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Critical success factors for offshore field development projects

A study of contracts on the Norwegian Continental Shelf awarded to South Korean yards

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Vi kommer sent herr konsul, men vi kommer godt!

— «Skipper Worse» (1882), Alexander Kielland.

PREFACE

This thesis concludes the author's Master of Science degree in Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU).

The author wishes to express sincere gratitude to the four anonymous interviewees for generously volunteering their time and expertise. Their willingness to discuss a sensitive topic was crucial for this study and their contributions are highly appreciated. The author would also like to acknowledge Mr Ahn Byungmu's important support in connecting with some of the interview subjects.

Professor Øystein Moen deserves praise for his insightful guidance and candid comments during the writing of this thesis. It has been a great pleasure to work with such a seasoned academic supervisor.

Last, but not least, I am grateful to my family for their invaluable support and encouragement in all my academic endeavors. They nurtured my curiosity from an early age, and today my desire to learn extends way beyond graduation.

Oslo, March 2017

André B.K. Holthe

ABSTRACT

This study examines Norwegian oil companies offshoring EPC-contracts on the Norwegian Continental Shelf to South Korean yards. Delays and cost overruns have stirred a public debate about this offshoring practice, yet researchers have paid little attention to what determines project success in this specific context. Through a multiple-case study design and interviews with senior project members, this thesis contributes to the understanding of factors that influence project implementation in South Korea. Three EPC-contracts are compared with one Fabrication Contract, thereby also allowing for comparative analysis of contract formats.

First, this thesis identifies 15 Critical Success Factors for the implementation of Norwegian offshore projects in South Korea. These factors are divided into categories corresponding to five essential implementation goals: mature engineering, yard priority, inter-firm coordination, tailored resource allocations and a strategic schedule.

Second, this study also reveals the underlying factors that cause project challenges. An exaggerated cost focus among both yards and operators, and organisations that were unfamiliar with each other lead to resource constraints and major coordination issues. Industry cycles also greatly influenced individual projects by determining yard capacity and cost trends. Contract format is seen to modify project execution, with Fabrication Contracts performing better than EPC-contracts. Lastly, an improvement in project execution over time is detected and this is attributed to organisational learning.

Implications of this study are that offshoring projects to South Korea require attention to specific factors during both project planning and execution. During planning, industry cycles should be taken into account as it greatly effects implementation and therefore decisions concerning contractor, contract format and contract timing. During execution, project organisations need to acknowledged and consider the characteristics of implementing projects in South Korea in order to achieve project success. For operators with South Korea experience, project implementation improves with each iteration, potentially developing into a competitive advantage.

SAMMENDRAG

Denne masteroppgaven undersøker norske oljeselskaper som setter totalkontrakter på norsk sokkel til sørkoreanske verft. Mens utsettelser og kostnadsoverskridelser gjør denne typen offshoring omdiskutert i den norske offentligheten, har det vært lite interesse blant forskere for å undersøke hva som bidrar til suksess i disse prosjektene. Gjennom dybdeintervjuer med ledende personer i fire norske prosjekter bidrar denne studien til forståelsen av gjennomføringsfasen i norske offshoreprosjekter i Sør-Korea. Tre totalkontrakter blir sammenlignet med én fabrikasjonskontrakt for å undersøke kontraktformatets påvirkning på gjennomføringen.

Studien identifiserer 15 kritiske suksessfaktorer for gjennomføringen av norske offshoreprosjekter i Sør-Korea. Disse faktorene deles inn i kategorier som utgjør fem kritiske gjennomføringsmål: modent prosjekteringsdesign, prioritet på verftet, koordinasjon mellom organisasjonene, skreddersydd ressursfordeling og en strategisk tidsplan.

Videre belyser studien underliggende faktorer som fører til gjennomføringsproblemer. Et overdrevent kostnadsfokus hos både verft og operatører, og organisasjoner som var ukjent for hverandre førte til ressursbegrensninger og store koordineringsutfordringer. Konjunktursykluser har også stor påvirkning på enkeltprosjekter ved å bestemme verftskapasitet og kostnadsutvikling. Kontraktsformatet har innvirking på prosjektgjennomføringen, og fabrikasjonskontrakten gir bedre resultater enn totalkontraktene. Til slutt observeres en forbedring i prosjektgjennomføringen over tid som tilskrives organisasjonslæring.

Implikasjonene av studien er at offshoring til Sør-Korea krever vektlegging av spesifikke faktorer i både planleggings- og gjennomføringsfasen. Under planleggingen må konjunkturene hensyntas siden de har innvirking på gjennomføringen og dermed også beslutninger knyttet til bl.a. kontraktør, kontraktsformat og kontraktstidspunkt. Under gjennomføringen må prosjektorganiasjoner tilpasse seg den spesifikke sørkoreanske konteksten for å oppnå prosjektsuksess. Operatører med erfaring fra gjennomføring av prosjekter i Sør-Korea forbedrer seg over tid, hvilket potensielt vil kunne utvikle seg til et konkurransefortrinn.

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ACRONYMS

CGT Compensated Gross Tonnage

CPI Company Provided Item

CSF Critical Success Factor

DSME Daewoo Shipbuilding & Engineering

EPC Engineering, Procurement and Construction

EPCI Engineering, Procurement, Construction and Installation

FC Fabrication Contract

FPSO Floating Production, Storage and Offloading

FPU Floating Production Unit

FSU Floating Storage Unit

HSE Health, Safety and Environment

HHI Hyundai Heavy Industries

KEXIM Export Import Bank of Korea

KOSHIPA Korea Offshore and Shipbuilding Association

MODU Mobile Offshore Drilling Unit

MOTIE Ministry of Trade, Industry and Energy

NCS Norwegian Continental Shelf

NTNU Norwegian University of Science and Technology

NTK 07 Norsk Totalkontrakt 2007

PDO Plan for Development and Operation

PIO Plan for Installation and Operation

SCR Steel Catenary Risers

SDFI State's Direct Financial Interest

SHI Samsung Heavy Industries

SWF Sovereign Wealth Fund

Part I

INTRODUCTION

1 INTRODUCTION

Large engineering projects are often associated with high risks and are notoriously difficult to get right. History is filled with ambitious projects that failed to deliver on time and budget: In China, the cost of the Three Gorge Dam mega-construction project increased from USD 8.35 bn in 1992 to an estimated USD 37 bn in 2009 (Graham-Harrison, 2009). In the USA, the development of F-35 Fighter Jets experienced years of delays and a 50 % cost increase to USD 388 bn (Shachtman, 2010). In the UK, the NHS *Connecting for Health* ended up costing 770 % more than budget, before the electronic health record system was discontinued in 2013 (Fleming, 2004).

Field developments on the Norwegian Continental Shelf (NCS) are no exceptions, and in recent years several high profile projects have experienced severe delays and cost overruns. Critics have attributed this to new offshoring practices, as Norwegian oil operators have increasingly awarded comprehensive Engineering, Procurement and Construction (EPC) contracts for field developments on the NCS to East Asian, mostly South Korean, yards. Under the EPC-contract format, the foreign vendor is responsible for all the major functions of the project development.

Through a case study of field developments on the NCS offshored to South Korean yards, this master thesis explores the critical factors necessary for project organisations to achieve successful delivery of complex engineering projects in the implementation stage. Comparing these results with the findings in Holthe (2016), the study also aims at tracing the impact of offshoring decisions made in the planning stage on project implementation.

1.1 RESEARCH QUESTION

The petroleum sector has long attracted attention from researchers due to its large-scale and complex projects. Stinchcombe and Heimer (1985) study of field developments on the NCS made seminal contributions to management research by exploring contracts as hierarchical documents shaping inter-firm projects.

Few studies, however, have examined the recent shift in offshoring practices on the NCS and its effect on project management in the implementation stage. While Ahn (2015) is a notable exception, the author focuses narrowly on cultural factors, devoting less attention to organisational and managerial factors.

Studying a particular project context also follows a common contingent approach in project management research. Since no universal recommendations for managing a project organisation is thought to exist, but rather depend on the specific external and internal context of the project, it is important and necessary to study project set-ups and situations with unique features (Shenhar et al., 2001).

This study aims at addressing the following key research question:

[Q1:] What are critical success factors for Norwegian offshore projects contracted to South Korean yards?

1.2 SCOPE

Field developments on the NCS follow two distinct stages before production start: the *planning stage* and the *implementation stage*. The general development process is illustrated in Figure 1.

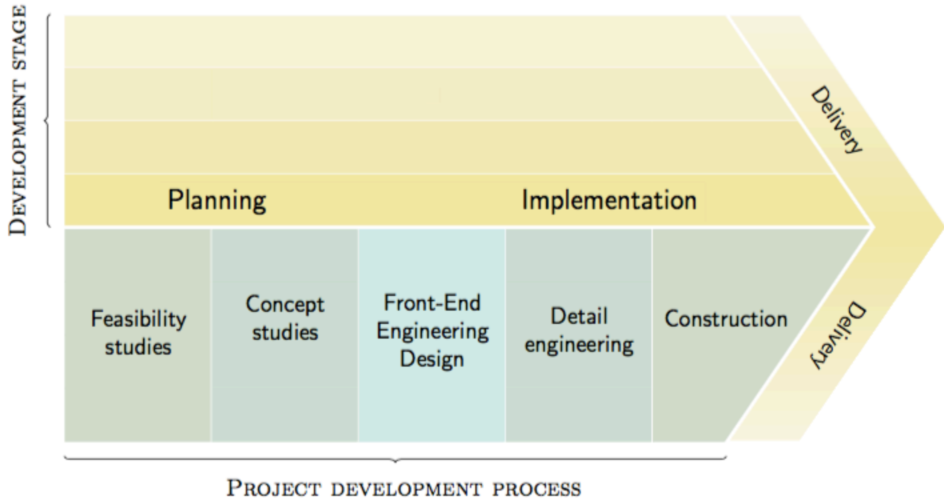


Figure 1: General project development process on the NCS (Norwegian Petroleum Directorate, 2013a)

This study will investigate the management of the implementation phase from the perspective of the operator company. The study is an extension of the work done on the planning stage in Holthe (2016). The aim is to identify critical factors for success in the implementation stage and discuss these within the context of the findings from the planning stage in Holthe (2016).

The case studies included in this thesis will be limited to the following field developments:

GOLIAT (2010): EPC-contract awarded to Hyundai Heavy Industries (HHI) in 2010 for the Goliat Floating Production, Storage and Offloading (FPSO) unit.

VALEMON (2011): EPC-contract awarded to Samsung Heavy Industries (SHI) for the Valemon platform topsides.

AASTA HANSTEEN (2013): EPC-contract awarded to HHI for the topside and substructure of the Aasta Hansteen Spar platform.

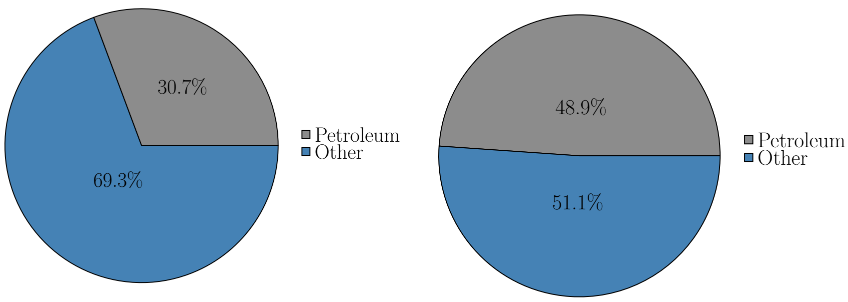
JOHAN SVERDRUP (2015): Fabrication Contract (FC) awarded to SHI for the construction of two platform decks for the Johan Sverdrup field.

The empirical data consists of interviews with managers stationed in South Korea to conduct project management for operator companies.

1.3 PRACTICAL APPLICATION

The petroleum industry's widespread use of projects to complete many of its core activities makes it well-suited for a case study of project management. Rigs, production units and vital platform infrastructure are all built using projects as an organisational form. A single project can involve hundreds of stakeholders and run for years from start to end, creating highly complex projects with high degrees of uncertainty. Projects in the industry usually also involve cross-border cooperation, adding additional layers of complexity.

Understanding how project management can influence success is therefore important to achieve long-term profitability in the petroleum sector. Moreover, the oil and gas industry makes up a significant part of the Norwegian economy, accounting for 21.5 % of GDP in 2014 (Norwegian Petroleum Directorate, 2012). As share of total investment and exports, its dominance is even more pronounced (Figure 2a and 2b). The impact of these field developments on overall economic growth in Norway, both directly and indirectly, is therefore substantial.



(a) Share of total investment (b) Share of total exports

Figure 2: Macro indicators, Norwegian petroleum sector 2013 (Norwegian Petroleum Directorate, 2012)

Through its petroleum tax system, the Norwegian government receives large revenues from the petroleum sector (Figure 3). The revenues are managed through a Sovereign Wealth Fund (SWF), and funds are made available for fiscal spending, limited annually to 4 %

of total assets held in the SWF. Since the size of the SWF is a function of both petroleum revenues and investment returns, the profitability of field developments directly effects fiscal resources available to the Norwegian government both in the short- and long-term.

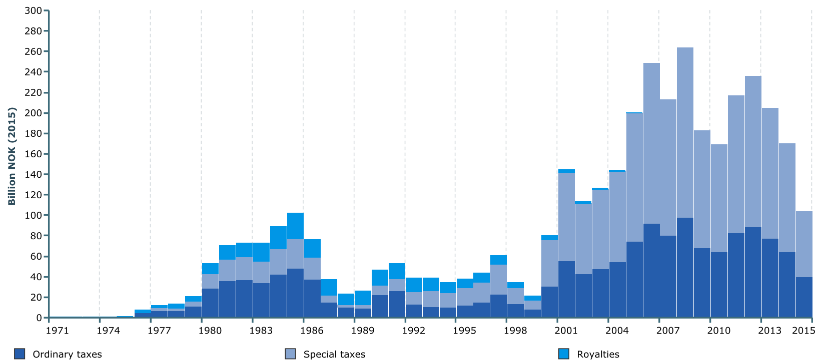


Figure 3: Net government cash flow from petroleum activities, 1971-2015 (Norwegian Petroleum Directorate, 2014)

The Norwegian government also has direct ownership of field developments and holds a majority stake in the leading operator on the NCS, Statoil ASA. Cash flows from the State's Direct Financial Interest (SDFI)[1] and dividends from Statoil create a direct and highly visible link between project profitability and the government's oil and gas revenues (Table 1).

Government revenues from petroleum

(NOK million)	**2012**	**2013**	**2014**	**2015**
Petroleum extraction tax	228 671	201 504	170 050	103 674
Environmental tax/area fees	4 036	4 932	6 114	6 485
Net cash flow from SDFI	148 889	124 294	112 857	92 718
Statoil dividend	13 887	14 421	22 646	15 384
Net government cash flow	**395 483**	**345 151**	**311 667**	**218 261**

Table 1: Statistics Norway (2016a)

1.4 STRUCTURE

This introductory chapter presents the research question and context of the study. Chapter 2 gives a brief introduction to the South Korean shipbuilding industry and its importance to the Norwegian offshore industry. Chapter 3 presents the four case projects including relevant contract details.

1 State's Direct Financial Interest (SDFI) is a basket of exploration and production projects on the NCS owned directly by the Norwegian government and managed by the state-owned company Petoro.

Chapter 4 summarises the theoretic background for offshoring decisions and explores the reasons why projects on the NCS were put to South Korea. Chapter 5 examines project management literature and integrates it with the literature findings in Chapter 4. Together, this forms a theoretic foundation for understanding the data gathered in this study.

Thereafter, Chapter 6 will elaborate on research methodology, before findings are presented in Chapter 7. Chapter 8 discusses the findings before recommendations and final remarks are made in Chapter 9.

Part II

BACKGROUND

2 SOUTH KOREAN SHIPBUILDING INDUSTRY

This chapter gives relevant background information on the development of the South Korean shipbuilding industry, its entry into the offshore segment and its importance for Norwegian–South Korean trade relations. The material builds on Holthe (2016) and has been updated and revised to reflect the latest developments.

2.1 INDUSTRY DEVELOPMENT

Rising from the ashes of the Korean War (1950–1953), South Korea had one of the fastest growing economies from the early 1960s until the 1990. An average annual growth rate of 7.3% between 1953 and 1994 (Chung, 2007) transformed the country's economy into a modern economic powerhouse in less than four decades. Today, South Korea is the world's 11th largest economy and the world's sixth largest exporter, with world-leading companies in IT, automobile, shipbuilding among many other industries.

Shipbuilding was an important part of South Korea's post-World War 2 industrialization. As South Korea expanded its industrial base from labour-intensive light manufacturing in the 1970s, the industrial conglomerates Hyundai, Daewoo and Samsung all opened shipyards. With labour costs at 1⁄4 of their Japanese competitors (Colton and Huntzinger, 2002), and with strong government support (OECD, 2015a), the South Koreans quickly became a force to be reckoned with in the global shipbuilding market.

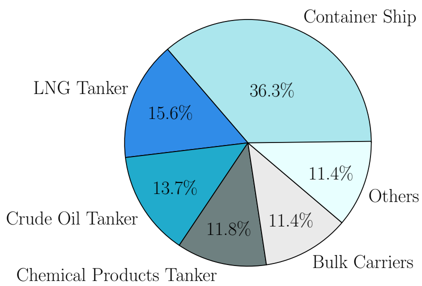
To support new industries in their infancy, the South Korean government set up industry specific research institutions in the 1970s, including one specialized in shipbuilding (Colton and Huntzinger, 2002). The Shipbuilding Promotion Law from 1958 had largely been ineffective, but was revised in 1967, and shipbuilding was made an economic policy priority when it was included in the fourth five-year development plan (1977–1981). The simultaneous promotion of related industries, and in particular the steel industry, created important synergies (OECD, 2015a).

Financial support from governments has been common practice in many shipbuilding nations (OECD, 2015a), and so also in South Korea. Established in 1976, the Export Import Bank of Korea (KEXIM) has been instrumental in providing financial guarantees for the capital intensive shipbuilding industry through direct and pre-shipment loans and financial and bond guarantees. K-Sure, has since 1992 been the government's official export credit agency and offers export credit insurance to protect against non-payment risks.

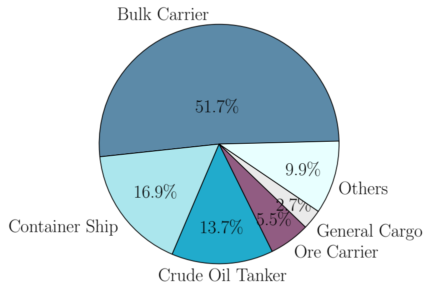
To this day, the South Korean government continues to play an important role in fostering human resources and develop R&D capabilities in the shipbuilding industry. South Korea currently has 21 universities, 18 colleges and 16 graduate schools that teaches shipbuilding engineering (OECD, 2015a). With offshore rising in importance in the shipbuilding industry (Section 2.3), the South Korean Ministry of Trade, Industry and Energy (MOTIE) launched a new maritime strategy in 2012 called *Plan to Develop Offshore Plant Industry*. The government also plans to expand the number of *Specialized Universities in Offshore Plant* from the current three institutions (OECD, 2015a).

2.2 INDUSTRY CHARACTERISTICS

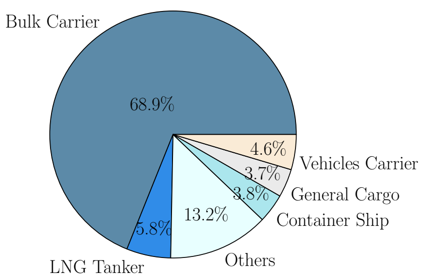
Today, South Korea is the largest shipbuilding nation in the world in terms of value, and second only to China when measured by volume (OECD, 2015a). The industry is dominated by the nine shipbuilding groups that make up the Korea Offshore and Shipbuilding Association (KOSHIPA). In 2013, there were about 71 small- and medium-sized shipbuilders in South Korea, but "the big three", Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Engineering (DSME) and Samsung Heavy Industries (SHI) still dwarf these companies (OECD, 2015a).



(a) South Korea



(b) China



(c) Japan

Figure 4: Orderbooks for South Korea, China and Japan 2013 (OECD, 2015a)

As global market leaders, South Korean shipyards produce a large variety of ships and offshore units. In the recent decade, however, shipbuilders have moved towards a stronger focus on high value products and especially very large tankers for oil and gas transportation. This development is reflected in an average vessel value in South Korea which is twice the industry average (OECD, 2015a).

In January 2014, container ships, LNG tanker and crude oil tankers made up the bulk of South Korean order books (65 %). Compared with major rivals China and Japan, however, the South Korean segment exposure seem more balanced (Figure 4). In Japan, for instance, a staggering 68.9 % come from bulk carriers.

2.3 MOVING INTO OFFSHORE SEGMENTS

The financial crisis in 2008 lead to a sharp drop in global orders for merchant vessels. South Korean yards went from acquiring contracts for 32,55 million Compensated Gross Tonnage (CGT) in 2007, to a mere 4,37 CGT in 2009 (Kwon, 2015). At the same time, oil prices not only recovered from the initial shocks of the financial crises, but climbed to new heights (Figure 5).

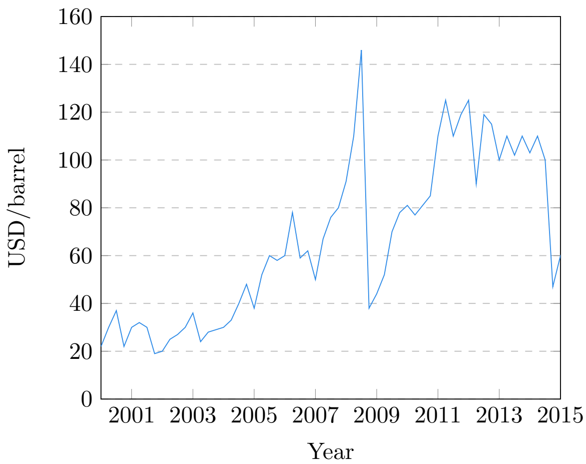


Figure 5: Crude oil Brent price 2000–2015 (OECD, 2015b)

From the beginning of 2011, oil prices were stabilizing around the 100 USD/barrel mark, leading to a surge in investments by oil companies (Figure 6).

A struggling maritime vessel market and a growing offshore sector meant a shift in the global shipbuilding industry. In 2013, offshore units made up 50 % of the global order book value, up from only 19% in late 2011 (Parry-Jones, 2013).

Amid the economic slowdown and increased competition from China, South Korean yards had to look for new markets to fill the void. Contract values for offshore units like FPSOs range in the several billion USD, while merchant vessels typically hover around 200–300 million

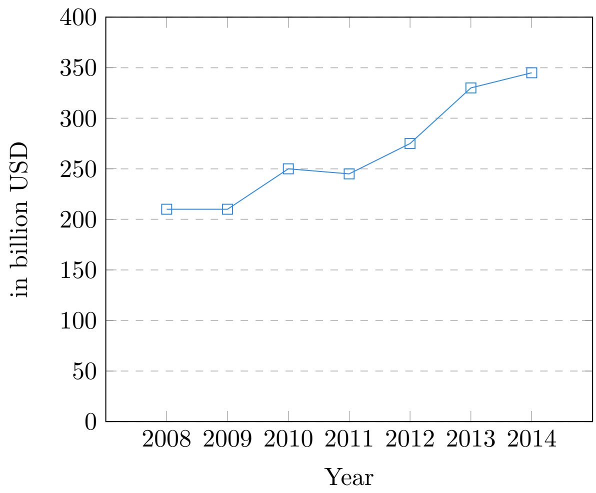


Figure 6: Offshore oil exploration and production spending (OECD, 2015b)

USD. Offshore contracts also offer higher value because of their complexity. With an investment boom building driven by the high oil price, the offshore segment looked like a golden opportunity.

The South Korean yards quickly dedicated large resources to win offshore contracts and their strategy showed immediate results. The value of offshore projects awarded to South Korean yards almost doubled from 12 billion USD in 2010, to over 26 billion USD in 2011, a level that was sustained in both 2012 and 2013 (Figure 7).

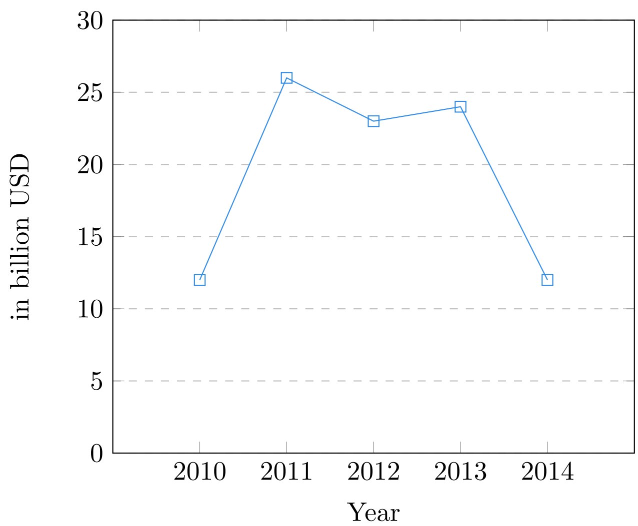


Figure 7: Offshore contract volume to South Korean yards (Kwon, 2015)

Offshore units are often large constructions that require larger dry docks that are not common place in the shipbuilding industry. According to the OECD (2015b) only 34 % of OECD yards have the capacity to produce large offshore plants like FPSOs. While these calculations only rely on maximum tonnage, the actual number of yards that have the technology and know-how to produce these units is probably even lower.

Because of their large size and capacities, the South Korean big three had a clear competitive advantage over yards in other countries and quickly grew their market shares. By January 2014, South Korea had a 42 % market share in the offshore segment, way ahead of Brazil (21 %) and China (16 %) (OECD, 2015b).

2.4 TURNING TIDES

However, the success in the offshore market also meant a dramatic shift in exposure. By 2012, offshore projects made up the majority of contracts for all the big three. SHI was the most extreme with a staggering 87,5 % of contracts from the offshore segment (Figure 8).

Figure 8: Offshore units as percentage of contracts (Kwon, 2015)

When oil prices unexpectedly started falling in mid-2014, what had been a blessing just a few years earlier quickly turned into a curse. In 2015 alone, the big three lost a combined 6,65 billion USD (7,7 trillion KRW) due to order cancellations and delays (Park, 2016). 2015 was the largest loss ever for the big three, and the first time all three recorded operating losses in the same year. It remains to be seen what this means for the long-term prospects of South Korean shipyards.

2.5 NORWEGIAN–SOUTH KOREAN TRADE RELATIONS

Trade between Norway and South Korea has traditionally been dominated by the maritime sector. South Korea has long been an important market for Norwegian shipping companies while South Korean shipyards have built ships for the same ship-owners. Following high oil prices 2009–2014, investments on NCS rose sharply from 104 billion

NOK in 2010 to 179 and 177 in 2013 and 2014 respectively (Norsk Petroleum, 2016).

