Aasen project, the visible and supportive top management contributed to conveying this message.

To summarize, the most important lessons from Ivar Aasen are:

- Emphasize the soft aspects of the project. Focus on establishing trust, commitment and ownership towards the project.

- Identify and consider all interfaces as important, and apply interface management to ensure cooperation between all interdependent parties.

- Complex projects similar to Ivar Aasen require sufficient flow of information between all interdependent parties. Measures should be taken to ensure well functioning and continuous information flow.

- Balance autonomy with clear priorities and expectations, supportive and visible management, and decision making in order to create a good, dynamic work environment.

- Learn from the successful subprojects of Ivar Aasen such as D&W and PETEK. They were able to work integrated with their contractors, be ambitious and goal oriented, which led them to success.

- Build the integrated team from day one. Regard the project as one unit, and avoid the owner/contractor mindset.

- Make sure the end user is involved as early as possible in planning, and that they are present during execution in order to avoid a dissatisfied customer and rework.

- Take measures that enhance communication and cooperation, such as collocation.

- Have procedures in place to ensure contractor competence.

- Maintain the good decision making processes from Ivar Aasen.

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Appendix A

Questionnaire. Support functions

[Translated from Norwegian]

The purpose of this questionnaire is to document different experiences, experiences and perspectives in the implementation phase of Ivar Aasen. The answers from this questionnaire will also form the basis for the planned interviews with respondents. During the interviews, respondents will also be given the opportunity to elaborate the answers to this survey. Those who have responded to the first, slightly superficial, inquiry can of course take these answers here too.

Question 1. Give a brief description of the following conditions in your sub-project

- Name:

- Your role in the project:

- Briefly on your tasks and the importance of these tasks for Ivar Aasen:

Question 2. Success factors and what you have learned?

- From a holistic perspective and from your own experience what were the most important challenges regarding your tasks and your relationship with different project managers / managers?

- What factors do you think have contributed to the success of your work? And what conditions could have been taken into account in a better way?

- Highlight only one condition that you think has been crucial to success in your work. Why is this the most important?

- What is the most important thing you have learned from your work in the project?

Question 3. Personal qualities, relationships and relationship to senior management

- What was the most demanding in terms of interaction with other project managers/subproject managers?

- Have you been unsure what your tasks are in the project? Or about relationships with other project participants? If so, what have you been unsure about? How has this uncertainty affected you? What have you done to deal with this uncertainty?

- Can you describe a situation or event where this uncertainty has been very demanding? How did you cope with this situation? What can we learn from this story? What have you learned from this story?

- Can you, based on your experience of your role in the project, provide a description of the type of person required for such work? What skills and personal qualities are required?

- How did you experience follow-up and support from top management in the project?

- What advice do you want top management concerning improvements?

- What was good?

- What norms and values characterized the implementation of this project?

Is there anything else you want to add?

Appendix B

Questionnaire - Main deliveries

[Translated from Norwegian]

The purpose of this questionnaire is to document different lessons, experiences and perspectives in the execution phase of Ivar Aasen. The answers from this questionnaire will also form the basis for the planned interviews with respondents. During the interviews, respondents will also be given the opportunity to elaborate the answers to this questionnaire. The length of your answer should be on about one page on each question. Those who have already answered some of the questions in a first, superficial round can build out the answers given there.

Name:
Position:
Main task:

Question 1. Give a brief description of the following conditions in your subproject.

- Briefly about the scope of work

- Briefly on technological challenges in the subproject

- Briefly about organizational challenges (contributors / Suppliers / subcontractors) and the need for interface / communication between different contributors

Question 2. Success factors and what you have learned (lessons learned)

- From a holistic perspective and from your own experience what were the most important challenges in your subproject?

- What factors do you think have contributed to success in your subproject? What could have been handled in a better way?

- To highlight only one condition you think has been crucial to success in your subproject; What is it - and why?

- What is the most important thing you have learned as a project manager in your subproject?

Question 3. Guidelines and priorities

- Describe the most important guidelines and priorities that you were asked to live by in your subproject.

- Was these guidelines and limitations understandable to you right from the start? How important to you as a project manager was it to have a good understanding of these guidelines and limitations right from the start?

- Tell about a situation or event where these limitations or guidelines have been very demanding, but where you were able to find the solution. What have you learned from this story? What can we learn from this story?

Question 4. Organizational and technological challenges

- How would you rate the complexity of your subproject (technological, organizational, cultural)?

- Can you describe any situations (problems and challenges) that have arisen because of this complexity? What did you need as a project manager?

- How can we prevent problems caused by complexity? What actions can we make to prevent these problems?

Question 5. Human Relations

People play a very central role in projects. The project expects efforts and dedication from all to achieve the project's goals. Relationships must be facilitated for people to maximize performance.

- What have you done to make people do their best? What was your approach? How did you work to maintain motivation, trust, and dedication among your employees?

- How did the project staff respond to your actions / approach?

- What is your advice for new project managers when it comes to collaborating with the people in the project? What works best? What does not work?

- Can you, based on your experience with your project, describe what kind of project manager is required?

Question 6. Uncertainty

Uncertainty (lack of adequate information / knowledge, or confusion about expectations, scope of work, roles and responsibilities, etc.).

- Have you been unsure how your task in the project should be solved? If so, what have you been unsure about?

- How has this uncertainty affected you as a project manager? What have you done to deal with this uncertainty?

- If you would advise forthcoming project managers on how to relate to the uncertainty, what would you say? What personal attributes are required to cope with the uncertainty?

Question 7. Relationship to senior management

Visible and accessible top management is an important success factor in all projects of this size.

- How did you experience follow-up and support from top management in the project?

- What advice would you like to provide management with improvements?

- What standards and values involved the implementation of this project?