Investments on NCS 2010–2015

Year	Wells	Old units	New units	Subsea	Pipelines	Total
2010	48	27	11	9	9	**104**
2011	51	25	27	13	11	**127**
2012	59	30	31	21	13	**154**
2013	71	39	36	15	18	**179**
2014	66	31	41	13	26	**177**
2015	60	20	40	8	20	**148**

Table 2: Norsk Petroleum (2016)

Investments increased in all categories, from development wells to new and existing facilities (Table 2). As part of this investment spree, many operators on the NCS awarded large projects to South Korean yards (Table 3).

Norwegian projects to South Korean yards 2010–2015

Year	Operator	Field	Type	Contract	Yard
2010	ENI Norge	Goliat	FPSO	EPC	HHI
2011	Statoil	Valemon	Jacket	Topside EPC	SHI
2011	BG Norge	Knarr	FPSO	Topside FC	SHI
2011	Songa	CAT-D	MODU	EPCI	DSME
2011	Statoil	Heidrun	FSU	Topside EPC	SHI
2012	Total	Martin Linge	Jacket	Topside EPC	SHI
2013	Statoil	CAT-J	MODU	EPCI	SHI
2013	Statoil	Aasta Hansteen	Spar	Topside EPC	HHI
2013	Statoil	Gina Krogh	Jacket	Topside EPC	DSME
2015	Statoil	Johan Sverdrup	Decks	Topside FC	SHI

Table 3: Ahn (2015)

While there are no local content requirements on the NCS, Norwegian offshore and maritime suppliers proved resilient as they won large contracts from South Korean yards for equipment packages for the NCS projects. Supported by a free trade agreement between EFTA and South Korea that came into effect in 2006, trade between Norway and South Korea boomed. Bilateral trade increased from 8,7 billion in 2006 to a record 41,8 billion in 2015 (Statistics Norway, 2016b). Norwegian mainland exports to South Korea stood at 16,3 billion NOK in 2015, 85 % of which were offshore-related equipment and machinery.

Today, South Korea is Norway's second largest trading partner in Asia, in large part due to offshore-related activities. Moreover, the Royal Norwegian Navy in July 2013 chose DSME to build a new logistic ship – the largest vessel in the Norwegian fleet. This points to an increasingly important bilateral relation that has developed alongside increased trade and business contact between the two nations.

3 PROJECT DESCRIPTIONS

This chapter gives relevant background information on the four projects constituting the case studies in this thesis. The projects are featured in a chronological order.

3.1 GOLIAT

This section presents general information for the Goliat field as well as details related to the contract awarded to HHI for the Goliat FPSO.

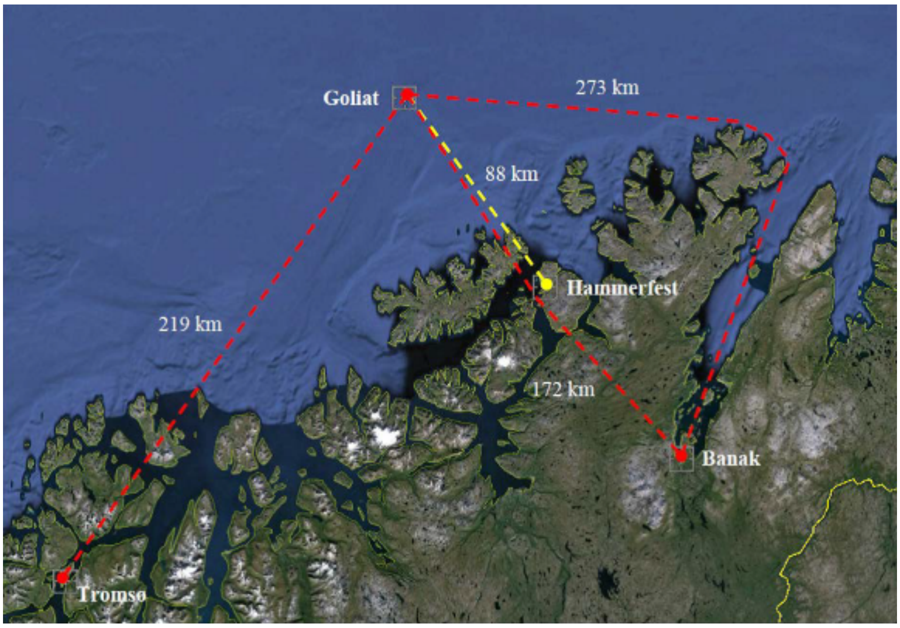


Figure 9: Goliat location (Eni Norge, 2015)

3.1.1 *Field info*

OPERATOR: Eni Norge

LICENSEES: Eni Norge (65 %) and Statoil (35 %)

STATUS: Producing

Goliat is an oil and gas field located in the Barents Sea, approximately 65 km off the Norwegian mainland, containing an estimated 28 million Sm^3 of oil and 8 million Sm^3 of gas (Eni Norge, 2015). Goliat was the first oil producing field in the Norwegian sector of the Barents sea.

Goliat is planned to operate for 15 years, but designed to last for 30 years in case production of additional reservoirs in the area would become feasible. Located just 50 km from the Snøhvit field, the Goliat field development might make it economically feasible to also produce oil from Snøhvit, a field that today only produces natural gas.

Since the original production licence (PL229) was first awarded in 1997, the owner structure has changed significantly, and today only Eni Norge and Statoil remain. The field is operated by Eni Norge with operational management stationed in Hammerfest.

The Plan for Development and Operation (PDO) was submitted to Norwegian authorities in February 2009, and approved in June 2009. The first oil was produced from Goliat on 12 March 2016, and the field was officially declared open on 18 April. The Goliat FPSO is the northernmost oil producing oil platform in the world.

Total investment estimates for the field development can be seen in Table 4, stipulating a 51,8 % increase in costs compared to PDO and Plan for Installation and Operation (PIO) estimates (Norwegian Petroleum Directorate, 2013a).

Goliat investments

Year	Mill. NOK
2009	755
2010	2 744
2011	6 683
2012	8 136
2013	6 699
2014	9 389
2015– (est.)	12 568
Total	**46 974**

Table 4: All nominal values (Norwegian Petroleum Directorate, 2016)

3.1.2 *FPSO contract*

The two licensees decided that the field would be developed with a cylindrical FPSO concept. The concept is designed with built-in working spaces because of the harsh weather conditions in the area. For instance, the FPSO is significantly taller than conventional designs, chiefly to prevent icing.

In February 2010, HHI won a EPC-contract for the FPSO platform. The contract was valued at 6.9 billion NOK at the time of signing, and covered the following processes:

- Detailed engineering

Figure 10: Goliat FPSO (Eni Norge, 2015)

- Procurement
- Construction
- Preparing for operation
- Transportation from South Korea to Norway

The FPSO has a storage capacity of 151 000 m^3 oil, and a total of 32 well slots. To reduce climate gas emissions from production, some of the platform's energy needs are met by electricity from the mainland through a submarine power cable.

In 2014, the work on just the FPSO platform was estimated to have cost a total of 13.7 billion NOK (Ramsdal, 2014).

3.2 VALEMON

This section presents general information for the Valemon field as well as details related to the contract awarded to SHI for the Valemon Jacket.

3.2.1 *Field info*

OPERATOR: Statoil

LICENSEES: Statoil (53.775 %), Petoro (30 %), Centrica Resources Norge (13 %) and Norske Shell (3.225 %)

STATUS: Producing

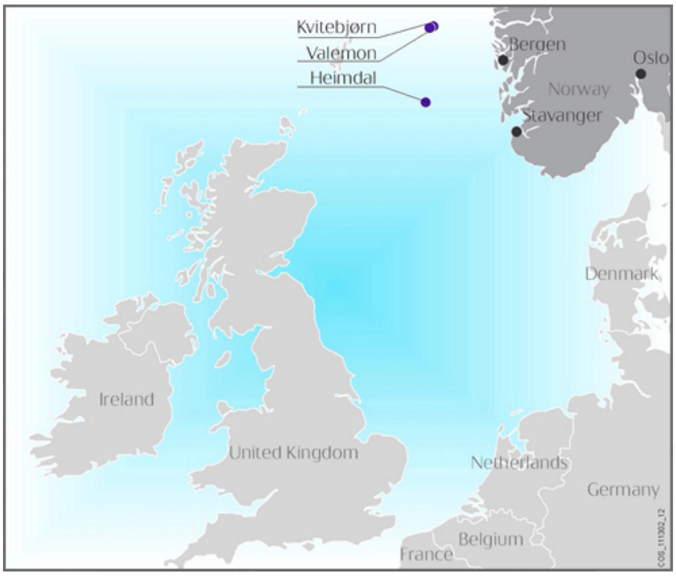


Figure 11: Valemon location (Statoil, 2016b)

Valemon is a gas and condensate field located in the North Sea, approximately 160 km west of Norway's second largest city, Bergen. The field is situated not far from existing fields such as Kvitebjørn and Gullfaks South. The field contains an estimated 192 million barrels of oil equivalent (Statoil, 2016b).

The PDO was submitted to Norwegian authorities in October 2010, and approved in June 2011. Total investment estimates for the field development can be seen in Table 5, stipulating a 5,6 % decrease in costs compared to PDO and PIO estimates (Norwegian Petroleum Directorate, 2013a).

Valemon investments

Year	Mill. NOK
2010	85
2011	1 399
2012	3 902
2013	5 858
2014	16 976
2015– (est.)	8 142
Total	**25 118**

Table 5: All nominal values (Norwegian Petroleum Directorate, 2016)

The platform concept consists of a steel jacket installed at the sea bed at a depth of 135 m and facilities for separating gas and condensate. Because of its proximity to existing fields, Valemon will utilize infrastructure already installed in the area for its production operations. After drilling, Valemon will largely be an unmanned platform controlled remotely from the Sandsli operating centre in Bergen.

3.2.2 *Topside contract*

In 2011, SHI won a EPC-contract for the Valemon topsides. The contract was valued at 2.3 billion NOK at the time of signing, and included the platform topsides and living quarters with an option for the mating operation of the topsides and the steel jacket. Valemon was the first complete platform deck that Statoil contracted from South Korea.

Figure 12: Valemon platform (Statoil, 2016b)

3.3 AASTA HANSTEEN

This section presents general information for the Aasta Hansteen field as well as details related to the contract awarded to HHI for the Aasta Hansteen Spar.

3.3.1 *Field info*

OPERATOR: Statoil

LICENSEES: Statoil (51 %), Wintershall Norge (24 %), OMV Norge (15 %) and ConocoPhillips Skandinavia (10 %)

STATUS: PDO approved, production planned to start end of 2018.

Aasta Hansteen is a gas field with some condensate located in the Norwegian Sea, approximately 320 km off the coast of Bodø. The field contains an estimated 45.4 billion Sm^3 of gas and 0.9 million Sm^3 (Norwegian Petroleum Directorate, 2013b). Aasta Hansteen is the first deepwater field development in the Norwegian Sea.

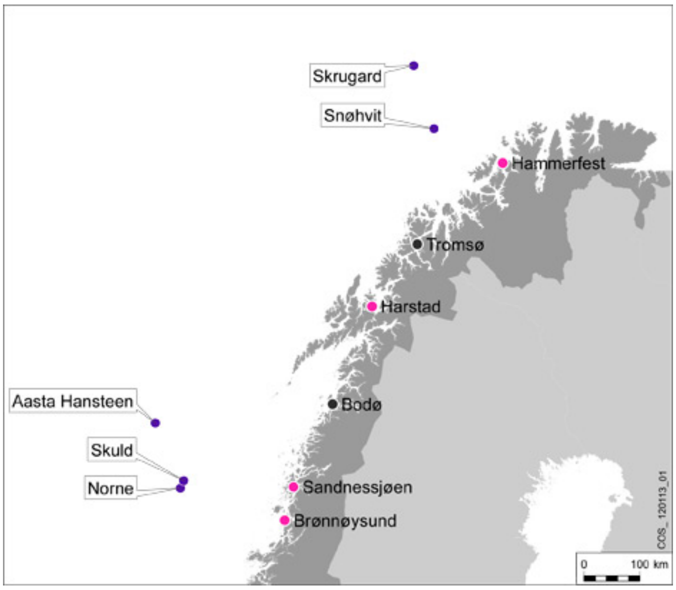


Figure 13: Aasta Hansteen location (Statoil, 2016b)

The development concept is a floating field centre, also called a spar platform. It will be the world's largest spar platform, and the first such facility on the NCS. It is the first time ever a spar platform is developed to produce condensate. The concept is also unique in that it will be the first deepwater floating production unit installed above the Arctic circle using Steel Catenary Risers (SCR).

The PDO was submitted to Norwegian authorities in December 2012, and approved in June 2013. Total investment estimates for the field development can be seen in Table 6, stipulating a 13.3 % increase in costs compared to PDO estimates (Norwegian Petroleum Directorate, 2013b).

Aasta Hansteen investments

Year	**Mill. NOK**
2013	3 981
2014	7 754
2015– (est.)	22 354
Total	**34 089**

Table 6: All nominal values (Norwegian Petroleum Directorate, 2016)

In an amendment to the Norwegian national budget for 2015, it was informed that production start would be postpone from Q3 2017 to second half of 2018 (OED, 2015). The same document explains that half of the cost increase is said to stem from currency fluctuations. The remaining is attributed to engineering and construction delays, price increases on equipment and more man-hours used for engineering.

3.3.2 *Spar topside and hull contracts*

In January 2013, HHI won a EPC-contract for the deck with living quarters on the spar platform for the Aasta Hansteen development. The contract was valued at 6.5 billion NOK at the time of signing. The contract also included mating of the topside and the hull.

Earlier, a consortium of HHI and Technip also won a EPC-contract for the hull for the spar platform, with a contract value of 4 billion NOK. For the topside contract, CB&I and Dockwise, both Dutch firms, will be perform the actual mating and engineering work.

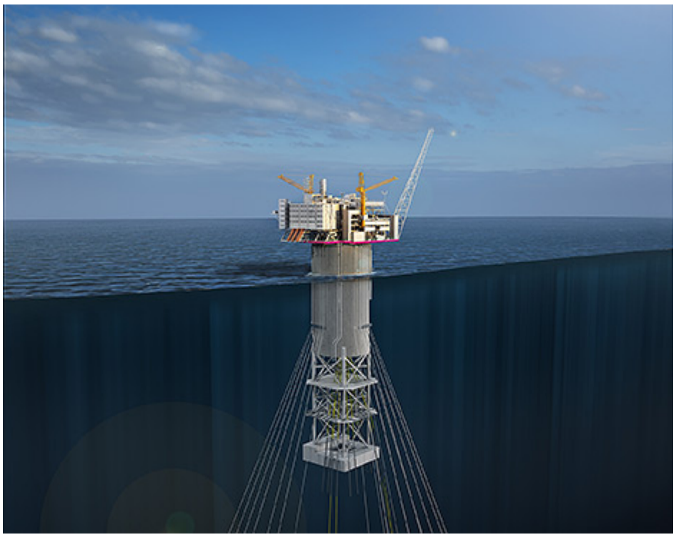


Figure 14: 3D-model of the Aasta Hansteen spar (Statoil, 2016b)

3.4 JOHAN SVERDRUP

This section presents general information for the Johan Sverdrup field as well as details related to the contract awarded to SHI for the riser and processing platform topsides.

3.4.1 *Field info*

OPERATOR: Statoil

LICENSEES: Statoil (40.0267 %), Lundin (22.6 %), Petoro (17.36 %), Aker BP (11.5733 %) and Maerk Oil Norway (8.44 %)

STATUS: PDO approved for first development phase, production planned to start end of 2019.

Johan Sverdrup is a large oil and gas field in the North Sea, located approximately 155 km off the Norwegian mainland (Figure 15). The field is one of the five largest oil fields ever discovered on the NCS, containing 0.7–3.0 billion barrels of oil equivalent. At its peak, Johan

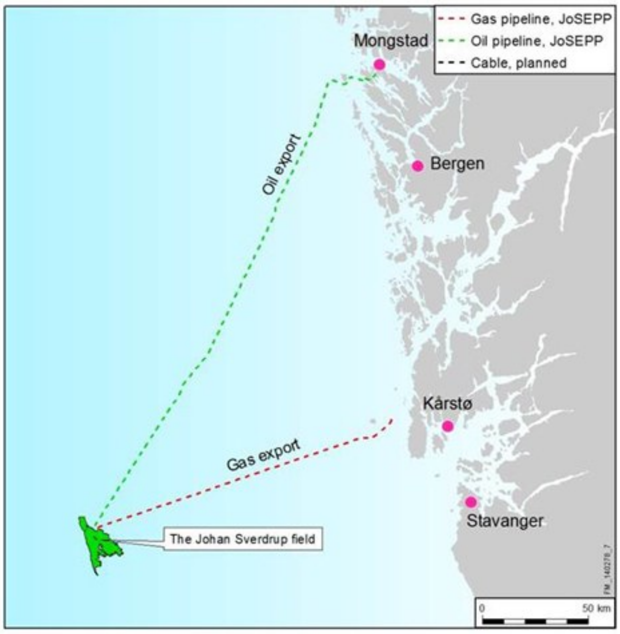


Figure 15: Johan Sverdrup location (Statoil, 2016b)

Sverdrup will produce about 25 % of all the oil on the NCS, with production projected to continue for more than 50 years.

Johan Sverdrup will be developed in stages, and the first stage will consist of four connected platforms forming the field centre (Figure 16). Each platform will have a dedicated function: living quarters, process facility, drilling facility and risers, all connected by walking bridges.

Oil from Johan Sverdrup will be piped to the Mongstad terminal in Hordaland province, while the gas will be lead to the Kårstø processing plant in Rogaland province (Figure 15). The field will be powered by electricity from the mainland. Total investments are estimated to be 120 billion NOK (Table 7).

Johan Sverdrup investments

Year	Mill. NOK
2015– (est.)	120 551

Table 7: All nominal values (Norwegian Petroleum Directorate, 2016)

3.4.2 *Topside contract*

In 2015, SHI was awarded a Fabrication Contract (FC) for the topsides of the Johan Sverdrup processing and riser platforms. At the time of signing, the contract value was 7 billion NOK.

Figure 16: First development phase on Johan Sverdrup (Statoil, 2016b)

The processing platform is a 26 000 ton structure made to stabilise oil and process natural gas to rich gas [1]. The riser platform is tasked with managing oil and gas exports and water and gas injections. The onshore power cable also connect to riser platform where power is transformed before it is distributed to other platforms. Moreover, the riser platform serves as a future connecting node, should other structures be integrated into the field centre at a later stage.

Johan Sverdrup is different than the other case projects in that the contract is not an EPC-contract. Aker Solutions won the Engineering and Procurement for the topsides for the same platforms, and SHI is therefore responsible only for the construction element. The contracts for the two other platforms on Johan Sverdrup were both awarded as EPC-contracts, and was won by Aibel and Kværner Stord, respectively.

3.5 PROJECT COMPARISON

A comparison of the four projects is presented in Table 8.

Projects

Year	Operator	Field	Value	Contract	Yard
2010–2015	ENI Norge	Goliat	6.9 bn NOK	EPC	HHI
2011–2014	Statoil	Valemon	2.3 bn NOK	EPC	SHI
2013–	Statoil	Aasta Hansteen	6.5 bn NOK	EPC	HHI
2015–	Statoil	Johan Sverdrup	7.0 bn NOK	FC	SHI

Table 8: Summary of projects

1 Natural gas containing heavier hydrocarbons than a lean gas

Part III

LITERATURE

4 OFFSHORE DECISION-MAKING

This chapter summaries the literature reviewed in Holthe (2016) on factors influencing offshoring decisions. In order to better understand the relationship between them, factors are grouped in push and pull factors (Section 4.1 and 4.2). Based on the literature findings, Holthe (2016) developed preliminary expectations for push and pull factors for projects on the NCS being offshored to South Korean yards. These preliminary expectations are presented in Section 4.3.

4.1 OFFSHORING PUSH FACTORS

Push factors are factors that "provide incentives or motivate a firm to relocate (...) activities elsewhere." (Haakonsson et al., 2013, p.680). Push factors are here subdivided into firm level and environmental level factors, meaning that they originate from both home location and the general environment.

4.1.1 *Firm level*

4.1.1.1 *Firm experience and learning*

Several seminal studies point to the offshorer's prior experience with offshoring as an important push factor. The topic is investigated from different angels, including firm experience, organisational learning and firm path dependence.

Past experience is found to be a driver of innovation offshoring (Lewin et al., 2009), and Rilla and Squicciarini (2011) identify similar findings in locational choices for R&D centres. Furthermore, experiential learning seems to influence the offshoring of advanced tasks (Ørberg Jensen and Petersen, 2012). The path dependent nature of firms, lower transaction costs and the ability to consider more risk factors are offered as explanations for the positive relationship between firm experience and learning, and offshoring (Lewin et al., 2009).

None of these studies, however, address whether the underlining explanations are interdependent. For instance, it seems plausible that path dependence and lower transactions costs might be related. Firms will be better at tasks it has previously performed, and therefore can be expected to achieve lower transaction costs by sticking to these tasks, as least in the short term. Moreover, these studies do not elaborate on whether considering more factors when offshoring leads to lower perceived or actual risks (is must lead to some kind of lower risks, otherwise it would be unlikely to positively influence the offshoring decision).

Hätönen (2009), on the other hand, finds that past offshoring experience predicts both future degree and success of internationalisation. While internationalisation success is not equivalent with offshoring success, it can be argued that Hätönen indirectly suggests that firms, through firm learning, are able to both consider and mitigate more risk factors in future offshoring projects.

This result might also illustrate what Lewin et al. (2009) meant about internationalisation patterns being path dependent. As the firm expands, it develops global networks unique to the organisation while at the same time discovering new opportunities. Perhaps does this explain the emerging link between internalisation and offshore location decisions.

Hahn et al. (2009) found that the firm's competitive environment plays a significant role in offshore location decisions, regardless of previous offshoring experience. Firms without prior offshoring experience are willing to engage in offshoring if enough competitors do the same. This suggest that the importance of firm learning for offshoring decisions is moderated by environmental push factors.

With the exception of Hahn et al. (2009), the above-mentioned studies all focus on offshoring of advanced tasks. It might be that the relationship between firm learning and offshoring is different for more standardized and less essential tasks. Nevertheless, firm learning might still be related to the findings in Hahn et al. (2009).

If one accepts the argument that offshoring practices starts with more standardized tasks and develop from there, in any given industry, competitors are more likely to engage in offshoring of less complex tasks. Competitive pressures to offshore for these types of tasks are therefore, on average, likely to be higher. By extension, it might be argued that firm learning is less important when offshoring standardized tasks because competitive pressures dwarf the effects of firm learning, even for firms with prior offshoring experience.

The empirical studies on firm learning in this review draw on data from different industries such as IT (Hahn et al., 2009) and more traditional manufacturing (Ørberg Jensen and Petersen, 2012), broadening the validity of the findings. However, none of the studies specify how much experience is needed to push firms to develop offshoring practices, nor at what level competitive pressure starts influencing firm learning. Just as Schmeisser (2013) points out that offshoring research has not yet dealt adequately with the timing of offshoring (the "when" question), this also seems to be true within the sub-field of firm learning's impact on offshoring.

Regardless of the above-mentioned shortcomings and limitations, the literature clearly shows that firm experience is positively related to offshoring. Hence, firms with prior experience with offshoring can be expected to engage more in offshoring than firms without such experience.

4.1.1.2 *Activity attributes*

Firm activities are traditionally separated on the basis of two dimensions: type (services vs. manufacturing) and complexity. The offshoring literature, however, exhibits growing attention to a more nuanced approach that rather considers activity attributes and its impact on offshoring decisions.

Doh et al. (2009), for instance, distinguish based on how *interactive*, *repetitive* or *innovative* an activity is, while Liu et al. (2011) similarly looks at *interactiveness*, *routineness* and *complexity*. Ørberg Jensen and Petersen (2012), however, argue that discretionary judgement, site specificity and interdependency are the activity features that determine offshoring strategies.

The fundamental argument of these three studies is that transaction costs, and not productions costs alone, matter in the offshore location decision. Activity attributes are therefore used to better reflect how transaction costs vary between different activities. While Ørberg Jensen and Pedersen (2011) use a more traditional way to characterise activities, the authors' interest in the topic is also prompted by a realizing that production costs and wages do not capture the full complexity of offshoring decisions.

The picture that emerges is complex, but these studies all find that the fit between activity attributes and location characteristics is an important explanation for why certain activities are offshored to certain locations. Ørberg Jensen and Petersen (2012) even argue that when employing attributes, the distinction between services and manufacturing becomes blurred, suggesting that this approach is warranted.

Comparing these results with other studies reviewed, two interesting parallels are observed. First, the attribute approach to activities not only offer an explanation for why one offshoring location is chosen over another, but also potentially contributes to our understanding of the more complex phenomena of multiple-sourcing and near-shoring.

Cho et al. (2014) argue that multiple sourcing (sourcing from both external foreign provider and foreign subsidiary) exists because of firm level characteristics. At the same time, Bagchi et al. (2015) find that in-sourced and offshored IT project differ on several technical dimensions. It is plausible that activity attributes also play a role in multiple-sourcing, and that interesting results might be unravelled by conducting research along this dimension.

The case is similar for near-shoring, where traditional drivers such as wage disparity cannot explain the location decision. Activity attributes might offer a (partial) explanation for the results in Hahn et al. (2011) who find that factors driving near-shoring and offshoring are fundamentally different.

Second, Hahn et al. (2011) find that firms are willing to take on more risk for low skill activities, when compensated sufficiently with lower wages. Using the terminology of Liu et al. (2011), this would be activities that are repetitive, routine and with low complexity. It might appear that as activities are commoditised, wages (or rather production costs) again become more important than transaction costs. The implication would be that the development stage of an activity matters, and that it would be beneficial to examine activities over time to see if either its attributes and/or offshore location is dynamic.

In conclusion, the literature establishes a clear link between activity attributes and offshoring destination. Different attributes are suggested, and the most common are attributes that measure degree of repetitiveness, innovativeness and interactiveness.

4.1.1.3 *Managerial intention*

Many studies find that the offshoring decision is clearly linked with managerial motives. Lewin et al. (2009) and Roza et al. (2011) call it managerial intentionality, while Hätönen (2009), Lacity et al. (2009) and Rilla and Squicciarini (2011) all use variations of strategic intent. They all find that top managements reasons for engaging in offshoring strongly shape the offshoring decision.

The reasons behind offshoring business activities influence the decision-making in part by defining which factors are considered in the location decision. If cost reduction is a stated goal, then factors thought to be important to achieve this will be included in the assessment. Interestingly, Massini et al. (2010) discover that firms that have an overarching and explicit offshoring strategy are more likely to consider a broader range of factors before arriving at a decision, regardless of the initial managerial intention.

An immediate observation is that a clear offshoring strategy is pivotal to avoid overlooking important factors in the offshoring decision-process. Since the managerial intent so strongly shape the final decision, elements not initially considered might be ignored later on despite their relevance. This can be especially difficult for firms that pursue complex and ambiguous strategic goals that are both hard to quantify and who's total implications are hard to predict.

Cost reduction (Kinkel and Maloca, 2009; Lacity et al., 2009; Schwarz et al., 2009) is by far the most common offshoring intention identified in the literature. Increasing international competitiveness (Beverakis et al., 2009), addressing capacity constraints (Kinkel and Maloca, 2009), or home-base augmenting (Rilla and Squicciarini, 2011) are other frequent reasons.

Why does the strategic intent vary and why are some intentions more commons than others? As discussed in Section 4.1.1.2 on activity attributes, location characteristics should correspond with the activity one wants to offshore. Since activities vary, it is only reasonable to assume that the managerial intent for offshoring varies with the activity in question.

The literature supports this, as standardized tasks performed by predominantly low-skilled workers are closely linked with cost-oriented offshoring (Kinkel and Maloca, 2009), while offshoring of more advanced tasks seek to achieve international competitiveness (Ørberg Jensen and Petersen, 2012).

That some factors are more common than other can reflect that some activities are more frequently offshored than others. In addition, the literature is biased towards manufacturing and IT offshoring, and focus to a less degree on advanced offshoring. As both offshoring practices and research develop, one would expect to find more diversity in the managerial intentions.

In sum, there are compelling evidence that managerial intention drives offshoring decisions. Cost reductions stand out as the most important managerial reason to offshore, but others such as increased competitiveness and resolving capacity bottlenecks also exist. Moreover, intention appear to be shaped by the activity that is being offshored.

4.1.1.4 *Firm characteristics*

In addition to the aspects discussed above several firm characteristics are found to play a role in the offshoring decision.

Firm performance

A somewhat surprising finding is that firms with poor financial results are more likely to engage in outsourcing (Lacity et al., 2009). It is surprising, because one would assume that since cost reduction is often a stated goal of offshoring (see Section 4.1.1.3), firms that offshore would gain a cost advantage over firms that do not offshore. Hyun (2010) finds similar results when he concludes that productivity is not a good predictor of offshoring, even though the two studies have different approaches, and are thus not necessarily comparable.

There are two possible explanations for these findings. First, perhaps firms that offshore have higher net costs after offshoring than before, either through unforeseen transaction costs that exceed other cost savings, or because they are unable to reap the full benefits of offshoring.

It is well-documented that cost savings from offshoring often fall short of initial expectations. Forrester Research (McCarthy et al., 2003), for instance, found that firms obtain savings of 25 %, not 60 % as expected. The gap represents, among other possible explanations, rising transaction costs. However, offshore cost savings are real, and appear to be consistent, such that it is unlikely that offshoring itself is the culprit of bad financial performance.

Second, and perhaps the most likely explanation, is that firms that already perform subpar are pushed into offshoring in order to increase its competitiveness and stay afloat. A potential related result is found in Brändle (2015) that discover a negative relationship between offshoring potential and likelihood of being involved in offshoring. Jobs that have a clear offshoring potential are, for whatever reason, not being offshored.

Many good explanations can be offered for this, legal regulations and strong unions are just two of the possibilities, but perhaps is it also because these jobs are found in firms that are not struggling financially, so that the push factor discussed above is not present. The implication would be that firms with good financials have an unrealized offshoring potential.

It should be cautioned that while the results in Lacity et al. (2009) are from the IT sector, Brändle (2015) looked at more traditional manufacturing plants. As such, the findings are not directly comparable and more research is needed to establish a definite relationship between the results.

Firm size

Evidence suggest that offshoring drivers are influenced by firm size in several ways. First, Srivastava et al. (2008) find that large firms are more likely to engage in offshoring. Second, Roza et al. (2011) find that offshoring drivers differ qualitatively when controlling for firm size. While cost drivers are pivotal for small and large firms, entrepreneurial drivers are most important for medium-sized firms. At the same time, resource drivers are significant for both medium and large firms.

An important observation to make from these results is that firms size might, directly or indirectly, influence managerial intention.Roza et al. (2011) highlights that managerial intention is vital to the offshoring decision, but the perspective inRoza et al. (2011) differs from Lewin et al. (2009), which explored managerial intention as a determinant of innovation offshoring Roza et al. (2011), on the other hand, show that firm size gives different drivers. Taken together, these studies suggest that managerial intention is an important factor in the offshore decision-making, and that firm size is one of the underlining drivers.

Firm size might influence why organisations decide to offshore because size can be a predictor of organisational needs. Firm size to a large degree determines resources, capabilities and growth stage, such that it seems natural that firms of different sizes would approach offshoring with different objectives.

Why then does offshoring intensity increase with size? The Uppsala school would see this as a continuation of an organisation's international growth path. With larger size comes larger foreign presence, and thus more opportunities and capabilities to offshore. Srivastava et al. (2008) also find that higher financial leverage (higher debt to equity ratio) decreases offshore intensity. By assuming that large firms have better access to cheaper credit, we might argue that this might be another reason why large firms have higher offshore intensity. Hence, large firms with large financial pockets can be expected be the most active offshoring firms.

In conclusion, the literature identifies two types of firm characteristics that increase the likelihood to offshore, namely bad financials and large firm size.

4.1.2 *Environmental level*

While the focus of this is research is on firm level considerations, many of the studies reviewed include environmental components. However, since the search algorithm is geared towards firm level variables, the majority of the studies deal with location related pull factors and not directly with environmental push factors. However, some interesting results are still present and will be briefly discussed below.

4.1.2.1 *Industry characteristics*

Ambos and Ambos (2011) find that for R&D offshoring, industry knowledge intensity plays a crucial role. The more high-tech an industry, the more likely it is to have high levels of RD offshoring. The results are strengthened by Ørberg Jensen and Petersen (2012) who discovered that knowledge intensity at the firm level is correlated with the offshoring of advanced tasks. While these findings are not from the industry level, the results are more general as it suggests that knowledge intensity influences all advanced offshoring, and not just R & D offshoring.

Here we have another possible link with the competitive pressures discussed previously in relation with managerial intention in Section 4.1.1.3. Taken together, the results seem to suggest that factors which increase competitive pressures also push firms to offshore. The sample size in this review is too small to be able to say something definite about the relationship between knowledge intensity and offshoring. However, it once again highlights that competitive pressure is an important push factor for offshoring.

4.1.2.2 *External events*

Hutzschenreuter et al. (2011) look at offshoring in Germany and the US over three decades to try to decipher the interplay between internal firm level considerations and external events at the country level in the offshore decision-making. The study identifies external triggers that causes inflection points from which waves of offshoring emerge. Political changes that open up new labour markets abroad coupled with a shortage of skilled labour at home, is one example of such external factors.

The external factors discussed in the study are all larger trends that shape industries and nations for years. Consistently delayed infliction points in Germany compared with the US leads to the conclusion that home-country regulations and institutions also matters in how and when these external events are absorbed.

While it might seem intuitive that large global events effect firms, the study nevertheless concludes that for companies that are not first-movers, internal motivators still seem to drive the decision-making. Perhaps does this point to, as previously discussed, how important managerial intentions are for firm level decision-making. Firms' decisions are influenced by the world in which they operate, but an organisation's path dependency still plays a crucial role in its continuous development.

Summarizing the findings at the environmental level, we see that both industry factors and external events that increase competitive pressures can push firms to offshore.

4.2 OFFSHORING PULL FACTORS

Pull factors are factors that work "inside a country location and act like magnets to attract firms" (Haakonsson et al., 2013, p.680). In this case, pull factors are thought to be environmental at the country level, meaning that all pull factors originate from the offshore destination location.

4.2.1 *Location attractiveness*

Location attractiveness refers to how attractive a country is as an offshore destination seen from offshorer's home-base. Location attractiveness is a function of many variables, including factors at the institutional, industry and cultural levels. In the following, location attributes that influence location attractiveness will be tackled, followed by a discussion of whether there exists a location preference.

4.2.1.1 *Location attributes*

The main argument in all the reviewed studies on location attractiveness is that factors which increase either costs or risks reduce location attractiveness, and vice-versa. Costs are here understood as transaction costs, which better captures the total costs incurred in an economic transaction.

The trade-off between cost and risk is a fundamental economic relation, which in the case of offshoring implies that if a location can offer the same service at the same risk, but at a lower price, an arbitrage opportunity exists. As soon as such an opportunity emerges, all market players are expected to exploit it (since no additional risk is taken on), and the opportunity will swiftly evaporate.

We find evidence of this in the literature as risk differentials are found to be important factors, and firms increase offshoring to a destination when a host country becomes less risky (Hahn et al., 2011). Risk can come from a variety of sources, including factors at the institutional, political and operational levels.

Liu et al. (2011), for instance, find that institutional quality and cultural proximity determine the attractiveness of a given a location. The higher the institutional quality and the more familiar the culture, the more attractive the location becomes, mainly by lowering risk levels, but presumably also through lowering costs. Some factors also found to directly influence both costs and risks, e.g. regulatory factors (Malos, 2010).

As discussed in Section 4.1.1.2, activity and location attributes are found to correspond, and this is in turn thought to be linked to managerial intention. Furthermore, as seen in Section 4.1.1.3, reducing costs is found to be the most common reason to start offshoring. It should therefore come as no surprise that discounted wages matter for the location decision (Hahn et al., 2011). However, low wages are far more important when the jobs offshored are low- skilled (Hahn et al., 2011) and/or standardized (Kinkel and Maloca, 2009).

When investigating service offshoring or offshoring of advanced tasks, however, the picture is a lot more nuanced. Rilla and Squicciarini (2011) find that a skilled workforce and knowledge infrastructure are the most important factors for R&D functions. This corresponds well with the diverse managerial intentions for advanced offshoring found in Section 4.1.1.3. Simply put, an offshore location is attractive if it has what management is looking for.

The literature goes to great lengths to identify new factors that influence location attractiveness. Some factors play a limited role in determining costs and location attractiveness, e.g. global tax differentials (Drtina and Correa, 2011) and landed costs (Young et al., 2009), but are nevertheless present.

Others, however, are not thoroughly convincing. Den Butter and Linse (2008), for instance, claim that subjective factors are becoming more important as objective factors are mitigated by trade integration. While it is true that free-trade agreements lower the so-called objective factors, the authors do not sufficiently address the fact that non-tariff barriers still play a major role in hampering international trade (OECD, 2005).

Some studies have even more novel suggestions about what can constitute a location advantage, e.g. time-zone proximity (Prikladnicki and Carmel, 2014), but probably exaggerate the applicability of the results. For time-zone proximity to be relevant, frequent and daily contact with the contractor is a prerequisite, and the study largely ignores the role of project management in mitigate problems that arise from time-zone differences.

Over time, location attractiveness shifts because of the dynamic nature of location factors (Ellram et al., 2013). The development path of an offshore location appear to be more complex, however, than the trade-off between cost and risk might initially suggest. Using data for US firms, Bunyaratavej et al. (2007) find that a country is likely to attract more service offshoring when average wage increases.

This suggests that increasing wages is an indicator of other developments, such as improved skills sets, higher education or increased productivity. Put more simply, higher wages increases location attractiveness because it signifies a society in (positive) development. A workforce and a business sector that is more capable, will attract more offshoring of the same kind, and over time time more high level offshoring.

Overall, cost and risk differentials by far determine location attractiveness. For standardized tasks, cost is the most important factor. The more advanced a tasks gets, however, the more institutional and country level characteristics, including culture, seem to influence risk, and therefore in the end also location attractiveness.

4.2.1.2 *Location preference*

Cultural differences are thought to increase transactions costs, and as earlier stated, findings suggest that firms prefer, all other things equal, cultural proximity. In fact, Bunyaratavej et al. (2007) find that firms prefer locations closest to the home base in terms of not only culture, but wage, education and infrastructure. This does not go against the trade-off between costs and risks, but rather highlights that culture is an important cost and risk element in offshoring.

Comparing these findings with Gefen and Carmel (2008), it is interesting to note that in their very controlled and stylized dataset (an online programming marketplace), US firms were the only clients that showed no location preference. All other firms did indeed exhibit a preference for domestic providers. Gerbl et al. (2014) report similar findings that strengthen the evidence that location distance matters.

Furthermore, when Bunyaratavej et al. (2007) investigated the more complex, and some might say realistic, service business environment, a clear geographic preference is found. This suggests that as offshoring becomes more complex, cultural proximity plays a larger role in the location decision.

In sum, the literature exhibits compelling evidence that a location preference underlines most offshore location decisions.

4.2.2 *Interaction between push and pull factors*

As can be concluded from the preceding discussion, offshoring is a complex matter encompassing many factors that interact with each other to shape the final decision. Many authors (Doh et al., 2009; Haakonsson et al., 2013; Ørberg Jensen and Pedersen, 2011) caution against investigating offshoring at a too general level, precisely because of its complexity and numerous nuances.

But do we know anything about the weight of the push and pull factors respectively? Hätönen (2009) argues that firm- and situation-specific factors matter more than location-specific factors. As many studies point to managerial intentionality as a decisive factor (Lewin et al., 2009; Roza et al., 2011), this proposition is to some extent supported by other researchers. Adding another level of complexity, the relationship between the push and pull factors is found to be dynamic (Haakonsson et al., 2013), and might also be a function of how many factors that are initially taken into account (Massini et al., 2010).

4.3 EXPECTATIONS FOR OFFSHORING FACTORS ON THE NCS

Based on the literature summarised in Section 4.1 and Section 4.2, an attempt will be made to anticipate what these findings mean for the case of Norwegian operators on the Norwegian Continental Shelf offshoring EPC-contracts to South Korea.

The discussion will be structured in the same categories and in the same order as the preceding literature review. The discussion will culminate in distinct expectations for both push and pull factors.

4.3.1 *Push factors expectations*

4.3.1.1 *Firm experience and learning*

In terms of prior experience with offshoring, Norwegian operators have long used foreign yards to build offshore projects, including the South Korean Big Three. Norsk Hydro contracted HHI for Jacket components for the Brage field as far back as 1991, and used the same yard for the Troll Floating Production Unit (FPU) Hull construction in 1997 (HHI, 2016).

Since operator companies always utilize outside vendors for project constructions, contracting vendors can be assumed to be a core capability of these companies. This means that the organisations have a lot of experience with planning, executing and evaluating such projects. Prior experience with South Korean yards would have further reduced the perceived risk for the Norwegian operators, in line with the findings in the literature.

While the offshoring of EPC-contracts to South Korea was a new development starting with the Goliat FPSO contract to HHI in 2010, the findings are in line with literature predictions.

4.3.1.2 *Activity attributes*

What kind of activity attributes does an offshore EPC-contracts have? While the complexity varies from project to project, it can be argued that an EPC-contract is the most advanced form of offshore construction offshoring. The yards are responsible not only for the individual processes (engineering, procurement and construction), but for the entire project. This represents a much complex operation than handling any of the processes separately.

Supplier management and project coordination are likely to be key capabilities in a project governed by an EPC-contract. This gives the project more interactiveness than other offshore development projects, since the yard has to account for the operator's feedback as the project progresses. While projects do have routineness, especially in the construction phase, chances are that both the engineering and procurement will have project-specific features.

Many of the EPC-contracts offshored to South Korea also required a high degree of innovativeness. The Goliat FPSO unit, for instance, represented an engineering challenge never attempted before, that would, among other things, tackle both the extreme weather conditions and strict environmental regulations in the Barents Sea.

In sum, the EPC-contracts to South Korean yards exhibit high levels of complexity, interactiveness and innovativeness coupled with lower routineness compared with simple construction contracts, making it an advanced form of manufacturing offshoring. As will be discussed in detail in Section 4.3.2.1, this is perhaps not a complete fit with location attributes in South Korea.

4.3.1.3 *Managerial intentions*

Without structured empirical evidence, it is hard to say something definite about the managerial intentions for offshoring to South Korea. However, public statements by prominent representatives of Norwegian operator companies, give clues into the internal considerations that were made prior to awarding the EPC-contracts in question to the South Korean yards.

Procurement Director at Statoil, Mr Jon Arnt Jacobsen, claim that capacity limitations and cost levels in Norway were the most important reasons for not placing the contract at Norwegian yards Jacobsen (2016), implying that South Korean yards scored best on these measures. In this context, capacity probably entails two different aspects.

First, coinciding with the global investment spree in the oil and gas sector as discussed earlier, shipyards around the globe, including Norwegian yards, had nearly full order books. Capacity utilization ratio in the shipyard industry hovered around 90% in years 2008–2010 (Figure 17). South Korean shipyards were among the few in the world that could take on projects of this size and complexity at this point in time.

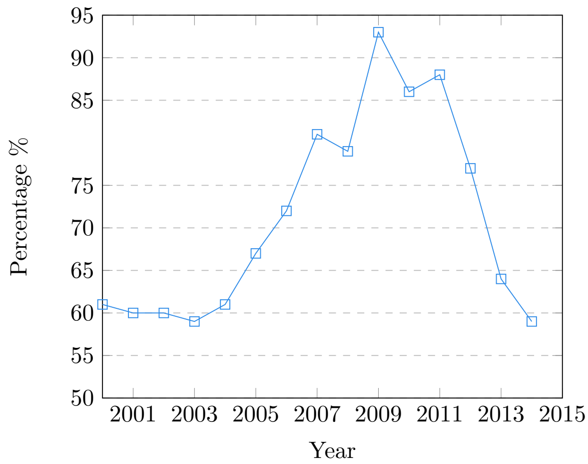


Figure 17: Capacity utilization ratio in the shipbuilding industry in OECD countries (OECD, 2015b)

Second, some of the major EPC-contracts, like the Goliat FPSO, required large yard dimensions. Few, if any, could match the South Korean shipyards in terms of dry-dock dimensions, lead by the HHI which completed the world's largest dry-dock in 2009 (490 m long, 115 wide and 13.5 m deep). Cost is of course a function of many factors, of which capacity utilization is one, another is labour wages. South Korean shipyards workers earned an average of 63 000 USD in 2014 (Herh, 2015), compared to 83 000 USD for Norwegian workers (De Rosa, 2012).

Using offshoring to reduce costs and mitigate capacity issues are both common managerial intentions found in the literature. However, the kind of activity attributes found in the EPC-contract are usually associate with more diverse strategic drivers. Emphasise on cost might, however, be seen as a strategic goal, in the sense that many operators were worried that the domestic shipyard and supplier industry were becoming complacent due to the high oil price.

Awarding contracts to South Korea might have been a way of getting the domestic industry on-board on long-term cost cutting and productivity improvements. Certainly, operators would not risk these important projects just to prove a point, but it is plausible that it was part of a larger strategic mind-set. However, other situation and environmental-specific factors are probably more important explanations for why cost was a pivotal managerial driver.

Knowing that managerial intentions are found to be driving forces in the literature, and seeing certain strategic intentions crystallise both in company statements and circumstantial evidence, we can expect that cost reductions and resolving capacity issues were major factors in the offshoring decision.

4.3.1.4 *Firm characteristics*

Looking at firm characteristics, we see that all the operators can be seen as large firms, either as an international oil firm (Total), a Norwegian subsidiary (ENI Norge) or a global Norwegian operator headquartered in Norway (Statoil). With the exception of Songa Offshore, a medium sized rig business, this corresponds well with the findings in the literature that large firms are more likely to offshore.

The most prominent finding in the literature on firm characterises was that bad financials was strongly correlated with offshoring intensity. However, there are no indications that this is the case here. What might be possible explanations for this deviation?

First, the literature deals with more traditional and fixed manufacturing, and might therefore not be directly applicable to the production of offshore units. Second, contracting offshore units is capital intensive, such that firms need a financial foundation to finance the contracting, leading firms in the industry to exhibit different financial characteristics compared to other industries.

It is hard to develop any meaningful expectations about firm characteristics without investigating the issue more thoroughly. The sample would have to be improved by including a larger number of firms on the NCS, and by not being based only on firms that we know already offshore. Since the result for firms' financial situations are opposite from what the literature predicts, it is also difficult to develop predictions for this issue without further investigations, which is out of the scope of this thesis.

4.3.1.5 *Environmental level*

As earlier noted, the time-period in question was the first time Norwegian operators awarded comprehensive EPC-contracts to South Korean yards. Some industry trends during that period may have contributed to this development. Nilsen and Braadland (2014) argue that EPC-contracts were developed as a response to sharp cost increases in the oil and gas industry during the 1990s.

As such, the fact that the contracts were awarded in the EPC-format might simply reflect an industry belief that this contract form was the best tool to manage the development of offshore constructions. South Korea might have been chosen for other reasons, and it is plausible that the EPC-contract was just the contract of choice at the time.

In terms of external events, the period of contracting South Korean yards was proceeded by the financial crisis, a crisis which directly and indirectly created two simultaneous and interacting situations favourable for South Korean yards: high oil prices and a decline in the merchant vessel market.

These factors created a situation in which South Korean yards had the capacity that Norwegian operators needed, at a time were the South Koreans desperately needed new orders. This is similar to the infliction point seen in the literature (Hutzschenreuter et al., 2011) around the year 2000, when IT companies flocked to India due to high demand for IT workers at a time of few IT graduates in the West. There is also evidence that the South Korean yards were very eager to win offshore contracts, undercutting prices to the point that industry insiders claim prices were below direct costs.

On one hand you had industry trends increasing EPC share of total contracts, while South Korean yards had ample capacity. Given other circumstances, both for South Korean yards and for the offshore yard industry, it is plausible that contracts more often would be split in the traditional three processes. But is it yard capacity or industry contracting trends that first and foremost determines the prevalence of the EPC-contracts?

Since yard capacity is found to be a major cost driver on the NCS (Nilsen and Braadland, 2014) and EPC-contracts are used to combat rising industry costs, we can hypothesise that there exist a positive correlation. We therefore expect EPC-contracts, as a share of total contracts, to be higher when capacity is high, and vice-versa. Since the time period investigated was a period high capacity utilization, we would expect South Korean yards to win less EPC-contracts, as a share of total contracts, during periods of lower utilization ratios.

4.3.1.6 *Preliminary expectations*

In the discussion on push factor expectations, we have examined the interaction of several independent push factors. In particular, we have seen managerial intentions being amplified by environmental level push factors. These observations culminate in the following three preliminary push factor expectations:

EXPECTATION 1: Cost reduction was a major strategic reason behind offshoring to South Korea.

EXPECTATION 2: Addressing capacity issues was a major strategic reason behind offshoring to South Korea.

EXPECTATION 3: Under industry circumstances with lower capacity utilization ratio for offshore yards, EPC-contracts as a percentage of total contracts will decrease for South Korean yards.

4.3.2 *Pull factors expectations*

4.3.2.1 *Location attractiveness*

We have already established that South Korean shipyards were attractive in terms of cost and capacity at the point of contracting (see discussion of managerial intention in Section 4.3.1.3). South Korean shipyards also boost rare capacity capabilities for offshore units that further strengthened their competitiveness in winning these particular contracts on the NCS.

Using maximum tonnage as a measurement, only 34 % of all OECD yards (which notable does not include China), have the capacity to produce offshore units (OECD, 2015a). Yet, many of these yards to do not have the know-how to produce complex structures such as FPSOs, making the actual number of competitors much lower. In comparison, 96 % of all the yards in the OECD have the capacity to produce offshore support vessels or similar, less complex, vessels.

South Korea is a highly developed country with high institutional quality and infrastructure. South Korean workers are also highly educated: 63 % have completed higher education, the highest in the OECD (OECD, 2011). From a Norwegian perspective, its trade agreement with EFTA from 2006 makes trade highly integrated and completely tariff free in the offshore sector.

As discussed, activity attributes of EPC-contracts are different than each of the separate processes (engineering, procurement and construction) that make up the contract would indicate. South Korean yards have a proven track-record for constructing both advanced ships and offshore installations for decades. Industry insiders rightfully claim that South Korean yards have acquired "significant expertise in construction" (Maslin, 2014). However, uncertainties remain about the South Korean ability to handle procurement and engineering in the offshore segment. Let us first examine the procurement process.

South Korean shipyards are known for keeping close relations with the local supplier industry, squeezing suppliers to the extremes in terms of obligations and cost reductions, in return for long-term business opportunities for the suppliers. The yards have established effective working relations with local suppliers, and naturally prefer keep using these networks. The local supplier networks ensure effective operations, but also maintains an industry power structure in which the big yards can dictate terms for small- and medium- sized suppliers.

The procurement process for offshore projects, however, turns out to be a lot more challenging for South Korean yards. First, the South Korean supplier industry is not as technically strong with offshore equipment as with ship equipment. While the local equipment content for ships built in South Korea is around 90 %, it is much lower for offshore projects, probably as low as 20– 30 % (OECD, 2015a). Second, at the time, South Korean yards and suppliers had little knowledge or experience with the NORSOK standard, a standard specific to the NCS (Ramsdal, 2015).

These two factors disrupt existing supplier networks, and push the yards to rely on foreign suppliers for a majority of offshore equipment packages. Less local content means challenges in terms of initiating and managing new supplier relations with foreign (largely Norwegian) providers. Different working styles, language and cultural barriers add to this challenge, and supplier management because a key success factor. In sum, this weakens the South Korean yards' ability to efficiently manage the procurement process.

If we move on to the engineering process, major South Korean industry players have publicly admitted that for offshore projects, South Korean yards fall short of Western engineering capabilities. At a conference in 2014, Vice Chairman Suh Youngjo of KOSHIPA said:

> We have difficulty in this area [offshore], because of a lack of engineering experience and offshore equipment (Maslin, 2014).

At the same occasion, a senior official from SHI stated:

> While the country [South Korea] has developed significant expertise in construction, it is behind when it comes to engineering skills for EPC work and in-country equipment suppliers (Maslin, 2014).

As with the procurement process, South Korean engineering capabilities are further weakened by a lack of knowledge of the NORSOK standard. A key point is that the NORSOK standard specifies functional requirements, meaning that it does not specify how a part should look like, but how it should function. This leaves room for interpretation, and experience with the NORSOK standard is said to be key to avoid costly delays in the engineering process. In retrospect, some have claimed that this is the source of the many delays these projects have seen (Ramsdal, 2015). Clearly, the above shows that South Korean engineering capabilities had shortcomings at the time of contract.

In addition to the procurement and engineering challengs, several issues put the South Korean project management skills into question:

First, managing three different processes simultaneously is in itself a daunting management task. Moreover, managing an EPC-contract is a much bigger challenge than a regular construction contract (Nilsen and Braadland, 2014). Since these were some of the first EPC-contracts for South Korean yards, they lacked experience with managing the contract format. The earlier referenced statement by a Samsung official supports this claim. Second, as an extension of the procurement and engineering challenges discussed above, it is fair to assume that these capability issues further amplified the project management challenge for South Korean yards.

While the Norwegian operator companies can be assumed to prefer suppliers with a proven track record on the NCS (regardless of home country), the South Korean government has created a strong push for developing a local supplier industry for offshore installations. This also puts the shipyards in a squeeze between the contract owner and the South Korean government. While not directly influencing the projects, this might have added extra management challenges for the shipyards.

The literature suggests that there ought to be a fit between activity attributes and location attributes. While South Korean yards possess many of the necessary capabilities and South Korea exhibits country level factors that correspond to several of the activity attributes, uncertainty remains regarding engineering, procurement and project management capabilities. The yards have most of the technical capabilities to construct offshore units, but lack knowledge on the NORSOK standard, foreign suppliers and the engineering process. Together with a lack of EPC experience, these factors create doubts on the yards' project coordination capabilities.

Looking at the challenges discussed above it is natural to conclude that the challenges related to procurement, engineering and project management were factors that were given less weight in the the location decision-making. In terms of location-activeness, South Korea must have been deemed attractive for other reasons, including, but not necessarily limited to, the two push factor expectations developed before, cost reduction and addressing capacity issues.

4.3.2.2 *Location preference*

The literature suggests that offshorers favour proximity. In terms of wage, education and infrastructure, South Korean shipyards delivers on these points, as shown above. However, culturally, the distance is vast between Norway and South Korea. Research suggests, that in terms of Hofstede's five cultural dimensions Norway and South Korea are diametrically opposite (Ahn, 2015).

One might say that South Korea exhibits more similarity than discrepancy, at the same time, as earlier noted, the EPC-contract format requires a lot of interaction and coordination between operator and shipyard. This presents the projects with additional risks of elevated transaction costs, compared with putting the projects to a country with a culture more similar to the Norwegian. It therefore seems as though the cultural dimension was not a major factor when deciding about the offshoring location.

4.3.2.3 *Preliminary expectations*

In the proceeding section, some of the challenges with awarding offshore EPC-contracts to South Korean yards have been pointed out. Since the contracts were indeed put to South Korean yards, the conclusion must be that these issues were given less weight in the decision-making. This leads to the following two preliminary pull factor expectations:

EXPECTATION 4: Challenges related to procurement, engineering and project management capabilities were given less weight in the decision to offshore to South Korea.

EXPECTATION 5: Cultural distance was given less weight in the decision to offshore to South Korea.

5 PROJECT MANAGEMENT SUCCESS

This chapter presents relevant literature on project management success. Moreover, relations between the offshoring literature in Chapter 4 and the project management literature is discussed. Furthermore, the preliminary expectations established for offshoring decisions in the planning stage are further developed into expectations for challenges in the execution stage. Together, this forms the basis for understanding the empirical data gathered in this study.

5.1 PROJECT MANAGEMENT DEFINITIONS

Before we move on to explore success in project management, it is useful to define what we mean by project management. British Standard (2010) defines a project as

> A unique set of co-ordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific objectives within defined schedule, cost and performance parameters.

Similarly, the standardisation body (British Standard, 2010) defines project management as:

> Planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance.

These definitions are general and applicable to most industries and organisations, but unique features of each project and industry might drive a particular project management focus. This will become more apparent as we examine our case projects. It is useful to remind ourselves, however, that what sets project management apart from other types of management is that time is a finite resource (Atkinson, 1999).

The project management literature stresses the distinction between a *project success criterion* and a *project success factor* when deciphering project success. Lim and Mohamed (1999, p.243) describe the difference between criteria and factors in the following way:

> Criteria are the set of principles or standards by which judgement is made; whereas factors are the set of circumstances, facts, or influences which contribute to the result.

In other words, a success criterion is the standard by which you judge the results from a project, while a success factor is what lead to the results. Section 5.2 will deal with success criteria, while Section 5.3 will examine success factors.

5.2 PROJECT SUCCESS CRITERIA

5.2.1 *The Iron Triangle*

Ever since Olsen (1971), cost, time and quality have been the defining success criteria used in project management. Often called *The Iron Triangle* (Figure 18), many studies explore project success factors using these three criteria to measure success (Pinto and Slevin, 1988a; Wateridge, 1998; Wit, 1988). Empirical studies involving project managers also suggests that practitioners consider on time, to budget and to specification the most important success criteria (White and Fortune, 2002).

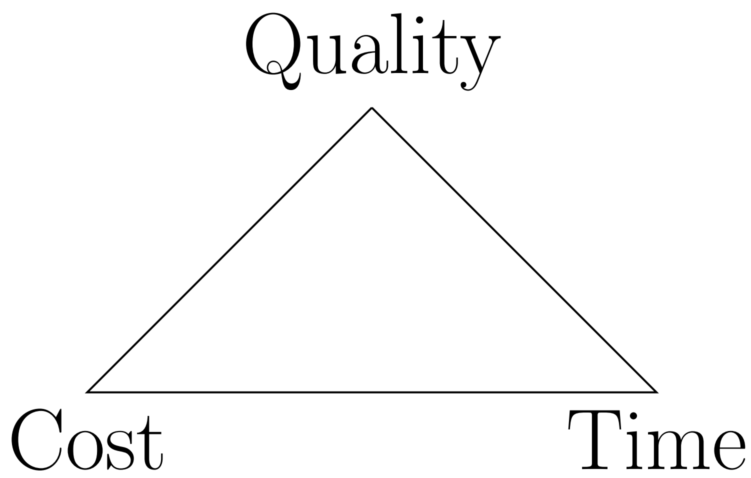


Figure 18: The Iron Triangle

Cost and time are scheduling properties evaluated according to predefined goals. Quality, however, is a very subjective matter, and perceptions of quality are influenced by type of project and industry, among many other factors. Wateridge (1998) defines six success criteria and captures nuances of the quality concept in all but the first one (Table 9). As Atkinson (1999) points out, the relative importance of success criteria will depend on the nature of the project and might sometimes even be competing. Building stadiums for the Olympics, time is clearly crucial because the Games will take place in a narrow time-window. Similarly, quality will be of out-most importance in projects for life-critical systems such as fire sprinklers.

Wateridge's project success criteria

1. Profitable for the sponsor/owner and contractors
2. Achieves its business purpose strategically, tactically and operationally
3. Meets its defined objectives
4. Meets quality thresholds
5. Produced to specification, within budget and on time
6. All parties are satisfied during and after the project

Table 9: Wateridge (1998)

A fundamental trade-off is often said to exist between the three criteria in the *Iron Triangle* (Atkinson, 1999), with economic criteria like time and cost believed to matter most for commercial projects (Wit, 1988). Surprisingly, however, Wit (1988) found that meeting time and cost goals are not always enough for a project to be perceived as a success. Nor did failure to meet time and cost goals necessary lead to a project being perceived as a failure. Clearly, the perspective from which a project is evaluated matters.

5.2.2 *Stakeholder perspective and the Square Root*

The most basic view of success criteria like the *Iron Triangle* takes the perspective of client, contractor and other actors directly involved in project implementation. Literature recognises, however, that other stakeholders are also important.

Lim and Mohamed (1999) propose that success criteria should be looked at from two perspectives: the macro and micro perspectives. A project is a macro success if the original project idea is achieved. This can only be assessed once a project has reached the operational stage, hence macro level success implies that the end-user and other end-phase stakeholders are satisfied. .

The micro view, however, is concerned with completion of the construction phase, and as such includes only the actors involved in the construction (owner and contractor). These stakeholders are satisfied if predefined project goals are met. This is especially true if the owner and contractor are not long-term partners and their cooperation is limited to the project (Lim and Mohamed, 1999).

Lim and Mohamed's argument implies that more stakeholders should be included to analyse project success. Since these actors, hailing from both inside and outside of the project organisation, can have vastly different project expectations, is *The Iron Triangle* fully capturing the necessary success criteria?

Atkinson (1999) traces project management failures from the limited set of criteria used to measure project success. The author claims that time and cost are at best guesses about uncertain future variables. Furthermore, quality is thought to be a mere function of stakeholder attitudes and beliefs, and that these fluctuates during the project lifecycle. It is therefore argued that the Iron Triangle does not fully capture project performance because it focuses narrowly on delivery criteria.

Atkinson's answer is a comprehensive framework, referred to as *The Square Route* (Figure 19), that can be said to include both macro and micro perspectives as described by Lim and Mohamed. *The Square Root* incorporates *The Iron Triangle* with three new categories: *Information System*, *Benefits to the organisation* and *Benefits to community stakeholders*.

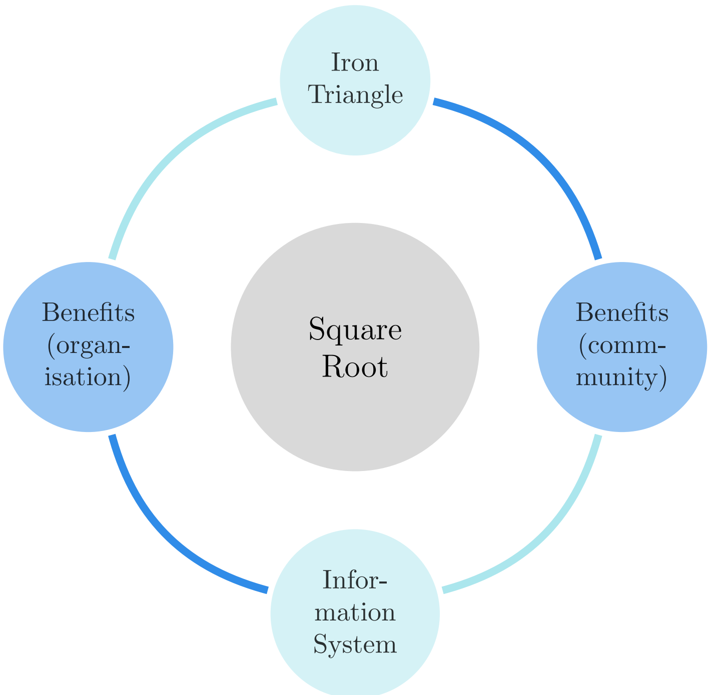


Figure 19: The Square Root

Information Systems include all technical strengths of the end-product, while benefits are grouped in benefits to the organisation (direct) and to the community as a whole (indirect). Examples of success criteria within each of these categories can be seen in Table 10.

In the *Square Root* framework, owner and contractors are sectioned off from other actors allowing for a more nuanced view of different stakeholders and their success criteria. Product assessment is also strengthened through a more detailed examination of product features in *Information Systems*.

Square Root success criteria	
The Iron Triangle	**The Information System**
Cost	Maintainability
Time	Reliability
Quality	Validity
	Information Quality
Benefits (organisational)	**Benefits (community)**
Improved efficiency	Satisfied users
Improved effectiveness	Social impact
Incresed profits	Environmental impact

Table 10: Atkinson (1999)

5.2.3 *Types of projects*

Different success criteria can be important to different types of projects. That is because project type is believed to shape project goals, and in turn, success criteria. The results in Shenhar et al. (2001) show the importance of understanding the project type when deciding how to measure project success.

The foundation for this approach comes from the categorisation made in Shenhar et al. (2000), which distinguishes projects according to how they are managed: *i*) operationally, or *ii*) strategically. Strategically managed projects are concerned with achieving business goals (profits, market share, competitive advantage), while operationally managed projects focus on completing tasks.

Shenhar et al. (2000) argue that managers in strategic projects keep adjusting to achieve strategic goals, as opposed to managers in operational projects that stick to predefined plans about time, cost and quality. Shenhar et al. (2001) expanded on this by examining projects in several industries with low, medium, high or super high technological uncertainty across four success dimensions:

D.1 Meeting time, budget and other requirements

D.2 Impact on customer

D.3 Benefit to organisation

D.4 Impact on future

The authors found that **D.1** was important to all projects, but overruns were less likely in low-tech projects. For more high-tech projects, while certainly not encouraged, overruns seemed to be accepted as long as the project delivered a net gain from the other success dimensions.

For **D.2**, the benefits for customers increased with higher technological uncertainty. Low tech projects offer standardised products and the cost and advantages are known to the customer before implementation. At the high-tech end of the spectrum, benefits can be high, but so is uncertainty. As for benefits to the organisation, results for **D.3** showed that short-term profits were the main goal for low-tech projects. For medium-tech projects, other aspects like product diversification play a role. Since high-tech projects come with high uncertainty, these projects tend to focus on long-term goals like gaining larger profits, market-share or unique technical capabilities, despite that might mean sometimes mean short-term losses.

In a similar fashion, project impact on the future, as captured in **D.4**, were mostly important for high-tech projects. The very idea behind engaging in highly uncertainty projects seem to be that they offer organisations future advantages.

These advantages are distinct from the benefits in **D.3** by their strategic nature. For instance, some projects might be initiated to forge long-term relationship with partners that might be beneficial in the future, without it being known today how the organisation will reap the benefits from the relationship.

5.3 CRITICAL SUCCESS FACTORS

A large body of research has tried to identify factors that are particularly important to fulfill the success criteria discussed in Section 5.2. This stream of research focuses on Critical Success Factor (CSF), and was identified by Söderlund (2002) as one of seven major schools of thought within project management. Boynton and Zmud (1984, p.23) define CSF as:

> those few things that must go well to ensure success for a manager or an organization, and, therefore, [...]that must be given special and continual attention to bring about high performance. "

As pointed out by Pinto and Slevin (1988b), early contributions to CSF research were mostly theoretic and extensive empirical studies were scant. According to Belassi and Tukel (1996), these studies primarily focused on scheduling, perhaps, as discussed in Section 5.2, because project success criteria and stakeholders were narrowly defined early on. Single case studies attempted to produce practical CSF lists for managers, but tended to lack broad applicability outside of the case context.

However, just as the success criteria literature has grown more diverse, later studies have refined the CSF concepts significantly. In the following, some important contributions will be highlighted.

5.3.1 *Classification of CSFs*

The seminal work of Pinto and Slevin (1988a) examined 10 project internal factors developed in Slevin and Pinto (1986) and 4 external factors, empirically testing their relative influence on project success (Table 11).

Internal and external CSF

Internal	**External**
Project mission	Project team leader characteristics
Top management support	Power and politics
Project schedule	Environmental events
Client consultation	Urgency
Personell	
Technology to support project	
Client acceptance	
Monitoring and feedback	
Channels of communication	
Troubleshooting	

Table 11: Pinto and Slevin (1988a)

All the factors tested were found to be significantly related to project success, and combinations of the 14 CSFs could explain up to 60 % of project performance. One particular factor, *Project mission*, stood out as essential across all project phases.

Pinto and Slevin's study offered important advances for CSF research. First, by establishing an empirical relation between CSFs and project success. Second, by expanding the concept of CSFs to also include external forces, much along the same lines as success criteria research started to include external stakeholders.

While this certainly broadened the scope of CSFs, a general and comprehensive framework was still lacking. A first step was taken when Pinto and Prescott (1990) grouped their 10 internal CSFs into *planning factors* and *tactical factors*.

Planning factors are factors that contribute to the establishment of goals, plans and schedules, while *tactical factors* are activities that operationalise these project plans. Subsequently, four of the initial ten CSFs were categorises as planning factors (project mission, top management support, project plan and client consultation), while the rest were deemed to be tactical factors (Table 12).

Planning and tactical CSF	
Planning	**Tactical**
Project mission	Personell
Top management support	Technology to support project
Project schedule	Client acceptance
Client consultation	Monitoring and feedback
	Channels of Communication
	Troubleshooting

Table 12: Pinto and Prescott (1990)

Planning factors were found to be more important for project success than tactical factors throughout the entire project life cycle. The result implies that one should try to get things right from the start, rather than to adapt as the project progresses. This result also indicates that planning and tactical factors are interdependent.

Furthermore, Pinto and Prescott used a multidimensional measure of project success (budget, schedule, value and client satisfaction) and showed that success is dependent on both internal and external variables. This implies that the while the project organisation has influence over some CSFs, other factors are merely environmental and therefore not within their control.

Pinto and Prescott's distinction between planning and tactical CSFs is useful for understanding how individual CSFs shape project success. However, it offers little insights into the complex interactions between groups of factors. Belassi and Tukel (1996) addresses this gap with a framework that classifies CSFs into four groups:

1. Factors related to the project
2. Factors related to the project manager and the team members
3. Factors related to the organization
4. Factors related to the external environment

The factor groups are meant to include all potential CSFs, and the groups, and the interaction between various groups, create what the authors call *System Responses*. The *System Responses* in Belassi and Tukel's framework function as intermediate effects of CSFs. These *System Responses* again contribute to the project outcome, meaning that the CSF groups are viewed as inputs that affect project implementation, and not directly project outcome.

The relationship between CSF groups and *System Responses* is illustrated in Figure 20 (CSF groups in blue boxes, *System Responses* in black). An empirical study of the framework revealed interesting aspects of project management (Belassi and Tukel, 1996, p.147):

> The results of the survey indicate factors related to organizations are most critical for project success. In addition, the analysis suggests that factors related to project managers' performance are not as critical.

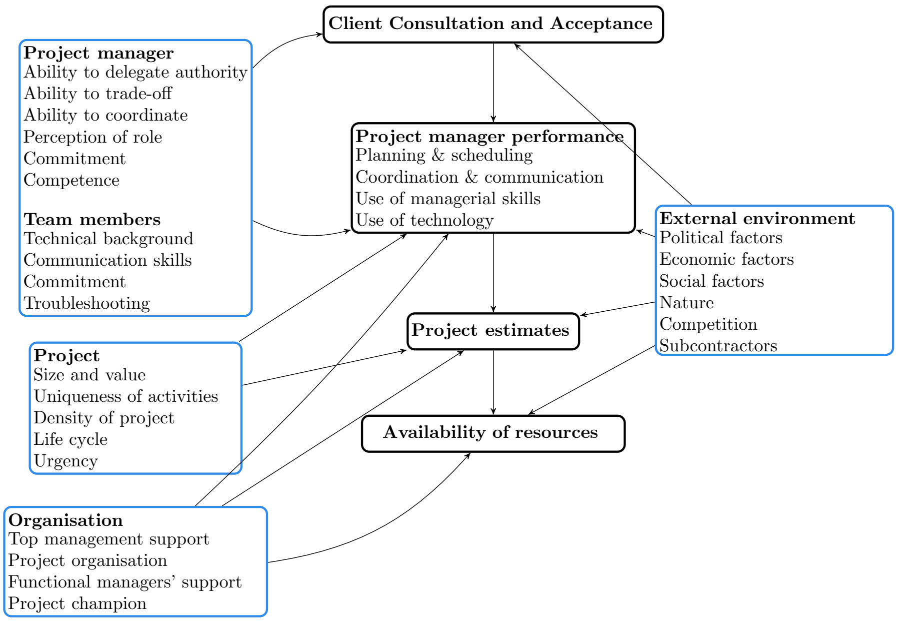


Figure 20: CSF framework developed by Belassi and Tukel (1996)

The results indicate that organisational factors play a larger role than manager's individual performance. This moves the emphasise in project management from the individual manager level to a more strategic and structural level. The strength of the Belassi and Tukel framework is that it makes it possible to study coherent groups of CSFs rather than having to single out individual factors.

5.3.2 *Variations in CSFs over project life cycle*

As Wateridge (1998) points out, criteria can vary over time, and while some criteria can be assessed continuously, others can only only be evaluated at project completion (total cost, delivery delay etc.). A common framework that illustrates variations over time in projects is the project life cycle model (Figure 21). The project life cycle is divided into four stages: *I*) Conceptualisation, *II*) Planning *III*) Execution and *IV*) Termination.

Phase I is the stage in which top management has recognised a strategic need and the organisation examines various way to address

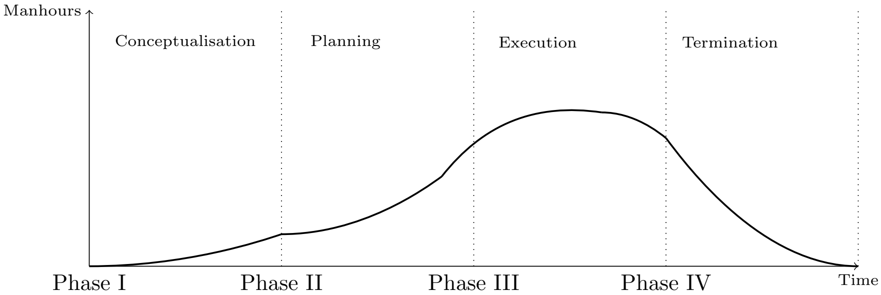


Figure 21: Project life cycle model (Pinto and Prescott, 1988)

it. Initial goals are set and resources needed are evaluated. Phase II is where more concrete plans are developed, and organisational support for resource commitments are sought (manpower, budget, expertise etc.). Execution is Phase III, and is by far the most resources intensive stage during the product life cycle. The actual project activities are carried out, and human, financial and physical resource inputs are transformed into the intended result. Phase IV comes when the project is completed, the product is handed over to the user and organisational resources are reassigned for other purposes.

Pinto and Prescott (1988) set out to test the relative importance of their 10 CSFs (discussed in Section 5.3.1) over the course of these four stages. The findings show that the impact of CSFs does indeed vary with time, but also that different CSFs are important in different phases.

Table 13 shows the most crucial CSFs in each given project phase, given in order of descending importance. *Project Mission* emerges as a CSF during all phases of the project. This calls for full attention to this factor throughout a project's life time.

CSFs over project life cycle

Phase III	**Phase II**	**Phase III**	**Phase IV**
Mission	Mission	Mission	Tech. tasks
Client Consult.	Mngt. Support	Troubleshooting	Mission
	Client Accept.	Schedule	Client Consult.
		Tech. tasks	
		Client Consult.	

Table 13: Pinto and Prescott (1988)

Moreover, *Technical Tasks* are found to be important in both the Execution and Termination phases, while *Troubleshooting* appear to be crucial in the Execution phase. Pinto and Prescott (1988) argue that this is because tactical factors (Section 5.3.1) become more important later on in a project, which seems only reasonable as tactical factors are operational factors. Notably, *Personnel* is the only original CSFs found to have no (relative) significance in any of the stages. Pinto and Prescott argue that this is because projects have become so common in modern project organisations, necessary project training and expertise is taken as a given.

Client Consultation is important in all but the Planning stage, wherein *Client Acceptance* emerges as a CSF instead. This implies that diametrically different approaches to client liaison are needed at different times in order to succeed. In three phases, the organisation needs to listen to the client (*Client Consultation*) , while its approval needs to be obtained in the Planning phase (*Client Acceptance*). It is critical that appropriate strategies are put in place to deal with this shift.

The findings in Pinto and Prescott (1988) have both practical and theoretic implications. First, managers could use it to shift resources between areas as the project enters new phases to maximise the chance of project success. Second, researchers can better isolate the effects of individual CSFs by designing research that takes these relative differences in to account. For the sake of this study, special attention will be put to the factors identified as important to the execution phase.

5.3.2.1 *Implementation errors*

In later works, Pinto and Slevin (1988c) developed a framework for categorising implementations errors. The framework consists of four types of implementation errors (Table 14) and models the implementation of a project as a two-stage process in which (1) a tactical plan is developed before (2) a strategy is executed.

The likelihood of these four errors is illustrated in the strategy/tactic matrix in Table 15. The implementation error framework is especially useful for understanding if implementation errors occur at the tactic or strategic level.

Error Type	
Type I	Action was planned, but was not implemented adequately.
Type II	The action was insufficiently planned, but was still implemented.
Type III	Effectively implementing an action, but the action is not strategic enough to solve its intended problem
Type IV	Taking an action that was adequately planned and which was the right action, but that is not used by the organisation

Table 14: Pinto and Slevin's implementation errors

		Effectiveness of strategy	
		Low	High
Effectiveness of tactics	Low	High chance of failure	Type II and Type III errors
	High	Type I and Type IV errors	High chance of success

Table 15: Strategy/tactics effectiveness matrix (Pinto and Slevin, 1988c)

5.4 OFFSHORING AND PROJECT MANAGEMENT LITERATURE

In Section 4.3, five expectations were developed for the Norwegian–South Korean offshore field development context, based on offshoring literature:

EXPECTATION 1: Cost reduction was a major strategic reason behind offshoring to South Korea.

EXPECTATION 2: Addressing capacity issues was a major strategic reason behind offshoring to South Korea.

EXPECTATION 3: Under industry circumstances with lower capacity utilization ratio for offshore yards, EPC-contracts as a percentage of total contracts will decrease for South Korean yards.

EXPECTATION 4: Challenges related to procurement, engineering and project management capabilities were given less weight in the decision to offshore to South Korea.

EXPECTATION 5: Cultural distance was given less weight in the decision to offshore to South Korea.

By seeing these expectations in relation to the CSF literature discussed earlier in Chapter 5, some interesting observations can be made.

5.4.1 *Project organisation capabilities*

Expectation 4 laid out that shortcomings at the South Korean yards related to procurement, engineering and project management capabilities were given less weight in the offshoring decision. If the yards do indeed lack these capabilities, then a successful project would hinge on the operator company's project organisation ability to address these issues during project execution.

One would therefore expect factors that support the yards in these areas to be important CSFs for the execution phase. This can be further divided into several sub-elements. First, the project organisation needs to understand the yard's specific capabilities and needs. Second, the project organisation itself needs to have the capabilities in question so that it can devise effective solutions. Last, but not least, the project organisation has to be able to effectively communicate its solutions to the yard. All these elements are likely to be important both for individual team members and for the project organisation as a whole.

Moreover, Expectation 1 asserted that reducing costs was a driving force behind the offshoring decisions. In theory, reducing costs should not be possible without also receiving less quality (otherwise, that would be an arbitrage opportunity). One would therefore expect that the project organisation would need to counterbalance this by using more resources on supervision and quality control in order to maintain quality.

If not the alternative would be a project with either less quality, increased final costs, a delayed schedule or a combination of the three. Of course, offshore projects are highly complex projects, so defining overall quality is difficult. Moreover, the market environment allows for certain price fluctuations based on capacity utilisation and other external economics factors, so that there are times were contracting is more opportune than others.

However, if the reported cost reductions from offshoring to South Korea are accurate (40 % by some accounts), it seems more likely that the offers are in fact not of equivalent quality (Førde et al., 2010). It might very well be that overall cost efficiency is achieved with a combination of a capable project organisation and a South Korean yard. However, it is unlikely that the yards are able to meet quality, price and schedule without the support of the operator's project organisation.

5.4.2 *Cultural dimension*

The communication aspect becomes especially important if we consider Expectation 5, which predicted that cultural differences were given less weight in the offshoring decision. The communication between the project organisation and the yard needs to be flexible and targeted enough, that cultural differences does not hinder coordination and cooperation.

This study takes the view that cultural factors are only important to the degree that they influence other factors, e.g. communication or project manager's ability to delegate authority. Cultural differences will therefore be accounted, if necessary, in such factors. This has the advantage that it will pin-point in which situation one needs to pay attention to cultural differences. That in turn makes it easier to devise effective and targeted solutions to potential cultural challenges.

5.4.3 *External Environment*

Expectation 1, 2 and 3 all predict that external economic and competitive factors determine the contract location and contract format. Since the case study is limited to the execution phase, we can expect the influence from external environmental factors to be reflected in other factors. The case study will therefore focus the discussion on more relevant factors that are internal to the project execution.

5.4.4 *Expectations for execution phase*

The discussion above culminates in the following overall expectations for success in the execution phase. Please note that this list is not exhaustive, and only describes an overall direction based on the preliminary expectations. More detailed factors will emerge in the findings (Chapter 7) and be examined in the subsequent discussion (Chapter 8 and 9).

EXPECTATION 6: Project organisations need to support the yards' activities to address capability shortcomings.

EXPECTATION 7: Project organisations need to devote more resources to quality control to meet quality, price and time targets.

EXPECTATION 8: Communication needs to account for its specific context in order to be effective.

Part IV

METHODOLOGY AND RESULTS

6 RESEARCH METHODOLOGY

This chapter outlines the methodology and research steps of this study, including research strategy, data collection, data analysis and research quality. This study follows a research process similar to the research steps described in Yin (2013), but tailored to fit the specific context. The research process is illustrated in Figure 22.

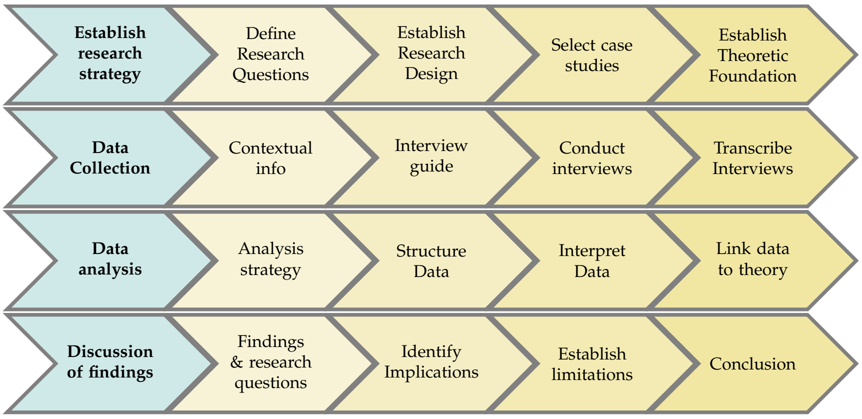


Figure 22: Research Process

6.1 RESEARCH STRATEGY

This study uses an inductive case study approach to understand offshore field development projects on the NCS. The research in this thesis uses the literature review in Holthe (2016) as a basis for developing a theoretic framework. The expanded framework is then used to analyse the data gathered through interviews with personnel from operator companies engaged in the case projects. A comparative multi-case analysis is conducted to increase understanding of general patterns.

6.1.1 *Defining research questions*

The practice of offshoring projects on the NCS to South Korea have been controversial from the start. Influential businesses actors in Norway have claimed it hurts domestic industry, and both local and national politicians have voiced their opposition. High profile projects put to South Korea with large cost and schedule overruns have given offshoring critics plenty of ammunition.

However, operator companies have continued to award contracts to South Korean yards despite the fierce resistance. Their operational project challenges remain unchanged, and so it seems that shifting the focus from the offshoring decisions to project management would yield more fruitful results and practical solutions. This is the background for this study's key Research Question.

However, by better understanding project management in the execution phase, the aim is also to further our understanding of the entire field development process, including decisions to offshore projects. This would enable further analysis of the findings in Holthe (2016).

6.1.2 *Research design: Comparative multiple case study*

A case study can be defined as:

> an empirical inquiry that investigates a contemporary phenomenon within its real life context especially when the boundaries between phenomenon and context cannot be drawn clearly or unambiguously (Yin, 2013, p.23).

This study uses a multiple case study approach, exploring four projects on the NCS with contracts awarded to South Korean yards. Multiple cases are examined in order to achieve broader and more general results. Findings stemming from a multiple case design are regarded as more robust than those from single-case designs, strengthening the overall study and its conclusions (Yin, 2013).

As discussed in Section 5.3, a major challenge for CSF research is the many case specific variables. Case specific variables makes it difficult to draw general conclusions outside of the case context. For this study, operator company, contracted yard, project type, size and complexity are just some of the case specific variables that might influence findings. Employing a multiple case design is a way to address this challenge and broaden applicability of findings.

Critiques often claim that South Korean yards do not have the capabilities necessary to manage advanced projects under the EPC contract format. By employing a comparative case analysis, the aim is to isolate the contract variable and compare three EPC-projects with a recent high profile Fabrication Contract (FC) project.

Searching for similarities and differences in the data is a common strategy to reduce the likelihood of premature conclusions stemming from information-processing biases (Eisenhardt, 1989). A multiple case approach with a comparative element seeks to employ this strategy to its fullest. Furthermore, the study is explanatory in nature as it seeks to understand how to successfully manage the project execution phase.

The main unit of analysis for the key Research Question is the temporary organisations set up to manage the project execution phase. Since these organisations are set up by the operator companies, the unit of analysis will be explored through the lens of key personnel from these companies.

Belassi and Tukel (1996) argue that the literature exhibits ambiguity about project success because different stakeholders define success differently. This study seeks to address this by only looking at project success from the perspective of one stakeholder, namely the operator company.

6.1.3 *Selection of case projects*

The selection of case projects was initially guided by the interest in the recent offshoring increase to South Korea. At the same time, there was a need to limit the investigation to a time period with relative similar external environment (see proceeding discussion in Section 6.1.2). To balance these two aspects, it was decided to only consider contracts awarded between the year 2010 and 2015.

At least 10 large contracts on the NCS were given to South Korean yards in this time period (Table 3). 2015 was chosen as the end of the interval because a contract awarded that year signalled the peak of the EPC-contract era. In 2015, SHI was awarded a topside FC for the high-profile Johan Sverdrup field development.

This study attempts at contrasting the EPC-format with non-EPC projects to identify possible differences and similarities in CSFs. The Johan Sverdrup contract was therefore included to represent the non-EPC segment. At the other end, three EPC projects were included.the Goliat project was the first large EPC-contract to be awarded to a South Korean yard in 2010, and was therefore included in the EPC segment. The two other project included, Valemon and Aasta Hansteen, were chosen due to the availability of interviewees. The final case sample is shown in Table 16.

Case projects

Year	Operator	Field	Type	Contract	Yard
2010	ENI Norge	Goliat	FPSO	EPC	HHI
2011	Statoil	Valemon	Jacket	Topside EPC	SHI
2013	Statoil	Aasta Hansteen	Spar	Topside EPC	HHI
2015	Statoil	Johan Sverdrup	Decks	Topside FC	SHI

Table 16: Case projects

The project names are anonymised in the final presentation of data to ensure source protection, see Section 6.2.2.1

6.1.4 *Theoretic foundation*

The literature in Chapter 4 on offshoring decisions in the planning stage is based on a comprehensive review of 35 journal articles in Holthe (2016). A detailed outline of the review methodology can be found in the original study. This was later expanded into the next stage in the project life cycle, the execution stage, by reviewing key project management literature in Chapter 5. Finally, the two literature streams were integrated in Section 5.4.

The process for obtaining a theoretic foundation for project management in the execution phase is illustrated in Figure 23

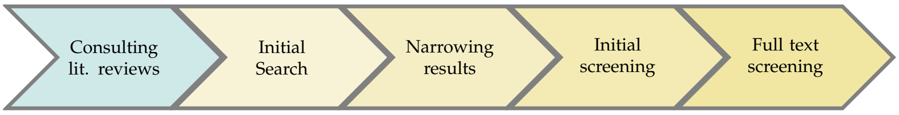


Figure 23: Project management literature review process

A keyword search was chosen as method to obtain relevant literature, and the academic database Scopus was chosen as the preferred source. A keyword search makes it possible to search, filter and structure a broad literature base in an efficient manner. Advanced search operators enables the researcher to sort through multiple research fields and different terminologies in relatively few iterations.

Scopus was chosen for its vast size, broad range and favourable reputation as a reliable database. Scientific staff at NTNU recommended Scopus, and the researcher also had prior knowledge of its many advanced search functions from earlier research work.

Two comprehensive literature reviews were consulted to make sure that the initial keyword search was based on established terminology:

- Söderlund (2002)
- Müller and Jugdev (2012)

Three generic search terms were generated from these reviews: *Project success*, *Project success criteria* and *Project success factor*. Initial searches were performed that looked for articles with these terms in the title or abstract. The searches were fine tuned with relevant filters such as research discipline. Finally, the results were sorted according to number of citations.

The 50 key cited articles for each search term was collected and the titles reviewed. Articles not related to business projects were discarded immediately. The abstract of the remaining articles were then reviewed. To be considered for full text screening, the articles had to contain theoretic or empirical contributions satisfying all the following criteria:

- Represents a significant contribution to the field

- Related to projects with a defined start/end
- Related to an industry context comparable to the case studies
- Related to singular business projects

After a full text screening, other published studies by authors represented in the short list was reviewed to seek potential major contributions in project management research not discovered by the keyword search. Articles that were particularly useful and that satisfied the criteria above were included. The final project execution literature list consists of 14 seminal articles:

- Atkinson (1999)
- Belassi and Tukel (1996)
- Lim and Mohamed (1999)
- Pinto and Prescott (1988)
- Pinto and Prescott (1990)
- Pinto and Slevin (1987)
- Pinto and Slevin (1988a)
- Pinto and Slevin (1988b)
- Pinto and Slevin (1988c)
- Shenhar et al. (2000)
- Shenhar et al. (2001)
- Wateridge (1998)
- Wit (1988)
- White and Fortune (2002)

While the review process described above proved successful in unveiling a broad range of important articles, certain risks are associated with this method. First, utilising literature reviews to generate search terms might eliminate useful literature. The keyword search iterations might also have excluded relevant contributions. This risk is minimised somewhat by utilising two literature reviews and several search terms.

Using citations to filter search results might also render a list that excludes important contributions. However, since this literature search was conducted to explore seminal contributions, sorting on citations strikes a fair balance between a broad search and efficiency. Moreover, looking at the final list of articles, all appear to hail from well-reputed journals with Q1 ratings[1], so that sorting on other variables like journal might have had a limited impact on the final list.

6.2 DATA COLLECTION

In this section, the sample, structure and methods used to collect data for this study will be presented.

1 According to Scimago Journal & Country rank, www.scimagojr.com

6.2.1 *Contextual info*

To better understand the data collected through interviews, certain contextual information has been gathered and structured. The first type of information is that related to the South Korean shipbuilding industry. The second type is related to the case projects themselves. This information is presented in Chapter 2 and Chapter 3, respectively.

Contextual info gives the researcher better grasp of the context which the projects have been conducted in, and therefore the information provided in the interviews. It allows the researcher to prepare more precise questions for the interview guide, seize on key information during the interviews and draw conclusions that have broader applicability.

6.2.2 *Interviews*

The data in this study is largely based on interviews. Yin (2013) acknowledges the importance of interviews in case studies, and points to it as an especially powerful tool to obtain first-hand and in-depth accounts of people's perceived understanding of their experiences. Seidman (2013) highlights interviews as a good window into complex social interactions – a category that business relations would certainly belong to.

Information that is not published or otherwise available can be discovered through interviews, creating a more solid foundation for further analysis. For the above reasons, interviews were chosen as the main method for data collection.

6.2.2.1 *Interview sample*

As Meyer (2001) points out, qualitative research is concerned with in-depth information, whereas quantitative research main focus is on representativeness. Sampling for qualitative research shall therefore be deliberate, not random, and tailored to the research context.

Since the project organisation is chosen as the unit of analysis, it was natural to limit the sample to personnel from the operator companies. As project owners, employees of the operator companies were deemed to have the best overview of the projects, and given the research question, best access to the most holistic and relevant information.

Furthermore, it was decided to only target employees with on-site managerial experience from South Korea. The reason for this was to ensure that the interviewees had sufficient insight into everyday coordination issues and at the same time had knowledge of the projects at a strategic level.

Nine people were contacted directly and a handful through intermediaries. Four people agreed to participate in the study, three declined, and the rest did not reply to repeated inquires.All participants held managerial positions in the project organisations at various levels.

One individual spoke on condition of anonymity in order to discuss project internal matters. It was therefore decided to anonymise all participants, and give them a source number based on a randomised order of the projects. To further increase source protection, all the EPC projects were anonymised in the findings and discussions chapters.

Interviewees

Name	Project
Source 1	EPC 1
Source 2	EPC 2
Source 3	EPC 3
Source 4	Johan Sverdrup

Table 17: Overview of interviewees

The individuals constituting the data sample for the interviews in this study are shown in Table 17.

6.2.2.2 *Interview preparations*

Leading up to the interviews an interview guide was prepared to conduct semi-structured interviews. The semi-structured format is well-suited to explore a predefined set of topics, while allowing the interviewee to speak freely and the interviewer to follow-up on ideas brought up during the conversation (Bryman and Bell, 2011).

According to Edwards and Holland (2013, p.3), qualitative and semi-structured interviews should have the following characteristics:

- An exchange of dialogue
- A thematic approach defined by the researcher, but with a flexible structure
- An understanding of knowledge as contextual, meaning that the researcher is required to actively contribute to the interaction

The interview guide was created to reflect these elements and to adhere to *the Funnel Principle* (Dalen, 2004). *The Funnel Principle* recommends starting interviews with broad questions, slowly narrowing down towards the research focus (Figure 24). The broad questions allows for reflection, while focused inquires seek out more detailed information about important topics. Moreover, it helps the researcher build a conversation around the research questions and to gather relevant contextual information.

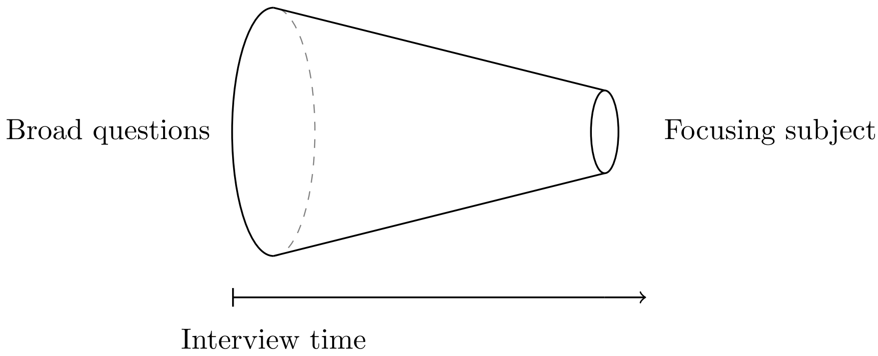


Figure 24: The Funnel Principle

The interview guide was first divided into two parts. The first part was chronologically structured around the execution phase. This was done to allow the interviewees to give their experience of the project, without the researcher inserting own biases into the conversation. The second part was structured on the literature in Chapter 5, and in particular the framework of Belassi and Tukel (1996). This was done to create a logical sequence from which to approach important topics. In addition to the interview guide, an interview introduction was prepared, including presentation of the research and questions regarding the interviewee's professional background and position in the project organisation hierarchy.

Questions were phrased in a broad and open-ended manner, strengthening the validity of the data collected (Dalen, 2004). Questions were also linked with the research question in mind. Each question topic was structured to begin with more factual and contextual information, before posing more specific questions.

A draft of the interview guide was reviewed by the supervisor, a seasoned researcher, and the guide was updated to reflect his comments. The full interview guide can be found in Appendix A.

6.2.2.3 *Conducting interviews*

4 interviews were conducted, one with each participant, spanning 7 hours of raw data. 3 interviews were conducted face-to-face in South Korea. The last interview was conducted from Seoul via Skype due to the interviewee's travelling schedule.

All interviews were conducted in Norwegian and recorded with *Smart Recorder*, a free audio recording software for mobile devices. Audio recordings increases both information accuracy and completeness, while eliminating interviewer mistakes from substandard note taking or selective memory. (Barriball and While, 1994) Informants were informed of the audio recording before starting the interview, and it was made clear that the material would only be used by the researcher and the supervisor, and not shared with others without participants' explicit consent.

Interviews were conducted without interruptions, and only the researcher and the interviewees were present during the interview. Research introduction gave participants an opportunity to get familiar with the research focus, background and the researcher himself.The researcher consciously tried to not interrupt the participants to avoid inserting the researcher's biases into the answers. The interviewees ventured into some digressions, but mostly stayed on topic.

All interviews ended by the researcher asking the participants if there was anything they would like to add. This gave them the opportunity to raise topics or express feelings they might have pondered during the interview (Dalen, 2004). Furthermore, the participants were informed that they would be given an opportunity to proof-read any material used directly from the interviews, and participants all agreed to answer follow-up question via email.

The researcher wore business attire during the interviews to maintain a professional self-representation and minimise potential biases stemming from age differences and socio-economic biases (Barriball and While, 1994). All participants seemed calm and comfortable with the interview setting and answered all questions posed to them by the researcher.

6.3 DATA ANALYSIS

In the following, the process of analysing the collected data is described.

6.3.1 *Analysis strategy*

Interviews were transcribed in full within one week of taking place, leading to 64 pages of raw data. All interviews were conducted and transcribed in Norwegian. As a consequence, the data was translated before it was included in this study. Translation can cause data to be misrepresented, which might have influenced the subsequent analysis. The fact that many of the most common project terms used by the interviewees are in English somewhat mitigates this risk.

It was decided to treat the projects separately when sorting the data to enable easier comparative analysis. This helped with identifying both common and distinct features from the four projects in the sample. The data was then sorted in five categories for each project:

- Project organisation
- Project characteristics
- Yard characteristics
- Project execution
- Communication with yard

This was done to distinguish project execution features from organisational structures and other factors. Moreover, communication with the yard was seen as an especially important element of the project execution and was therefore treated separately.

Since one of the EPC sources requested anonymity to discuss sensitive company matters, all source names were removed and project details were presented as generic as possible. Moreover, the EPC projects were given a randomised name between 1 and 3. Since Johan Sverdrup is easily identifiable in a comparative research design, its name was kept intact, while first receiving confirmation from all sources that this set-up was acceptable.

Overall, this design made it possible for the EPC projects to remain anonymous, while preserving the comparative element of the study. This was deemed a reasonable simplification that balanced the need for source protection and comparative analysis.

6.3.2 *Data interpretation*

It was decided to deal with findings and discussions in separate chapters to allow for a clear differentiation between data and analysis. In line with the comparative research design, data related to EPC projects was analysed before this data was contrasted with the findings from the non-EPC project Johan Sverdrup. This made is possible to identify more general findings from the EPC projects before comparing it with Johan Sverdrup while also allowing for two comparative components.

In the discussion chapter, data was structured along the three activities of an EPC contract: engineering, procurement and construction. While these activities can be overlapping, it was a reasonable division to separate findings from distinct activities. This had the advantage of also making it easier to contrast with Johan Sverdrup in which the yard only had full responsibility for one activity (construction).

The discussion gave rise to interesting questions which were followed up in the reflections section of the final chapter. This allowed for deeper analysis of elements that interesected several areas and made it possible to expand on important points in a structured manner.

6.4 RESEARCH QUALITY

In the following, the quality of the research methodology will be evaluated. The discussion will start with the reliability and validity of the study (Yin, 2013), before moving on to limitations.

6.4.1 *Reliability*

Reliability is the degree to which results can be replicated using the same research steps (Yin, 2013). To increase research reliability this study has closely followed a case study protocol and maintained a case study database documenting all research steps.

The case study database was established at the beginning of the research process, enabling safe and structured storage of research data and related information. The material has been stored electronically using a cloud service provider (Dropbox). Relevant folders and subfolders were created to organise the material and file names followed strict rules to ensure easy access to material whenever needed.

The case study protocol was created to ensure that data was collected in an analytic and organised manner, while a theoretic foundation was established using structured step. Both processes were thoroughly documented, as seen earlier in this chapter. The interview guide was especially important to create a uniform protocol for data collection.

6.4.2 *Construct validity*

Construct validity is the degree to which the data collected is relevant for to answer the research question. Interviews with senior company officials involved in the projects have been supplemented by case information from other sources such as public records. Using multiple data gives the study several measures and angles of the same case, strengthening construct validity.

The data sample in this study includes four contracts put to South Korean yards. The contracts were awarded in four different years to two of the three large South Korean yards. Four different construction types are represented, and while two projects are completed, two are still on-going. 3 of 4 projects were awarded by the operator Statoil, which is close to the proportion of Statoil projects during the time period (60 % of projects between 2010–2015 were awarded by Statoil).

Together these projects represent the time period from 2010 to 2015 fairly well and are deemed appropriate measures to examine CSFs for project execution in South Korea. See also sample limitations in Section 6.4.4.1.

6.4.3 *External validity*

External validity is the degree to which results can be generalised beyond the case study (Yin, 2013). This study tries to mitigate this issue by employing a multiple case study design. As Yin (2013) points out, results from multiple cases have an inherent element of replication, strengthening the external validity and the overall study.

6.4.4 *Limitations*

In this section, some research methodology limitations will be discussed.

6.4.4.1 *Sample limitations*

In a case study design, there is always a risk of making generalisations about the results from a limited sample. In this study, the sample size and sample representativeness are both possible sample limitations.

As for sample size, the number of projects could have been larger. Given the resource and time limits of this thesis, however, a total of four projects still strikes a balance between the need for several data points and the constraints of the study.

More importantly, the number of interviewees could have been larger. Even with the author's professional network in the Norwegian community in South Korea, it proved difficult to get to people to participate due to the sensitivity of the topic. More participants per project would have strengthened the validity of the findings by minimising the effect of biases from individual participants.

All the participants had senior roles in their projects, which somewhat mitigates this sample size issue, since these individuals are thought to have a good overview of the project, making sure that all relevant project aspects come to light.

While the projects represent the chosen time period well, it might be that the time period itself is not representative for Norwegian projects in South Korea, giving rise to sample representativeness limitations. First, the external climate with a booming oil industry might make the period less representative. Second, the initial interest in the period was due to new offshoring practices. However, it is too early to tell if these strategic changes are permanent or if they were limited to the period examined.

6.4.4.2 *Information completeness*

As mentioned elsewhere, the topics discussed in this thesis are sensitive matters for the companies and individuals involved. While the interviewees did speak open and freely about many controversial aspects, there is a risk that information has been withheld. Several important steps have been taken to reduce this risk.

First, anonymous participation significantly reduces the probability that interviewees will be identified and thereby lowers the risks of professional repercussions. Second, allowing all participants to comment on the findings chapter radiates trust that information will not be intentionally misrepresented at their expense.

7 FINDINGS

This chapter presents the findings from the interviews for each project. The descriptions will focus on key elements thought to be important in the context of CSFs, based on the literature reviewed and the research question.´

7.1 EPC 1

This section presents the findings for the EPC 1 project.

7.1.1 *Project organisation*

A South Korean yard was awarded an EPC-contract for EPC 1, while two European engineering firms were contracted to do basic engineering as subcontractors for the yard. Engineering was to start at one of the facilities of the engineering firm, and be completed at the yard in South Korea. In addition, a third European firm was to build and design parts of the project.

The project organisation at the yard initially had a traditional set-up with a separate engineering and construction organisation, lead by an Engineering and Construction Manager, respectively, reporting to a topside Project Manager on site who also functioned as company site-representative. The project reported to a Project Director located in Norway.

The project organisation saw a shake-up during construction phase, replacing the Construction and Engineering Managers. Moreover, the construction organisation was split between the elements being built in Europe and the elements in South Korea. The changes sought to create closer relations with the South Korean yard's construction organisation. Moreover, a function to better integrate the project organisation's own engineering and construction teams was established.

7.1.2 *Project characteristics*

EPC 1 had project and contractual characteristics that increased its uniqueness. The operator also had relatively few people with experience from such projects available in its organisation, which created pressure on its human resources. The details and reasons for this situation are omitted to shield the project identity.

> *[There were] lots and lots of positions to fill and people can only have one position at the time.*
>
> Source 1, EPC 1

7.1.3 *Yard characteristics*

Over the years, the South Korean yard contracted for EPC 1 is described as having shifted its workforce from in-house employees to largely relying on subcontracting. This includes typical subcontractor work like piping and coating, but also quality control. Contact between subcontractors is limited, which leads to coordination issues across disciplines.

> *For instance, the cable guy places cable trays on the wall, because that's what the drawing says. However, on another drawing, it says that the surface first needs to be coated with fire protective coating and then pipes needs to be installed because they are more important.*
>
> Source 1, EPC 1

The deteriorating financial situation at this and other South Korean yards have accelerated the subcontracting trend. Especially the supervisor level is said to have been hurt by this development. The yard was organised in such a way that contact between the different disciplines only happened at a certain managerial level. This further added to the coordination issues caused by the extensive subcontracting.

Moreover, the yard's organising principals stem from serial production of ships in which the same design is used every time. This makes standardisation much easier in the entire organisation. In such a context, you can for instance have ready-made scaffolding which you can use for all your projects. Offshore projects, however, are much more unique and diverse, and the yard's typical organisation model presented challenges for such projects.

> *They are used to organising work as a production line, and much more so than what an offshore project allows.*
>
> Source 1, EPC 1

The individual technical competence at the yard is said to have been very good. However, the limited flexibility in the yard's organisation was seen as blocking full utilisation of this competence.

7.1.4 *Project execution*

The parts built in Europe arrived at the yard in South Korea with large amounts of unfinished work. Project milestones were at this point comissioning, sail-away and production start. However, the project was not going according to plan, and the project organisation had to deal with more immediate issues.

> *When you are in a situation where it is not going according to plan, milestones become a rather meaningless project management tool.*
>
> Source 1, EPC 1

Many of the problems were attributed to an unfinished engineering design that made it difficult to build at full speed. The initial plan was to have engineering for some time at a European engineering firm, and finish it all off at the yard in South Korea. When the construction elements arrived from Europe, all engineering activities were already transferred to the South Korean yard, but the engineering was still not completed.

> *The yard has shortcomings in its engineering. We have strict regulations on for example technical safety that we are almost religious about. The yard understands the framework differently, and when we are unable to explain what we want, we are in big trouble.*
>
> Source 1, EPC 1

Engineering difficulties was at least partially caused by a lack of understanding of the project requirements.

> *The contractor has shortcomings in its understanding of the order. We often use functional requirements that describe how we want things to function. The yard, however, is not involved in oil well drilling or platform operations offshore, so they do not have this knowledge.*
>
> Source 1, EPC 1

There was also a discrepancy between the project organisation's expectations and the yards interpretation of requirements. One possible explanation for this was reportedly that requirements on the NCS have been developed through decades of cooperation with Norwegian yards and engineering houses. That has resulted in an intuitive understanding of requirements on the part of both the operator and its Norwegian partners. However, South Korean yards naturally do not have this knowledge.

Moreover, incentives are inherently different between the operator and the yard, causing the two sides to interpret requirements differently.

> *We always interpret requirements as strict as possible. The yard always chooses to interpret requirements to their advantage.*
>
> Source 1, EPC 1

However, rather than addressing these issues, the project organisation was passive and had a hands-off approach until the project organisation was restructured. Contact and engagement with the yard was limited, and the project organisation's understanding of the yard suffered as a result.

> *The construction team in the project organisation had very little contact with the yard's construction organisation. They actually did not know who was in charge [in the yard organisation]*
>
> Source 1, EPC 1

As an illustration that the project organisation might have miscalculate the engineering challenge, peak engineering (number of people assigned to engineering) in the EPC 1 project was right before sail-away, and not in the beginning of the project, as one would expect.

The project organisation's hands-off approach is said to have been rooted in a fear of interfering with contractor's responsibilities. Norwegian contractors allegedly often use the contract to their advantage when the operator interferes and suggests changes. In South Korea, however, contractors seldom exploit this possibility, but rather prefer the operator to take an active role. The project organisation's fear of getting involved appear to have been at odds with both project needs and the yard's expectations.

The issues that the EPC 1 project experienced seem to have been further complicated by unrealistic scheduling on part of the project organisation.

> *The project plans, that we force upon them by deciding both start and end date, are not always that realistic.*
>
> Source 1, EPC 1

The shake-up in the project organisation during the construction brought in people with experience from projects in South Korea and a different approach to managing projects.

> *At any large and complex EPC project, there will be shortcomings in the contractors competence. Our job [as a project organisation] is to find those shortcomings and address them.*
>
> Source 1, EPC 1

Many technical design issues regarding platform weight and hook-up design are issues that compound over time, and if not addressed properly, lead to complicated rework later on.

> *You need to tackle these issues early on. There is no use in just sitting around waiting [for issues to arise].*
>
> Source 1, EPC 1

Key personnel brought into the project later in the implementation phase not only had experience with South Korean projects, but also had forged personal relations with top management at the yard during earlier projects. The project organisation was increasingly able to bypass levels at the yard when needed, and speak directly to the decision-makers. The project also continued to enjoy enough priority at the yard even though other much larger projects were in construction at the same time.

> *[At EPC 1] we had our own issues and of course we always wanted more resources. However, compared to the challenges that other project faced at the time, we did still got attention [from the yard].*
>
> Source 1, EPC 1

7.1.5 *Top management involvement*

Top management in the operator company was used actively during the EPC 1 project to build relations with the yard. The operator is described as being in a particularly good position because it has over many years cultivated good relations with the yard management, and top executives from both companies have forged strong bonds.

> *We have a special standing at the yard, and a very different one than at other yards. We actually have a front row seat at this yard.*
>
> Source 1, EPC 1

Excellent corporate relations seem to have translated into good priority at the yard for the EPC 1 project.

> *EPC 1 was a relatively small project [for the yard]. Compared to its size, we received great priority.*
>
> Source 1, EPC 1

7.1.6 *Communication with yard*

As discussed in Section 7.1.4, the project organisation initially had difficulties identifying the right communication channels and to establish a good working relation with the yard. Communication happened at the wrong levels, and seem to have been more reactive than proactive. New people were assigned to the project during the latter part of the construction, and immediately started to work on building efficient contact with the yard.

> *We worked at lot with establishing both an effective dialogue and a dialogue at the decision-maker level. I went two levels up in the yard organisation, compared to the previous project organisation. Of course, I had an advantage because I had been there before and knew the right people.*
>
> Source 1, EPC 1

Communication was further complicated because the entire ecosystem was difficult to comprehend for the project organisation. For instance, different parts of the offshore yard seemed to operate almost autonomously, with its own dedicated subcontractors and resources that were not shared with other parts of the yard. This lack of understanding leads to further miscommunication.

> *The yard tells us that when this rig is completed, we will get people from there. We don't, because they are from a different subcontractor. We rarely grasp the extent of this, because of its complexity.*
>
> Source 1, EPC 1

7.2 EPC 2

This section presents the findings for the project EPC 2.

7.2.1 *Project organisation*

The project organisation on-site in South Korea for EPC 2 was headed by a Project Manager reporting directly to a Project Director in Norway. The organisation in South Korea was responsible for all matters related to the contract in South Korea, while separate project organisations in Norway took charge of other elements of the field development.

While the South Korean yard was awarded a comprehensive EPC-contract for the EPC 2 project, the yard was advised during the contractor qualification process to enter into a partnership with a competent engineering firm. The yard later contracted a European firm to do the initial basic engineering for EPC 2.

Both managers from the operator company and the yard were present in Europe to follow the basic engineering, before the project moved to South Korea for follow-on engineering and construction. This is referred to as a rather standard arrangement for EPC-contracts. However, some unexpected developments would force changes to the initial project set-up.

After the contract for EPC 2 was awarded, the yard won another large contract that significantly reduced the available capacity at the yard. During the project, the yard therefore approached the operator and suggested to outsource central parts of the construction to an outside yard. After lengthy discussions, the yard conceded to the operator's demands about which external South Korean yard to use. The chosen yard was favoured because of its proven track yard, even though it was more costly than other alternatives.

> *We of course wanted to build everything at one yard. It meant more costs, another site, another site team, more follow-up work and yet another contractor qualification process.*
>
> Source 2, EPC 2

The operator company therefore stationed a team at the chosen external yard to follow the construction. As the EPC contractor, the yard dealt with all contractual matters with the external yard, after the operator first qualified the new yard. The project organisation continued to relate directly to the original yard as the contractor for EPC 2, as stipulated by the initial contract.

7.2.2 *Project characteristics*

Due to certain project characteristics, EPC 2 experienced increased regulatory scrutiny. To reduce carbon emissions and address general environmental concerns, Norwegian authorities exerted strong pressure for certain technological solutions.

> *It is clear that what we did was followed very closely [by the authorities].*
>
> Source 2, EPC 2

EPC 2 also had other technological features that increased its uniqueness. In order to shield the identify of the project, these features are not described here. However, it is clear that significant technology development went into the project.

> *The overall concept was novel, but it had a proven track-record and similar units were either under construction or in production at that time.*
>
> Source 2, EPC 2

While the EPC 2 certainly included unique technology development, this feature was highlighted as the main cause for later delays. Rather than reflecting project execution challenges, this might have been driven by a deliberate communication strategy.

While there was of course elements of this, I would rather say we had a very challenging contract, perhaps due to a suboptimal contract strategy.

Source 2, EPC 2

In addition to the technical aspects, EPC 2 had a unique combination of several novel ideas. The combination of contractual and organisational innovations increased the overall complexity in the project.

I would certainly say that the organisational arrangement was novel.

Source 2, EPC 2

While time is always important in offshore field developments, EPC 2 was perhaps more urgent than most projects. The definition stage was prolonged, while other major contracts for the field development were awarded according to plan. It can be argued that this shortened the execution stage for the EPC 2, and made a completion on schedule even more important.

In such a situation, the time available for EPC 2 is not only less, but timely delivery of the project is suddenly critical to the entire field development.

Source 2, EPC 2

7.2.3 *Yard characteristics*

The yard that won the contract for EPC 2 is described has having top-notch construction capabilities. In no small part is this attributed to the facilities.

They have great cranes and docks, and their shipyard facilities are probably best in the world.

Source 2, EPC 2

However, in the years leading up to the EPC 2 contract, the South Korean shipyard industry, including the EPC 2 yard, made significant changes to their workforce. These changes did not happen over night, and continued during the years the EPC 2 was being built.

2003–2010 is described as a golden age for the South Korean shipyards with full order books and high profits. During the good times, workers demanded their share of the pie. As a strategy to counter rising wages, the EPC 2 yard and other yards started to shift from a workforce made up of approximately 80 % employees and 20 % subcontractors, to a majority of contract workers, maybe even to a point where the numbers were turned upside-down.

> *The yards have undercut prices and this has reduced their efficiency and challenged quality. The only thing the yard does is to coordinate work, be the face of the contractor and monitor work progress. That means the yard needs great coordination capabilities. However, they are not set up to coordinate and do not have the experience and insight to ensure client expected quality.*
>
> Source 2, EPC 2

During the process towards contract award for EPC 2, there were conflicting opinions in the operator company on the capabilities of the yard and the time, budget and manpower needed to execute the project at the yard. Arguments were made for different approaches and execution strategies.

While the focus of this study is on the implementing phase, these considerations give important context for understanding the project execution. A broader discussion of this aspect will follow in due course.

7.2.4 *Project execution*

The execution stage for EPC 2 started when the contracted engineering firm in Europe commenced its basic engineering work, which is the first part of detailed engineering. This phase was estimated to last for a given period of time, upon which engineering was supposed to relocate and be continued at the yard in South Korea. The milestone was met when the transfer went ahead as planned, but concerns remained that engineering was immature and therefore prematurely transferred to South Korea.

> *We did not have enough time to accomplish much. For everyone involved, the European engineering firm, the yard and us, the time was not sufficient.*
>
> Source 2, EPC 2

The European engineering firm expatriated some of its people to the yard in South Korea to help with the engineering transition for a few months. However, engineering had not progressed as planned, and within the operator company, different views emerged about how to handle this. Some feared that the yard did not have the necessary capabilities to complete the engineering, and that the transfer should be postponed. Others argued that the transfer would resolve many of the underlying issues.

> *We did as the contract said, (..) and that's when challenges with engineering progress increased due to lack of competency, capacity and coordination.*
>
> Source 2, EPC 2

Moreover, the yard had put the engineering for the platform hull to its shipbuilding division. The project organisation feared that the shipbuilding yard lacked offshore specific engineering competence. However, the EPC-contract opened for this alternative, and so it was within the yard's mandate to do so.

> *Since the EPC 2 yard did not have enough capacity to do both hull and topside engineering at the offshore yard, detailed engineering for hulls was put to the shipbuilding yard.*
>
> Source 2, EPC 2

When the yard assumed the engineering responsibility, the project organisation started to wrestle with numerous problems. Complaints were made about insufficient manpower, lack of offshore engineering competence, and poor understanding of NCS requirements. The project organisation tried to add engineering personnel from own organisation to support the yard and recruit understanding of Norwegian requirements.

At its peak, the project organisation is said to have had approximately 3 times as many staffers to follow up engineering, compared to what is standard when building at Norwegian yards. In Norway, the contractor usual takes full charge of the construction, while the EPC 2 project organisation had about 20 people to follow construction. In addition, 70–80 Korean inspectors were employed, compared to only a handful in Norway.

Moreover, since the yard is organised around disciplines (e.g. engineering, construction), not tasks, the yard is perceived to suffer from a silo mentality with weak coordination between disciplines.

> *First of all, this system is very hard to work with as a client. Second, it is not very efficient when building an integrated platform unit.*
>
> Source 2, EPC 2

Since the yard's capacity was strained between the many projects being built at the same time, tasks like piping, outfitting details and other work was outsourced to outside contractors. This is within the EPC-contract format, but it is clear that the operator did not anticipate the extent to which subcontractors were used. In total, about 100 different South Korean subcontractors were involved in the project.

> *As long as they had won the contract, we had to accept it, but it made the project harder to follow-up and lead to rework when critical quality issues were detected. The number of subcontractors involved, which tasks they handled and their [lack of] qualifications went way beyond what we had anticipated.*
>
> Source 2, EPC 2

The extensive use of subcontractors was perceived to amplify challenges at the yard with multidisciplinary coordination. This lead to sub-optimisation where individual disciplines seem to only be concerned with their own productivity, and not overall project efficiency.

> *Those who are responsible for coating will at anytime deliver what is smart from the coating perspective. Then another discipline comes and says, "Great coating, but I need to weld some brackets here." Then coating needs to be removed, they weld brackets and a new layer of coating is applied.*
>
> Source 2, EPC 2

The next scheduled milestone was steel-cut, which marks the beginning of the construction phase. Again, the milestone was technically met, but since engineering was still behind schedule, work did not proceed as planned.

> *We had steel cut on time, but we did not achieve the volumes we had planned. At that point, I think we said we were 2 months behind schedule, but that was a very optimistic estimate.*
>
> Source 2, EPC 2

Not having a matured engineering design when construction starts created issues throughout the construction phase. Design changes on one part of the structure effects the design of other areas, and so requires rework if the construction has started too early.

> *Engineering should be 70–80 % completed when you start construction, the rest is done as the project progresses.*
>
> Source 2, EPC 2

It is hard to estimate exactly how far the engineering had come when construction started, but it seems clear that it had not developed sufficiently. The construction phase is marked by a dilemma for the project organisation. Should they acknowledge the full extent of the delays and change the project schedule? Or should they measure the yard by the initial plan to keep momentum and push them to speed-up construction?

Changing plans means easing some of the immediate urgency of the project, and the project organisation feared this would lead to the yard removing key personnel from the project to prioritise other more pressing projects at the yard. Changing plans would also risk more conflict in the relationship with the yard. Some, however, argued for a total remake of the schedule, including proposals to the bring project to Norway as quickly as possible to finish it at a domestic yard.

However, the project organisation initially tried the softer approach, and encouraged the yard to catch-up to the original plan, even though that was perceived as optimistic. Later on in the project, more pressure was applied to the yard, which seems to have resulted in more reported quality issues and rework in the later stages of the construction phase.

The procurement part of the EPC contract is reported to have been handled in a satisfactory manner. However, the engineering and construction issues discussed above meant the project continued to experience set-backs. When it set sail for Norway, the project was significantly behind schedule.

7.2.5 *Top Management involvement*

Because of certain project characteristics (omitted to shield the project identity), EPC 2 was seen internally as a prestigious and strategic project. The project organisation in South Korea therefore experienced high level of attention from top management, including frequent high level visits.

However, there were disagreements between the site-team and top management about how to approach the yard. Sometimes this lead to contradicting views being communicated to the yard. From the perspective of the site team, this was perceived as counter-productive and contributing to undermining the mandate of the project organisation vis-à-vis the yard.

7.2.6 *Communication with yard*

The EPC 2 project organisation on site had a strategy for communication with the yard, including predefined contact points at the yard for all levels of the organisation, how often communication should be initiated and how communication should be used strategically. The project organisation manager communicated with a designated project manager at the yard, and so on for all levels in the organisation.

However, as the EPC 2 project progressed, there was a realisation in the project organisation that the yard's project manager had a very different role from his counterpart. The yard's project manager was eventually understood to mainly be responsible for budgets and communication with the client, but to not have direct responsibility (or authority) over manpower allocation, production time or efficiency.

For these decisions, the so-called functional managers responsible for engineering, construction, and so on, were seen as the real decision-makers. Early on, the project organisation did not communicate directly with these managers, and it is unclear to what extent they do so later on as well. Rather, a contractual and formalised communication pattern is seen in which the project organisation sees communication with the functional managers as an internal issue for the yard.

> *This was certainly a learning process, and we were not good enough at analysing this aspect. We did not understand who actually had the power at the yard, and who decides where the manpower goes.*
>
> Source 2, EPC 2

The project organisation also relied on the contractual boundaries of the EPC-contract when managing contact with the many subcontractors. There was no direct commercial contact between the project organisation and any of the subcontractors. The project organisation qualified certain subcontractors in order to maintain quality standards, but other types of contact was left to the yard.

7.3 EPC 3

This section presents the findings for the EPC 3 project.

7.3.1 *Project organisation*

The concept for EPC 3 three had several parts, each with a Project Manager on site at the yard, reporting directly to the Project Director. It was early on decided that the Project Director would also be stationed in South Korea to follow the project. The project organisation on site has consisted of around 30–40 % expats and the rest locally hired professionals.

A consortium consisting of a South Korean yard and a European engineering firm was awarded an EPC-contract for parts of the project, with the European firm responsible for the engineering, while the South Korean yard was responsible for the fabrication. In addition, the South Korean yard was awarded a separate EPC-contract for other elements of the field development.

7.3.2 *Project characteristics*

EPC 3 is considered a complex project in terms of its technology. The construction set-up also requires more custom construction support than usual. The details are omitted to shield the identify of the project.

7.3.3 *Yard characteristics*

In the EPC 3 project, a similar situation was found with regards to the use of subcontractors, as described in the findings for the other EPC projects. The situation is also described as being different than a decade ago. The situation with frequent use of subcontractors has been the same at the yard throughout the EPC 3 project. The results of the extensive subcontractor use for the EPC 3 project execution will be presented in Section 7.3.4.

7.3.4 *Project execution*

Early on in the EPC 3 project, the engineering fell behind schedule. This is said to have been because of underestimation of project complexity and project scope. In addition, the coordination between the European engineering firm and the yard on the substructure engineering was described as suboptimal. It was therefore decided to delay the construction start. At this point, the project was estimated to be delayed by approximately one year.

> *In the beginning, we certainly underestimated the complexity of the project.*
>
> Source 3, EPC 3

The construction was affected by the slow progress of the engineering, but has also had it's own issues. The yard allegedly used estimates from shipbuilding projects to calculate the construction phase, and likely underestimated the complexity of the project. This in turn lead to an underestimation of the man-hours needed for construction. Coupled with some productivity loss, this lead to slow construction progress.

Procurement was not an issue during the project. Since the project was delayed, the necessary equipment arrived well in time for the construction phase.

It is pointed out that the capacity at the yard was very different at the beginning of the project. While the yard today has ample capacity, the capacity was earlier strained due to a combination of high order volume and large delays. It is emphasised that while the project organisation can influence priority, it obviously has no power of yard capacity itself.

In the beginning, the EPC 3 project experienced not to be a prioritised project at the yard. Both manpower and dock capacity was allocated to other projects, rather than to the EPC 3 project.

At the same time, the yard has cut staff since the collapse of the oil price, putting pressure on the competence of the remaining workers. The technical skills of the workers is found to vary a lot due to high competition in the local market for competent workers.

Throughout the EPC 3 project, the yard has used subcontractors for many tasks, including coating, piping and scaffolding. The payment structure offered to these subcontractors is described as colliding with the needs of the project.

> *The subcontractors are paid per unit of completed work. This means that they are given few incentives to cooperate and coordinate.*
>
> Source 3, EPC 3

The result of this payment structure is a lack of coordination between the different disciplines, often resulting one discipline interfering in the work of another. This creates mistakes which again makes it necessary to either use more man-hours than estimated, or in many cases, do rework.

> *For example, scaffolding might not be set-up when you are supposed to do your work, making it impossible for you to complete your task.*
>
> Source 3, EPC 3

Moreover, the payment structure also means subcontractor workers have little ownership in the project, therefore less commitment and connection to the project. The project organisation has been forced to counter this by adding more man-hours to follow-up in order to ensure both quality and progress. In this follow-up work, the inspectors have had to do more detailed inspections than what is normally done.

One proposal to address the incentive issue could have been to create a payment structure that is based on delivery, not per unit (e.g. per meter of cable). Despite various suggestions from the project organisation and operator companies at other projects, the yard has been unwilling to change the incentive structure for subcontractors. The yard is currently experiencing tough economic times with subsequent massive layout, and this is thought to be the explanation for the yard's persistent subcontractor policy.

It should be noted that a similar misalignment in incentives can also be found in the yard's own organisation. The yard is set-up like a factory and measured purely on productivity, not on project-level efficiency.

It is estimated that some senior managers in the project organisation spent about 40 % of their time on Health, Safety and Environment (HSE) matters, more than any other task, such as engineering (30 %) and technical queries (30 %). The safety culture at the yard is described as notably different than the safety culture in the operator company.

> *In the beginning, HSE focus was on training and procedures. Over time, however, this has shifted more and more towards policing.*
>
> Source 3, EPC 3

The operator company has tried to disseminate knowledge within the organisation.

> *The best way of transferring knowledge is to have people from similar projects. At the same time, we have established professional networks for knowledge sharing with other companies and systems to spread knowledge within the organisation.*
>
> Source 3, EPC 3

7.3.5 *Top management involvement*

The operator's top management have been closely involved in the EPC 3 project, with key executives making regular visits to the project in South Korea.

> *This has been a deliberate strategy to build relations with the yard's top management, which we in the project organisation then can develop further in our everyday work.*
>
> Source 3, EPC 3

Good contact between the respective companies' top management is said to have been important to get the desired attention and priority at the yard. In the same way, the partners in the project have collectively put pressure on the yard to give the project higher priority.

7.3.6 *Communication with yard*

On site at the yard, the project organisation have deliberately placed their people all over the project, from supervisor level to project managers. This has been necessary to ensure the right information flow in the project.

> *Since the power distance is relatively low in our organisation compared to the yard, issues are brought to our attention before this information reaches yard managers. As such, we can identify problems and raise them at the appropriate level to ultimately resolve issues.*
>
> Source 3, EPC 3

The functional managers at the yard are described as important decision-makers, and therefore crucial counterparts to cultivate relationships with. The project organisation has also chosen to establish contact with a few selected subcontractors. The connection has been established with the yard's knowledge, and has been done to further relationship building and coordination with the subcontractors.

7.4 johan sverdrup

This section presents the findings for the Johan Sverdrup project.

Johan Sverdrup project

Year	Operator	Field	Value	Contract	Yard
2015–	Statoil	Johan Sverdrup	7.0 bn NOK	FC	SHI

Table 18: Johan Sverdrup summary

7.4.1 *Project organisation*

The FC-contract to SHI includes two platforms, the riser and the process platform, and is lead by a Project Director on site at Geoje island, South Korea, where the yard is located. The Project Director has a separate engineering and construction organisation to follow the contract. The engineering organisation on site deals with so-called site queries, meaning technical queries from the yard. The site-team solves some of these issues themselves, but also forwards queries to the engineering contractor in Norway.

The construction organisation is split in two between the riser and the process platform because the schedules and deliveries are different, but also because it mirrors the yard organisation. The engineering organisation and the two construction organisations are each lead by a Project Manager.

The project organisation is staffed with both local and expat workers. For example, one of the construction organisations consists of 50 people, roughly divided in half between local and expat personnel. Local workers predominantly carry out inspection tasks on the yard, while expat workers typically make up discipline managers and supervisors.

This division of labour is explained by different skill sets. Local workers have the necessary language skills to engage yard workers on site, while expat workers have more knowledge about project status, company standards and NCS requirements.

Johan Sverdrup is a Statoil project and as such also has the support of the Statoil South Korea Country Office. The office was set up in 2014 because of the large contract volume being awarded to South Korean yards. The Johan Sverdrup project organisation does not report to the country office, but the office liaises with both Norwegian and South Korean government agencies, and provides assistance to the projects in connection with external or internal high level visits in addition to some administrative support.

7.4.2 *Project characteristics*

A four platform concept was chosen for the Johan Sverdrup field development; a living quarter, drilling, riser and process platform respectively. The living quarter is being designed and built by Aker Solutions, while Aibel has won a similar contract for the drilling platform. Last, the riser and process platforms are designed by Aker Solutions and currently being built by SHI.

An important part of the project organisation's work is to harmonise the design of the four platform units. All commonalities should be designed the same, so that they are interoperable.

> *If you use a particular type of light bulb on one platform, you should use the exact same light bulb for all the other platforms. This of course means that the project requires some unique interface coordination.*
>
> Source 4, Johan Sverdrup

The fact that the Johan Sverdrup field development consists of four platforms does not significantly increase the urgency of the project (requiring simultaneous completion). Rather, time is important for the Johan Sverdrup development because the present value of the field as a share of future Statoil revenues is huge – around 25 % of total Norwegian petroleum production, by some estimates (Statoil, 2016a).

When designing the Johan Sverdrup platforms, lifespan is an important parameter. The platforms are designed to operate for 50 years, compared to a typical platform life cycle of 25–30 years. As such, it increases the project's uniqueness.

> *[platform lifespan] dictates many decisions, and the quality requirements are subsequently set higher. It influences material selection, and many other decisions. It creates a more complex project with more stringent quality requirements.*
>
> Source 4, Johan Sverdrup

7.4.3 *Yard Characteristics*

Extensive use of subcontractors, as describe in the previous projects, also seem to have been the situation at SHI during the Johan Sverdrup project so far. The many subcontractors reportedly cause two types of problems: coordination issues and issues complying with Statoil's own technical regulations.

> *[The use of subcontractors] is often problematic. Problematic, but definitely manageable. It requires strong people in our organisation that are able to talk with subcontractor supervisors and take part in coordination.*

Source 4, Johan Sverdrup

As with other projects, coordination issues are often rooted in the subcontractors payment structure (per unit) and often creates conflict between different subcontractors. For example, if two subcontractors are working in the same area, discussions over who should have priority can become heated. The project organisation in Johan Sverdrup have tried to mitigate this by taking an active approach and to forge better contact between the subcontractors.

> *We often call multidisciplinary meetings without having anything to communicate. Meetings held in Korean, only so that subcontractors can meet, because they might not meet otherwise.*
>
> Source 4, Johan Sverdrup

As for compliance with Statoil's regulations, this is a somewhat broader issue stemming from a mismatch between worker competence in Norway and South Korea. Statoil, for instance, have competence requirements for workers that handle pipe insulation. In Norway, workers usually have competence in the entire pipe insulation process and certificates to verify their skills.

In South Korea, however, a subcontractor might be hired without prior experience in pipe insulation. Unskilled workers will perform the more simple tasks, while skilled workers will do the more tricky procedures.

A paradoxical result is that many subcontractor workers that have participated in complex projects like Johan Sverdrup gain skill-sets that make them increasingly valuable in the job market. These project therefore often see a high turnover of workers who move on to more lucrative jobs elsewhere. This again makes it even harder to find workers with the right competence.

> *Many workers on these type of [offshore] projects, have later found much more attractive jobs, e.g. in the nuclear sector.*
>
> Source 4, Johan Sverdrup

Furthermore, similar organisational incentives as have been described in previous project, seem to also have been present at SHI during the Johan Sverdrup. Incentives are structured around productivity, and loss of productivity is an indicator that many managers are measured on. The entire SHI organisation is therefore structured around serial production, not projects. The much discussed subcontracting policy is essential to this as most workers are said to not only be subcontractors, but employed on a daily basis.

> *Some people say that Koreans do not work when it rains. But there is a specific reason for that: it reduces productivity. If it's*

> *raining on Friday, but the forecast says sun on Sunday, they may say to their workers "No, you cannot work today, but come back on Sunday, and we will give you work."*
>
> Source 4, Johan Sverdrup

While there are similarities between the three big South Korean yard, there are also notable differences in their culture and organisation. At SHI, the project management team is said to be larger and more influential than at for example DSME.

> *At SHI the project mangement team has a slightly better standing than at DSME.*
>
> Source 4, Johan Sverdrup

7.4.4 *Project execution*

The first thing that happens in an FC-setting is that the yard mobilises its people to the engineering contract. The yard gives input to engineering on constructability, and ensures that requirement exclusive to the SHI yard is taken into account.

> *It is important to remember that the construction method at a typical South Korean yard is different than at practically all other yards in the world. This dictates the sequence of deliveries from engineering.*
>
> Source 4, Johan Sverdrup

In an FC-contract, the operator company is said to own the interface between the yard and the engineering and procurement contracts. That means that the project organisation have had to actively facilitate all contact between the different contractors. Different elements in the construction phase have different schedules, which again dictates when you need equipment like valves, pumps etc.

> *When SHI is missing a drawing or a valve, they come to us. All of of these things are referred to as Company Provided Item (CPI).*
>
> Source 4, Johan Sverdrup

A challenge for the project organisation has been to coordinate between the needs of the engineering and the construction contract. While the engineering contractor would like to stick to their original design, the yard will always try to get the design to be as easy to build as possible. In the end, it's up to the project organisation to strike a balance between the different needs and stakeholders.

So far, the Johan Sverdrup project at SHI has shown good results. Engineering is 90 % completed. The only engineering part remaining, electrical instruments, will be done during the installation. Steel cut was in June, ahead of schedule, and the project is now in block fabrication phase.

> *In terms of schedule, the project has progressed really, really well. Deliveries to the yard are going according to plan, and we are well in line with their needs for design completion.*
>
> Source 4, Johan Sverdrup

Coating will commence in early December, while the erection phase will begin in late January 2017. The riser platform is said to have a more ambitious schedule than the process platform. The riser platform is scheduled to be completed in February 2018, and the process platform 10 months later.

Building two platforms at the same yard at the same time have given two important advantages: personnel and procurement synergies. Personnel synergies happen both at the project organisation and at SHI. Moreover, procurement synergies entails better prices for bulk materials, but also increased flexibility as parts often can be exchanged between the platforms if necessary.

The project execution for the Johan Sverdrup project at SHI have achieved the necessary attention and priority from the yard.

> *[Priority] has been a success factor so far in this project. We feel that we are a priority project.*
>
> Source 4, Johan Sverdrup

Priority is described to be a function of the number of competing project and the project organisation's efforts. For Johan Sverdrup, the competitive environment has been favorable and the project organisation has actively engaged with the yard to move the project forward. In general, two factors are seen as crucial for the project team's efforts to result in yard priority.

First, the engineering design must have reached a certain maturity. The design does not need to be completed, but it needs have be developed sufficiently. Second, a strong project organisation on site focused on deliveries is needed. The site-team is advised to support technical decisions, interpretations of NCS requirements, and generally push and steer the project in the right direction. Johan Sverdrup have succeeded with both of these factors so far.

> *It can be very simple things, like establishing contact with the right people and convince them that the design have matured, [and tell them] "start construction".*
>
> Source 4, Johan Sverdrup

In addition to a mature design and a capable site-team, economic incentives can play a role. Examples of incentives that can potentially have a large effect is to offer to pay for an extra night-shift when you something urgent at hand.

> *You do not need to spend billions [of NOK], it can be rather small sums, if used properly.*
>
> Source 4, Johan Sverdrup

If a capable site-team is necessary to achieve priority at the yard, then what makes a strong site-team? First, a decisive Project Director and management team with a strong mandate is said be crucial. Site-team managers need to face issues that arise with a problem-solving approach, and swiftly convert solutions into decisions.

> *Some are very hands-off and just point to the contract "it should be like, it should be like that." You need to have an approach that enables you to contribute.*
>
> Source 4, Johan Sverdrup

Further down in the project organisation, a strong site-team requires workers with good technical competence. Norwegian offshore installations are perhaps the most complex constructions being built at South Korean yards. South Korean yards are specialised in shipbuilding, and does not have the competence to solve all the issues that arise, especially with regards to NCS specific requirements and regulations.

> *You need to have a team in place with the technical competence to solve technical queries, and a project management that can follow and back-up decisions.*
>
> Source 4, Johan Sverdrup

At the Johan Sverdrup, the communication within the construction site-team at SHI is described as well-functioning so far with a multidisciplinary structure and typical, Scandinavian low power distance. The Project Director have had an important role in bringing issues from various parts of the project organisation to the attention of the yard.

> *Project Director on site is not a permanent member of weekly meetings with SHI, but more a level to which the rest of the organisation can raise issues. That is the Project Director's role, and it has proven to very effective.*
>
> Source 4, Johan Sverdrup

As touched upon in Section 7.4.2, the FC-contract format means that the operator company is responsible for coordination between the engineering, construction and procurement contracts. This gives less mandate to the site-teams in each sub-project to develop specific solutions, because the three contracts need to be coordinated.

As such, the site-team at SHI following the construction have had to coordinate closely with separate engineering and procurement teams, both based in Europe. This communication has been more challenging than the internal communication in the construction organisation.

> *Usually it's the same team that does the entire process. Now we have completely different reporting procedures, large time differences. This communication have been more challenging, but far from an obstacle.*
>
> Source 4, Johan Sverdrup

7.4.5 *Top management involvement*

Johan Sverdrup is a strategic and financially important project for the operator company Statoil. The Johan Sverdrup Project Director therefore reports directly to the top management and Executive Vice President of Technology, Projects & Drilling, Ms Margareth Øvrum.

However, the project organisation at the yard has not experienced more high-level visits than usual. For the site team, top management involvement can also be a source of distraction if not employed correctly.

> *The more stakeholders involved in a project, the harder it becomes to make decisions. It can be a simple decision for the site team, that is complicated by stakeholders who either have a mandate or believe they should have a mandate. More stakeholders can increase the complexity of the project.*
>
> Source 4, Johan Sverdrup

7.4.6 *Communication with yard*

SHI has a project management team designated as the counterpart for the Johan Sverdrup project organisation. As in other projects, this department is considered more a coordination-body than a decision-centre. However, the project organisation can influence how the yard experiences the customer. By being a positive force, better relations are achieved with the actual decision makers.

> *If we only show them the contract and say "You are supposed to deliver this", then they will shield their own organisation*

> *from us as much as possible. However, if we offer constructive solutions, and help them, we get a completely different access.*
>
> Source 4, Johan Sverdrup

Statoil has a long history of working with SHI, and today the company enjoys a special relationship with the yard. Key personnel in both organisations have had good contact for years, and even though SHI are undergoing changes at the moment, the relationship between the two companies has been very good so far during the Johan Sverdrup project.

For the Johan Sverdrup project organisation, it has been easy to identify the right decision-makers. Good relations with the yard has contribute to this, but having people in the organisation with experience from both SHI and other projects South Korea have been very positive.

> *It is essential to have people with South Korea experience in the organisation. Even though you are told that your counterpart, the project manager at Samsung, he is not a project manager, it is hard to take this information and understand what it implies and what to do about it.*
>
> Source 4, Johan Sverdrup

The SHI organisation is described as functioning very different from a Norwegian yard. Part of this is explained by a difference in the internal competitive environment at the yard. At a Norwegian yard, there are few, if any, competing projects. At a South Korean yard, however, an offshore project is small compared to many orders placed by large shipping companies. Yard managers does therefore not follow the entire project through, but are shifted between projects depending on where they are needed the most.

> *Just like there is just-in-time logistics, the yard has just-in-time mobilisation. Those who will end-up being decision-makers in a specific area or discipline might even not be mobilised yet. So when you start a project, it is important to remember that those who will end-up being decision-makers are not even mobilised yet.*
>
> Source 4, Johan Sverdrup

Communication with the yard also goes through different phases as the construction progresses. When the several hundred building blocks that make up the platform are being built, they are constructed in many smaller production halls. One particular part of the SHI organisation owns this phase, while a completely different organisations owns the assembly process.

> *I spend a lot of time in the production halls now. This is not an official communication channel, and the people there are not found on an organisational chart.*
>
> Source 4, Johan Sverdrup

The Johan Sverdrup project organisation have had to shift its communication focus depending on the phase, but also direct the attention towards the real decision makers.

> *The yard has an official Project Management Team, who are our designated counterparts. But we also need to be involved in other parts of the organisation.*
>
> Source 4, Johan Sverdrup

Part V

DISCUSSION AND CONCLUSIONS

8 DISCUSSION

This chapter will discuss the findings in light of the literature reviewed in earlier chapters. First, challenges found in the three EPC projects and the project organisations' responses to these challenges will be compared. Second, the EPC results will be contrasted with the findings from the FC project Johan Sverdrup.

8.1 COMPARING EPC-PROJECTS

In this section, overall challenges encountered in the three EPC projects and the project organisations responses' will be compared. The discussion is structured along the three major activities of an EPC-contract; engineering, construction and procurement.

Challenges will be scored on a four point scale, e.g. highly insufficient, insufficient, sufficient and highly sufficient. Moreover, Pinto and Slevin (1988c)'s framework for project implementation errors will be used to categorise suboptimal responses from the project organisations.

8.1.1 *Engineering progress: a real head-ache for the EPC-projects*

All EPC projects in this study had major challenges with the engineering phase. Engineering issues had a large impact on overall project success by causing delayed engineering designs, construction delays and often rework because the design changed after construction started. In the following, we will explore what caused these challenges and how the project organisations responded to them.

> *I would say that delayed engineering with substandard quality was the most important cause of overall project delays.*
>
> Source 2, EPC 2

8.1.1.1 *Engineering competence*

Challenge	EPC 1	EPC 2	EPC 3
Yard engineering competence	Insufficient	Highly insufficient	Insufficient

Table 19: Yard engineering competence

Yard engineering competence in the three projects can be seen in Table 19. All sources refer to a lack of engineering competence as a major concern. Access to engineering competence is largely determined by yard capacity. This is especially evident in EPC 2, where low capacity forced the yard to move hull engineering to its shipyard division. The engineering competence available for the project was significantly reduced by this development, leading to an even lower score than the two other projects.

The EPC 2 contract clearly should have included provisions that put restrictions on engineering activities. However, it is not certain that would have improved access to competence. The yard had real capacity issues and the project had few alternatives as it is not viable to switch contractor during the implementation phase. However, the yard would have to treat a contractual obligation seriously. If the contract had been structured differently, the yard would have been much more inclined to prioritize EPC 2 over similar projects.

Using Belassi and Tukel (1996)'s terminology, the contract structure can be described as an internal *Project* factor that interacts with yard capacity, an *External environment* factor. Together, these two factors influence a project's *Availability to resources*, in this case, access to engineering competence. Both yard capacity and contract structure had a negative impact on the availability of engineering competence for all projects. We also see that capacity is a much stronger factor than contracts. Both these results are especially evident for EPC 2.

> *We need to identify their knowledge gaps, and we need to fill them.*
>
> Source 1, EPC 1

Contract structure and yard capacity are largely outside the project organisations realm. Then, which tools can the project organisations use to increase access to engineering competence? Generally speaking, the project can address the competence challenge by (1) identifying competence issues and (2) addressing them. Difficulties with identifying knowledge gaps can be seen as a tactical error (**Type III** error), caused by limited understanding of the yard's competence shortcomings. Failing to fill gaps that are identified would be a **Type I** error, and largely reliant on the quality of the cooperation with the yard.

If we look at EPC 1, we observe a much more tactical approach after the project shake-up. The project organisation seems to realise that it needs engineering clarifications as early as possible. By making daily interaction and relationship building a priority in the organisation, a more cooperative dialogue with the yard develops. This enables trust-building and information sharing with the yard, which in turn makes it easier to both detect and address engineering competence problems.

Findings from EPC 1 further suggest that improved operational relations with the yard helped ease engineering competence problems. This is in line with Dahlgren and Söderlund (2001) that argued that contracts have limited impact on inter-firm projects, and that relationship building is much more effective. EPC 1 increasingly employed an approach that was based on relationship building, not contractual boundaries, lowering the likelihood of both tactical (**Type III**) and strategic errors (**Type I**).

A similar strategy can be seen in EPC 3 which actively used its own workers as listening posts to increase understanding of the yard's issues. In EPC 2, however, these kinds of efforts are rarely seen because the project organisation has a contractual understanding of its role. This limits the necessary interaction with the yard that could have helped solve problems related to engineering competence.

Generally speaking, engineering competence can be seen as one component of the *Technical tasks* that Pinto and Prescott (1988) found were crucial for the execution phase. In inter-firms project like these, the competence of the project organisation and yard are two separate entities. Findings suggest that better coordination increases this *Technical tasks* performance. As such, inter-firm coordination can be seen as the bridge that allows competence at the yard and in the project organisation to be fully utilised.

8.1.1.2 *Requirement knowledge*

Challenge	EPC 1	EPC 2	EPC 3
Yard requirement knowledge	Insufficient	Highly insufficient	Insufficient

Table 20: Yard requirement knowledge

All the EPC projects experienced issues related to yards' understanding and interpretation of company and NCS requirements, as shown in Table 20. Substandard requirement knowledge makes engineering more difficult, and thereby requires more time and resources.

Requirement knowledge can be seen as a construct with two subcategories. First, you have to understand the requirements. This is based on the competence of the yard and its workers. As with other engineering activities, this is a *Technical task*. Second, you have to interpret the requirements. This interpretation is subject to the yard's incentive structure, what Atkinson (1999) calls stakeholder beliefs.

The yards clearly lacked experience with offshore requirements, which lead to low performance on understanding the requirements. The yard also have fundamentally different incentives than the operator, and therefore largely divergent stakeholder beliefs. The yards have strong incentives to choose design solutions that are easy to build, even though the design might violate requirements. The yards therefore often interpret the requirements in a way that is not acceptable to the operator.

While understanding requirements can be improved through training and technical support, interpretation does not necessary improve with more knowledge. Since NCS requirements often are functional requirements with plenty of room for interpretation, individual stakeholder beliefs are ever the more likely to have a strong effect on the final judgment.

While all the yards underperformed on both understanding and interpreting requirements, the project organisations in early EPC 1 and 2 both responded sub-optimally. Since it is difficult for the project organisations to change the yards' incentive structures and improve interpretation, the focus should be on improving requirement understanding. Unfortunately, requirement compliance in these projects was mainly a supervision activity, rather than a proactive and collective effort with the yard. This approach is not very helpful when the problems are caused by a lack of requirement understanding, because the information is offered to the yard after mistakes have been made.

For EPC 1, this was rooted in a project organisation reluctant and unwilling to interfere with the contractor's responsibilities in the EPC setting. Similarly, EPC 2 had a very contractual approach, and it is likely that this was rooted in the same understanding of roles and responsibilities as in EPC 1. This can be seen as a failure to *Troubleshoot* the problems at the yard, a critical factor in the execution phase according to Pinto and Prescott (1988). In the case of EPC 1, this might have been amplified by a lack of requirement knowledge within the project organisation itself.

> *What is interesting is that if you go to our own engineers, and ask them to explain the requirements [...]. You will get a lot of different answers.*
>
> Source 1, EPC 1

If the project organisation is not able to explain requirements in a clear and consistent manner, then it is not surprising that the yard continued to have difficulties with understanding the requirements. EPC 1 initially seems to have been particularly unable to explain requirements, with both low tactical and strategic effectiveness, while EPC 2 mainly lacked the right tactical focus (**Type II** error). Both organisations are held back by a contractual approach to the yard's requirement performance.

After the EPC 1 project shake-up, consorted efforts were made to better explain offshore and company specific requirements to the yard. This seems to have had a clear positive effect.

For EPC 2, requirement issues are amplified by large coordination issues. On one hand, there are engineering coordination problems within the yard because it is organised around disciplines, not tasks,making multidisciplinary coordination difficult. On large offshore projects, many engineering tasks require such multidisciplinary cooperation, and so this is a daily headache for the project. When engineering is split between the two engineering divisions at the yard, organisational boundaries create new barriers, and engineering coordination suffers further.

On the other hand, the EPC 2 project organisation does not seem to handle engineering coordination with the yard very well. The project organisation clearly took a contractual approach and most of its communication channels with the yard consisted of predefined contact points. This is equivalent to the approach to taken by the project organisation in EPC 1 prior to the project shake-up.

By only engaging the yard when issues are found, the project organisation displays a lack cooperative behaviour. As a result, the yard is less likely to feel that the project is a collective effort, and it will probably share less information about engineering challenges at an early stage. This creates a vicious cycle in which the project seems unable to address engineering issues as early as possible. In the end, this makes it even harder to ensure both quality and progress.

8.1.1.3 *Engineering delays*

Challenge	EPC 1	EPC 2	EPC 3
Engineering delays	High	Very high	High

Table 21: Engineering delays

All the EPC projects experienced engineering delays early on in the project, especially EPC 2 and 3. Delays are the results of the challenges discussed above, but also presents a challenge in itself for the project organisation.

The three project organisations responded quite differently to the engineering delays. While EPC 3 decided to postpone construction start, EPC 1 and 2 tried to stick to the initial project schedule. This was especially evident when the EPC 2 engineering was transferred on time from Europe to South Korea, even though everyone involved knew progress had not been sufficient.

It is understandable that the project organisations in EPC 1 and 2 felt pressured to reach milestones and rather try to catch up later in the project. Time was especially critical for the EPC 2 project, which may have been an important factor in why the schedule was not changed earlier. In hindsight, however, the projects would have benefited from adjusting to a more realistic schedule until the necessary engineering issues were resolved.

The reluctance to adjust the schedules points to operationally managed projects in which predefined plans for time, cost and quality are the guiding management tools (Shenhar et al., 2000). Time is inherently the most immediate (and thereby operational) success criteria because delays are obvious as they happen. The full picture for quality and costs, however, only appear later in the project, and sometimes maybe even after the project is delivered. Moreover, it can be argued that offshore projects have higher degrees of technological uncertainty and typically bring more strategic benefits than ordinary projects.

By focusing on operational project criteria like time, the risk is that overall strategic goals and benefits suffer. That is exactly what seems to have happened in both EPC 1 and 2. Taking an early hit on the time criteria would have given both EPC 1 and 2 better opportunities to deliver projects with more overall benefits across the three success criteria. Rather, things were rushed, and all three success criteria suffered: first quality suffers, which then requires significant rework, in the end causing both further delays and cost increase.

Pinto and Prescott (1988) found that *Project mission*, meaning clarity of goals and general direction, was an important CSF during all project phases, including project execution. When EPC 2 experienced difficulties, top management in the operator company indirectly decided that on-time delivery was more important than other success criteria. The project organisation, however, argued that quality and costs would suffer if the original schedule was pursued. The result suggests that the project organisation analysis was accurate on this point.

The project suffered because there was no clear guidance from top management on how to make the necessary trade-offs between the competing success criteria. In doing so, the project organisation committed a **Type II** error, implementing an action without sufficiently planning for its consequences. Such a tactic turned out not to be effective, and because there is a limit to how much you can compromise on quality on an offshore installation, the strategy becomes increasingly ineffective as it becomes clear that the quality is deteriorating. In the end, quality decreased to a level that also meant that the ambitious time schedule could not be met.

By contrast, EPC 3 changed the schedule early on, giving more time for engineering. Top management in the operator company made an explicit tactical decision to trade a delayed project with increased costs for better engineering quality. This is a situation with high tactical efficiency that addresses the problem at hand (challenging engineering), thereby increasing the likelihood for effective strategy implementation.

Delaying the engineering transfer in EPC 2 is a clear illustration of how a more realistic time schedule would have benefited engineering quality and costs, and in turn the project schedule. Postponing the transfer would have given the project access to engineering competence and capacity at the European engineering firm – both in short supply at the South Korean yard at the time.

For both EPC 1 and 2, extending the engineering phase is likely to have reduced engineering challenges stemming from competence issues. As we will see in Section 8.1.2, good quality engineering is crucial for construction progress, so allowing enough time and resources for the engineering phase would also have a positive impact on the construction phase.

8.1.1.4 *Engineering summary: large potential for better implementation*

Challenge	EPC 1	EPC 2	EPC 3
Yard engineering competence	Insufficient	Highly insufficient	Insufficient
Yard requirement knowledge	Insufficient	Highly insufficient	Insufficient
Engineering delays	High	Very high	High

Table 22: Overview of engineering challenges

The challenges encountered during the engineering phase are summarised in Table 22. We see that all projects faced engineering challenges and delays. Since all experienced delays, it can be concluded that none of the projects had the right combination of plans, tactics, implementation strategies or resource contingencies to overcome these challenges.

However, findings show that EPC 1 and EPC 3 fared better than EPC 2. Project organisations that offer solutions proactively (EP3 and EPC 1 after shake-up) rather than emphasising contractual obligations (EPC 2 and early phase EPC 1) seem to achieve better engineering progress. This seems to be because challenges related to requirement knowledge and engineering competence are improved under such conditions.

Projects that adjust schedules, manpower and deadlines as soon as problems arise (EPC 3) seem to have a greater chance of moving beyond the issues. When a project does not make such adjustments, engineering issues become persistent problems throughout the project (EPC 1 and EPC 2).

8.1.2 *Construction progress: different organisations struggle to align*

For the three EPC projects, the single most important factor for construction to proceed as planned is clearly engineering progress. Since all the EPC projects in this study experienced difficulties with the engineering, it should come as no surprise that the construction phase also faced difficulties. All projects started construction at lower volumes than scheduled and also experienced more rework directly because of slow engineering progress. In addition to engineering progress, several other factors are important for construction progress. These factors will be discussed below.

8.1.2.1 *Priority*

Challenge	EPC 1	EPC 2	EPC 3
Priority	Sufficient	Highly insufficient	Insufficient, but mixed

Table 23: Construction priority

Priority at the yard is cited by all the three projects as important for construction progress and Table 23 shows the priority achieved by each project. Priority means the degree by which the project has the yard's strategic and operational attention and thereby access to its manpower and facilities, or *Availability of resources* in Belassi and Tukel (1996)'s terminology. Priority can be seen as the importance attached to the project by the yard, either financially, strategically, or otherwise.

Yard capacity is by far the most crucial factor influencing priority for the EPC projects in this study. In EPC 3, for example, priority improved only when yard capacity eased. Similarly, EPC 2 lost priority when the yard signed new (and more prioritised) contracts. For EPC 2, capacity was so scarce that central parts of the construction was put to an outside yard. This clearly had a negative effect on overall construction progress. Since yard capacity is an *External environment* factor outside the influence of the project organisations, how should the projects behave to get the best possible priority?

For EPC 1, priority is said to have been good throughout the project. Since the contract was only valued a few percentage points of the yard's total revenues, priority cannot have come from financial importance. Instead, excellent corporate relations between the operator and the yard seem to have been the major reason. All projects used top management to build corporate relations with the yards, but only EPC 1 enjoyed long-term relations with the yard that translated into priority.

Projects cannot influence its history with the yard, but project organisations can still improve corporate relations. EPC 2 and 3 both struggled with priority, but EPC 3 was able to use improved corporate relations to secure priority. EPC 3 did so by mobilising not only top management, but also the partner companies in the field development in a coordinated effort to increase pressure on the yard. This was important in eventually securing priority. EPC 2, on the other hand, did not achieve priority, even with top management involvement. Why is that?

An important reason seem to be that top management involvement was less coordinated. Returning to Shenhar et al. (2000) terminology, top management in the EPC 2 operator company appear fixated on operational goals and kept comparing progress to the initial schedule. The project organisation, however, emphasised strategic goals, and was therefore more willing to revise plans. Divergent *Project Mission* between top management and the project organisation made internal coordination difficult and external communication with the yard suffered. As a result, top management involvement was less effective in improving corporate relations than in EPC 3.

In addition to corporate relations, findings suggest that better operational relations have a positive effect on priority. The EPC 1 project organisation seem to have had insufficient operational relations with the yard's construction organisation before the project shake-up. After the shake-up, people with experience from projects in South Korea and with good relations to key players at the yard assumed senior positions in the project organisation. This seems to have helped maintain good priority even during turbulent times for the project.

Also in terms of operational relationship building, we can observe a clear difference between EPC 2 and the two other projects. While EPC 2 relied on contact with the designated project manager at the yard throughout the project, both EPC 1 and EPC 3 realised much earlier that the real power was with the functional managers. For EPC 2, this over-reliance on contractual boundaries made it difficult to identify decision-makers at the operational level and establish working relations with them. The result was a project that had difficulties securing priority.

Both EPC 1 after the shake-up and EPC 3 benefited from having managers with South Korea experience in the project organisation. These managers seem to better understand the decision-making process at the yard. After identifying the decision makers, both EPC 1 and EPC 3 actively cultivated relationships with these yard managers. This in turn yielded positive results for priority.

In addition to relationship building, contractual arrangements can influence construction priority. According to Norwegian government regulations, operators on the NCS need to use Norwegian contract tradition, e.g. Norsk Totalkontrakt 2007 (NTK 07), even when the contract it awarded to a foreign contractor. The contracts in this study had strict limitations on so-called liquidated damages, meaning compensation paid by the yard for not meeting the contract (e.g. late delivery).

At the time, the compensation limits were very low compared to the extra work needed finish the projects on time. In addition, engineering and procurement work is fully reimbursable. From the yard's point of view, it is clear that the Norwegian offshore project carry less financial risk. This might have influenced the low priority experienced by both EPC 2 and EPC 3.

The historic reason for this contract tradition is to protect the yards, which in Norway often are too small to bear large financial risks. South Korean yards, on the other hand, have more financial muscles and have more revenue sources than Norwegian yards. We can therefore say that the contracts were not a good fit for the project context.

How would more tailored contracts look like? A clue might come from contract practices in the shipping industry, the South Korean yards' traditional customer base. Ship-owners often include contract clauses where any delays give them the right to cancel the contract and get most of the contract value back. This might have improved priority for the EPC 2 and 3.

That being said, the findings in this study does not suggest that contracts are decisive for achieving priority. EPC 1 had the same contract type as EPC 2 and 3, yet received much better priority. Yard capacity and relationship building on the corporate and operational level seem to play a much larger role.

Overall, priority seems to be mainly be shaped by yard capacity, an *External environment* factor in Belassi and Tukel's framework. Corporate relations is the most important factor that the projects can influence. This factor is best understood as part of the category group *Organisation*. Furthermore, two internal *Project* factors, contract structure and operational relations with the yard, influence priority, with the latter being the most significant. Together, these factors make up a project's construction priority.

8.1.2.2 *Coordination*

Challenge	**EPC 1**	**EPC 2**	**EPC 3**
Coordination	Challenging	Highly challenging	Challenging

Table 24: Construction coordination

Coordination issues clearly influenced construction progress for all the EPC projects in this study (Table 24). Lack of coordination slows construction progress in several ways. For instance, delays occur when multiple disciplines are involved and one actor is not ready at the right time. Or if work is completed in the wrong sequence and the whole process needs to be done again, rework will be needed, slowing overall progress.

Three main sources of suboptimal construction coordination are found in the EPC projects (Table 25) First, inter-firm coordination between the yard and project organisation was often far from optimal. Second, the yard sometimes have internal coordination issues. Third, inter-firm coordination between the many subcontractors at the yard was difficult for all the projects. Subcontractors will be discussed separately in Section 8.1.2.3, while the other two sources will be dealt with here.

	Yard/Project	**Yard internal**	**Subcontractors**
EPC 1	Challenging	Challenging	Highly challenging
EPC 2	Highly challenging	Highly challenging	Highly challenging
EPC 3	Challenging	Challenging	Highly challenging

Table 25: Sources for coordination issues

Dahlgren and Söderlund (2001) developed two important concepts for understanding inter-firm projects that can aid our understanding of the first source for coordination issues. First, *Pacing*, meaning the mutual coordination of activities, and second, *Matching hierarchies*, the way two firms establishes joint decision-making.

All the projects had issues with inter-firm coordination with the yard. For EPC 1 before shake-up and EPC 2, this seem to come from an over-reliance on contractual boundaries. Because contractual boundaries made them narrowly interpret their own role, these project organisations took a limited role in the projects. This resulted in project organisations with little knowledge about who was in charge at the yard and the most pressing issues. This made both *Matching hierarchies* and *Pacing* very difficult.

Matching hierarchies was especially difficult for EPC 2 because they did not grasp the power structure at the yard – an issue that persisted throughout the project. While the project organisation had managers with experience from many countries, it appears that the lack of specific South Korea experience was an important reason for this result. Only in the very late stages, as the organisation had accumulated experience, did EPC 2 realise the power yielded by the yard's functional managers. At that point, construction was already severely delayed.

In the early phases, EPC 1 had similar issues, but after the shake-up positive improvements took place. The project organisation made consorted efforts to identify and establish relations with key decision-makers. For instance, the EPC 1 project organisation made attempts to communicate higher up in the yard's hierarchy. More direct contact meant more effective communication and less misunderstandings.

This improved *Matching hierarchies*, but also *Pacing*, and benefited overall inter-firm coordination. These efforts were lead by managers with South Korea experience, underscoring the importance of having personnel with location-specific knowledge. This also highlights an interdependent relationship in which good *Matching hierarchies* and good *Pacing* are both dependent on understanding local conditions.

While also experiencing coordination issues, EPC 3 seems to have understood the yard much earlier than the other projects. Two reasons appear to be responsible for this. First, EPC 3 had senior personnel with South Korea experience. Second, the project organisation had a deliberate strategy to place their own people at all levels of the project. This facilitated day-to-day interactions that gave important insights into the inner workings of the yard.

Moreover, this strategy seem to be an effective way to improve *Troubleshooting* because it makes the project organisation able to improve the information flow in the entire project. The project organisation can direct its own resources better and help the decision-makers at the yard do the same. Clearly, it also creates a more mutual effort likely to increase *Commitment* from everyone working on the project.

Coordination issues within the yard is caused by an organisational structure across South Korean yards designed for serial production. Offshore projects require more coordination between the different units than this structure allows, resulting in reduced productivity and construction progress.

It is difficult for the project organisations to influence the organisation structure at the yard. However, as EPC 3 shows, it is possible to contribute to better internal coordination by bringing information to the attention of decision-makers. This could be one part of an overall cooperative relationship with yard that would improve operational relations and thereby overall coordination.

8.1.2.3 *Subcontractors*

Challenge	EPC 1	EPC 2	EPC 3
Subcontractors	Many	Many	Many

Table 26: Construction subcontractors

Subcontracting was extensive during all the EPC projects (Table 26) and lack of coordination between the subcontractors seem universal. More man-hours were thus needed for inspections and follow-up in all the projects. Coordination problems between the many subcontractors is largely a *Pacing* problem caused by limited contact between the subcontractors. In EPC 1, for instance, subcontractors only communicated at a managerial level when meetings were called by the yard manager.

EPC 3 is the only project that addresses this issue head-on by establishing direct contact with selected subcontractors. This makes the project organisation much more involved in project coordination. Since the yards clearly have challenges with *Pacing* for subcontractors, this seems like a well-tailored strategy. While the outcome appears positive, it is hard to say anything definitive about this strategy because coordination issues remain also in EPC 3.

At the very least, we can say that this strategy appears more suitable than EPC 2's persistent contractual approach. EPC 2 treated subcontractor coordination as an internal matter for the yard. Rather than a solution-driven strategy, EPC 2 once again focuses on the contractual obligations and the result is as discouraging as we have seen in the previous discussion. The contractual approach does not work simply because it does not support the yard with its *Pacing* problem.

Coordination is further worsened by a payment structures that favours productivity and not project efficiency. Because the subcontractors are only paid per unit of completed work, they are not affected if work needs to be done twice, in fact, they would get paid twice.

We see that attempts during EPC 3 to change the payment structure were not successful. This is not surprising, as the subcontractor strategy is central to the business model at all the South Korean yards. The project organisations should therefore rather focus their attention on the subcontractor *Pacing* problem.

8.1.2.4 *Construction summary*

Challenge	EPC 1	EPC 2	EPC 3
Delayed engineering	Yes	Yes	Yes
Priority	Sufficient	Highly insufficient	Insufficient, but mixed
Coordination	Challenging	Highly challenging	Challenging
Subcontractors	Many	Many	Many

Table 27: Construction challenges

Construction challenges in the three EPC projects are summarised in Table 27. Priority and coordination are the two main factors underpinning construction progress, in addition to engineering maturity. Priority is achieved by developing good corporate and operational relations with the yard, while contract structures play a limited role. Coordinated and long-term high-level efforts are needed to build good corporate relationships.

Moreover, a cooperative approach beyond contract responsibilities are important for both operational relations and inter-firm coordination. The same approach can have a positive effect on subcontractor coordination, but the positive impact is more limited than with operator–yard coordination.

8.1.3 *Procurement progress*

The interviewees in this study predominantly focused on aspects related engineering and construction when describing their projects. Procurement only played a background role in these descriptions. The reasons for this might be twofold.

First, it might simply be because procurement was handled satisfactory. In both EPC 2 and EPC 3, procurement is said to have gone relatively okay and uneventful. Perhaps was that also influenced by the severe delays that both projects experienced, giving procurement ample time to be ready with equipment packages. Any challenges related to procurement could therefore possible have been masked by challenges in engineering or construction.

Second, procurement was briefly described by Source 1 in EPC 1 as an integral part of engineering. In that lays perhaps an acknowledgement that the challenging part of procurement is not only to procure equipment at the right time, but to coordinate procurement with the ever changing engineering design. When engineering progress is slow, procurement will necessarily have to adapt, without that necessarily being because procurement was mishandled.

8.2 COMPARING JOHAN SVERDRUP WITH EPC-PROJECTS

This section will examine the findings from the Johan Sverdrup project and compare these with the results from the EPC projects. While the Johan Sverdrup project is a pure Fabrication Contract (FC), with separate engineering and procurement contractors, findings related to both these activities will also be discussed, in addition to construction process.

8.2.1 *Engineering progress: a success story*

Engineering progress has been very good at Johan Sverdrup so far, with about 90 % of the design work already completed. That does not mean engineering has been a bed of roses, but rather that the project organisation has been able to solve many of the challenges it has had to face. In the following, contract coordination and yard requirement knowledge will be discussed.

8.2.1.1 *Contract coordination*

Challenge	Johan Sverdrup
Contract coordination	Challenging, yet manageable

Table 28: Contract coordination Johan Sverdrup

While engineering is not directly included in the Johan Sverdrup contract with SHI, input from the yard on constructability during engineering is still crucial. Unique construction methods at South Korean yards make this interaction even more important. Coordination between the different needs of the engineering and fabrication contractor is said to have been challenging during Johan Sverdrup. Yet, the project organisation seems to have been able to take on this challenge fairly well.

The contractual obligations in the FC contract require the project organisation to handle the interface between engineering and fabrication. This seems to have created a Johan Sverdrup project organisation that is more proactive and focused on deliveries than previously seen. The project organisation takes ownership of project progress and emerging challenges in ways that was only partially seen in EPC 3 and the latter part of EPC 1.

This approach seem to lead to sufficient coordination between engineering and fabrication. Engineering progresses well in part because the project organisation realises that the yard will only start construction when it trusts the engineering design. This is because the yard wants to minimise risk and avoid rework.

Since the project organisation owns the interface between the contracts, it seems to be more focused on taking responsibility for design decisions. This means that the project can move forward, rather than to endure long-winding discussions between the engineering and fabrication contractors. In other words, the active role of the project organisation facilitates good *Pacing* between the engineering and fabrication contractors.

8.2.1.2 *Requirement knowledge*

Challenge	Johan Sverdrup
Yard requirement knowledge	Insufficient, yet manageable

Table 29: Requirement knowledge Johan Sverdrup

Johan Sverdrup experienced similar challenges with the yard's requirement knowledge as the EPC project. However, the project organisation seem to have been able to address the yards shortcomings with a combination of tactical and strategic effectiveness.

First, the tactical component consists of a project management that actively supports solutions developed by the project organisation. A capable Project Director is described as being central in this work. Second, a strategic element is secured by a technically capable project team that is able assist and offer solutions to the yard.

The findings indicate that these two factors combined made the Johan Sverdrup project organisation able to *Troubleshoot* technical problems in a way that ensured progress. This included supporting the yard whenever limited requirement knowledge caused concern or issues.

8.2.1.3 *Engineering summary*

Challenge	Johan Sverdrup
Contract coordination	Challenging, yet manageable
Yard requirement knowledge	Insufficient, yet manageable
Engineering delays	No

Table 30: Engineering summary Johan Sverdrup

Engineering challenges in Johan Sverdrup is summarised in Table 30. Notably, there were no engineering delays, largely because the project organisation took charge of engineering deliveries and managed the challenges that arose.

8.2.2 *Construction progress: A better organisational match*

A mature engineering design allowed Johan Sverdrup to start construction at full speed and on time. In addition, good performance on most of the important challenges (Table 34) made it possible to proceed with construction well within schedule.

8.2.2.1 *Priority*

Challenge	Johan Sverdrup
Priority	Sufficient

Table 31: Construction priority Johan Sverdrup

Good priority at the yard supported the construction progress at Johan Sverdrup. Just as with the EPC projects, we can understand priority as *Availability of resources* during construction, subject to two internal *Project* factors (operational relations with yard and contract structure), one *Organisation* factor (corporate relations) and one *External environment* factor (yard capacity).

The Johan Sverdrup project organisation enjoyed good operational relations with the yard. First, this a result of a cooperative and problem-solving approach, much like EPC 3 and EPC 1 after the shake-up.

This again might stem from the project organisation having many team members with South Korea experience. Findings indicate that this helped the project organisation with *Matching hierarchies*.

Experienced staffers understand the yard, know who to connect with and also seem capable at coming up with approaches that are effective. For instance, the project organisation seems to shift their focus and presence around the yard depending on the construction phase. This indicates a deep understanding of the yard ecosystem. In terms of Pinto and Slevin's framework, the Johan Sverdrup project organisation facilities n both *Pacing* and *Matching hierarchies*, creating both an effective tactic and strategy.

In terms of corporate relations, Statoil has forged excellent relations the SHI yard over the years. Top management visits during Johan Sverdrup reinforced this relationship. However, findings also suggest that a restricted use of top management is necessary to avoid interfering with operational project management. Stakeholder management is said to become more difficult with more high level involvement, thus a targeted approach is advocated.

The contract structure for Johan Sverdrup is different in that is an FC and not an EPC, but does not appear to include radically different financial incentives than the EPC projects. However, the project used financial incentives on an ad-hoc basis to ensure construction progress. The payments are described as relatively small, but targeted payments that have secured priority at crucial times.

This is another example of the cooperative approach in Johan Sverdrup. The project organisation seems to understand that the likelihood of success is higher by offering incentives rather than to enforce contract obligations or point to the schedule. Apart from ensuring priority at crucial times during the construction, such incentives are also likely to improve overall operational relations, and thereby priority itself.

Yard capacity seems to have been somewhat better for Johan Sverdrup than the EPC projects, but it does not appear to be the main driver for good yard priority during the project. Sources describe other simultaneous projects that have not enjoyed the same privileges. This leads to the conclusion that the good priority is the result of factors that the project organisation and the operator company can influence.

8.2.2.2 *Construction coordination*

Challenge	**Johan Sverdrup**
Coordination	Challenging, yet satisfactory

Table 32: Construction coordination Johan Sverdrup

The Johan Sverdrup project achieved good construction progress in no small part thanks to very good coordination with the yard. As discussed in Section 8.2.2.1, the project organisation succeeded both with *Pacing* and *Matching hierarchies*.

In addition to the elements already discussed, findings suggest that The Project Director appears to have had a crucial role to ensure *Matching hierarchies*. First, the Project Director's role seems to be the project organisation's decision-solver to raise issues it needs higher level support to acheive. By focusing on this, inter-firm decision-making becomes more effective, in other words better *Matching hierarchies*.

Second, the Project Director is described as deliberately not dedicating time to fixed set of tasks activities. This is done so that the Director has more capacity and flexibility to allocate attention to what at any given time is thought to best serve the project. Not only does this improve the Director's ability to act on urgent matter, but it also means that the Director can shift focus depening on construciton. This flexible approach seems to give make the Project Director into a more influential role than in the EPC projects.

8.2.2.3 *Subcontractors*

Challenge	Johan Sverdrup
Subcontractors	Many

Table 33: Construction subcontractors

Like with all the EPC projects, Johan Sverdrup also experienced extensive use of subcontractors. Findings suggest that while the EPC projects saw subcontracting as a big challenge, Johan Sverdrup source describe it has "managable". Since the level of subcontracting appear to have been the same, this indicates that the Johan Sverdrup project handled coordination, including subcontractor coordination, better than the EPC projects.

As discussed in Section 8.1.2.3, coordination issues caused by the many subcontractors can largely be seen as a *Pacing* problem. The project organisation therefore tried to establish as many meeting points as possible between the subcontractors, even to the point of calling subcontractor meetings with no real agenda.

The Johan Sverdrup approach to the subcontractors has many similarities with EPC 3, which seems to have been the better EPC project in terms of subcontracter coordination.

8.2.2.4 *Construction summary*

The construction challenges in the Johan Sverdrup project can be seen in Table 34. Overall, the project scores better than all the EPC projects

Challenge	Johan Sverdrup
Delayed engineering	No
Priority	Highly sufficient
Coordination	Challenging, yet satisfactory
Subcontractors	Many

Table 34: Construction challenges Johan Sverdrup

on construction progress. For Johan Sverdrup, the competitive environment has been favorable, contributing to good yard priority. At the same time the project organisation has actively engaged with the yard to move the project forward.

8.2.3 *Procurement progress*

Procurement is not directly part of the contract with SHI, but obviosuly affects overall construction. So far, procurement progress has been good. Since two platforms are built at SHI at the same time with uniform parts, there are clear procurement synergies. In addition to price advantages, these synergies also allows flexibility in construction, because parts often can be borrow between the projects, rather than to wait for new orders.

Findings show that coordination with the procurement teams in Europe have been more challenging than usual becomes of the geographic distance. However, it also has given the procurement teams better ability to follow their suppliers. This result clearly overshadows the extra work needed for coordination, and in sum seems to be a clear advantage for overal project progress.

> *Almost all the equipment is manufactured in Europe. To follow procurement from Asia is difficult, and to have our procurement follow-up team in Europe ensure us better quality.*
>
> Source 4, Johan Sverdrup

9 RECOMMENDATIONS AND REFLECTIONS

This chapter outlines the main recommendations and implications of this thesis while offering further reflections on important aspects of project execution.

9.1 RECOMMENDATIONS

Figure 25 presents recommendations for the execution of Norwegian offshore projects in South Korea and take the form of Critical Success Factors (CSFs). Based on the previous discussion, the 15 CSFs are grouped in five categories, each corresponding to an important goal for the execution stage.

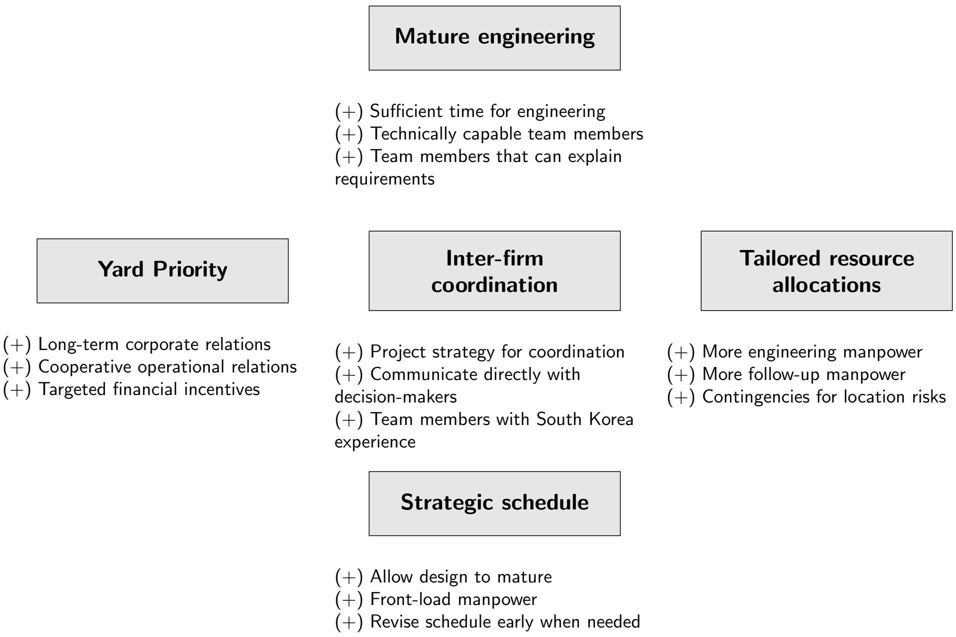


Figure 25: CSFs for Norwegian offshore projects in South Korea

9.2 REFLECTIONS

In this section, we will expand on the discussion from the previous chapters and, where applicable, highlight the role of the CSFs presented above. Reflections will centre around comparing findings with expectations, contract strategy and organisational learning.

9.2.1 *Comparing findings with expectations*

The engineering challenges experienced by the EPC projects were rooted in a lack of engineering capabilities at the yards. As detailed in Section 2.3, South Korean shipyards are relative newcomers as EPC contractors in the offshore segment. It is therefore not surprising that these shortcomings existed. Indeed, this was the background for *Expectation 6* developed for the execution phase, which anticipated that it would require extra efforts by the projects organisations to compensate for these shortcomings.

How should project organisations respond to such engineering competence challenge? Clearly, the project organisations need team members that can support and complement the yards' engineering competence. This requires **technically capable team members** that can offer independent technical solutions and at the same time **explain requirements**. This is well in-line with Pinto and Prescott (1988), that found that *Technical tasks* are CSFs for the execution stage.

However, if the engineering challenges were known, why were the EPC-projects not executed better? Explanations can be found both in how project planning impacted the execution stage and in project implementation itself.

9.2.1.1 *Planning stage: excessive cost focus*

In fact, engineering shortcomings at South Korean yards were not news to the projects in this study either. During the EPC 2 planning stage, for instance, doubts were raised about the South Korean engineering capabilities. That contracts still were awarded is consistent with *Expectation 4* developed for the planning stage, which asserted that operator companies put less weight on engineering capabilities when putting the contracts to South Korea.

This would have been fine if the implicit advise in *Expectation 6* was followed and extra resources were made available for the projects. However, the uncertainty created by insufficient yard capabilities was not sufficiently reflected in the project plans. Lack of resources and contingencies was most apparent in EPC 2, but no EPC project really assigned the appropriate time, manpower and resources to project execution during planning. In hindsight, this was a tactical error that made project execution much harder.

The projects should therefore employ a more tactical approach and strive to achieve **tailored resource allocations**. **More engineering manpower** should be allocated to ensure engineering progress and quality. Similarly, **more follow-up staff** should be added to ensure construction progress and quality. In addition, sufficient **contingencies** should be in place to able to react swiftly to changes due to location specific risks (e.g. yard priority changes because of full orderbook). Moreover, schedules should be managed by strategic goals, not operational, like seen in many of the projects. A **strategic schedule** would be **revised early** when problems are detected rather than hanging on to predefined plans and trying to catch-up (Shenhar et al., 2000). This would **allow engineering to mature** before moving to construction. Furthermore, since issues with engineering and other key activities tend to grow out of proportion if not quickly managed, projects should **front-load its manpower** to the early phases of execution.

We see here see similar inter-dependencies between CSF categories as in Belassi and Tukel (1996), for instance that a **strategic schedule** can contribute to **mature engineering** by providing **sufficient time for engineering** when needed. This underscores why projects should be managed from a strategic perspective, because an overly operational approach risks underestimating inter-dependencies between project goals.

But why did experienced operator companies underestimate the challenges and resources needed already in the planning stage? If we look at the preliminary expectations, one important push factor for offshoring to South Korea was cost reductions. This is in line the offshoring literature, where cost reduction is the most common offshoring reason (Kinkel and Maloca, 2009; Lacity et al., 2009; Schwarz et al., 2009). This is also strikingly similar to Hahn et al. (2009) in that the competitive environment seems to drive offshoring.

Knowing that costs was an important offshoring reason, and comparing this with execution results, it seems clear that costs were cut too drastically already in the planning stage. And while low domestic capacity pushed Norwegian oil companies to offshore, the opposite was true for South Korean yards. With ample capacity at the time, it has later been revealed that South Korean yards underestimated the work required and offered offshore projects at lower price-point that what was realistic (Kim and Lee, 2015).

Together, this makes for two contract parties that were both very eager to cut costs. It is more than fair to argue that in such an environment, projects costs and schedule were cut beyond what was realistic, which negatively impacted the execution phase. And as Pinto and Prescott (1990) points out, *Project Schedule* is a CSFs during the planning stage, meaning that come project execution, it is already too late to adjust plans and schedules.

As a side note, the cost pressure did not end with the planning stage. All the EPC contracts were awarded during a historic high oil prices, but at least parts of the execution phases came after the oil price plummeted. This drop made South Korean yards even more weary about costs, and at least contributed to the continued lack of priority that some projects experienced.

9.2.1.2 *Execution stage – coordination problems the real culprit*

While cost pressure during the planning stage did indeed impact execution, a more basic question remains: why was execution so problematic, even when many of the challenges were known? Norwegian operators and South Korean yards had not cooperated in the EPC setting before. Execution was problematic because both parties underestimated the large organisational differences, the coordination issues that followed and the steep learning curve.

As Dahlgren and Söderlund (2001) notes, a project is in many ways defined by the fact that inter-firm relationships are temporary. This is a difficult setting for two organisations to get to know each other, because both parties know that the relationship will be discontinued. This gives both sides incentives to advocate for "doing it our way". In turn, this inter-firm coordination difficult, because both *Matching hierarchies* and *Pacing* require trust (Dahlgren and Söderlund, 2001).

Broadly speaking, the EPC projects suffered from a lack of **cooperative operational relations**, which in turn damaged trust. The project organisations struggled to find a balance between holding the yards accountable and help solve project issues. As EPC contractors, the yards have large freedom to full-fill their contractual responsibilities. Supporting the yards is a balancing act for the project organisations, because the reason for using EPC contracts is that the contractor should bear many project risks.

Not only did the project organisations fail in striking such a balance, but they often used the wrong methods to resolve inter-firm coordination issues. First, using contracts to solve what are essentially cooperation conflicts shows a lack of understanding for why coordination is not working. Second, the "let's do it our way" approach does nothing to address either *Matching hierarchies* or *Pacing*. Third, while there are several good individual initiatives in the projects to improve coordination, the lack of an overachieving **project strategy for coordination** imperiled overall project success.

Inter-firm coordination is clearly essential for overall project progress. One lesson is that while organisations need time to get *Matching hierarchies* and *Pacing* right, an overall **project strategy for coordination** would shorten the learning process. This strategy should give an overall direction for how to balance active problem-solving with contractual obligations.

Moreover, **communicating directly with decision-makers** is essential for effective decision-making and for the project organisation to gain trust in the yard organisation for its opinions (*Matching hierarchies*). **Team members with South Korea experience** would bring valuable knowledge about the yard ecosystem and make it easier to identify decision-makers and implement the coordination strategy. Team members with South Korea experience are individual representations of the organisational learning that will be discussed later in this section, and should come as a supplement, not a replacement for knowledge transfer between projects.

9.2.2 *Contract strategy*

Contract strategy is an essential part of any offshore field development. We will in the following look at some interesting elements related to contract format, contract timing and contract location.

9.2.2.1 *Contract format: FC or EPC most suitable for South Korea?*

Findings and the subsequent discussion suggest that the Johan Sverdrup Fabrication Contract (FC) project performed much better than the EPC-projects on many important indicators, including engineering and construction progress. Was the contract format key or were other factors just as decisive?

Engineering progress is the success indicator where Johan Sverdrup stands out the most compared with the EPC projects. During engineering, there are two advantages with the FC contract. First, the FC contract makes it more likely to achieve a mature design early on. This is attributed to the focus of the project organisation, which in a FC-contract has special emphasise on the engineering deliverables.

> *I don't think we would have gotten this far with the engineering [in an EPC setting]. In an EPC-contract, engineering deliverables are rarely project milestones, they are just a part of the total delivery.*
>
> Source 4, Johan Sverdrup

Second, when a mature design is achieved, the FC-contract makes it easier to move from design to the construction stage. What often makes the yard unwilling to start construction is that they do not trust the design. In an EPC setting, the yard will wait until they are convinced that the design is mature and rework can be avoided. Since the operator owns the interface between engineering and construction in an FC-setting, the dynamic is different. The operator can take on this risk, thereby reducing uncertainty for the yard.

> *In an FC-contract you can tell the yard: "Start construction with these drawings. If there are any changes, that is our risk. We will pay according to the original contract."*
>
> Source 4, Johan Sverdrup

For the construction phase itself, contract type does not seem to be as important as in the other stages of the execution phase.

> *Given a mature design, I think construction would have proceeded in the same way [with an EPC contract].*
>
> Source 4, Johan Sverdrup

In terms of procurement, the FC contract can also be an advantage when dealing with South Korean yards, because you can station follow-up team closer to supplier in Europe. However, the FC advantage comes from the structure and geography of the supplier industry, rather than from substandard procurement capabilities at South Korean yards. Similar liasion organisations could also be established within the EPC format.

In a South Korean context, we see that the FC format offers advantages for engineering progress and for moving from engineering to construction. Other project elements like construction and procurement show similar performance as the EPC format. The FC format does not eliminate challenges per se, but merely provokes favourable behaviour by the project organisations that suits coordination with South Korean yards.

Given the importance of engineering in overall project success, FC format seems like a quick fix to the many execution issues. At the same time, contract strategy is much more than just contract format. It encompasses portfolio and risk management, capacity utilisation and many other strategic elements where EPC contracts have clear advantages.

To opt for the FC format just because execution in South Korea is challenging, is not necessary the best long-term strategy. It also does not acknowledge that the Johan Sverdrup was a well executed project in its own right, regardless of the contract format.

However, if the operators and licensees are to continue to use South Korean contractors, the project organisations need to take a different role in the projects to increase the likelihood of project success. For example, the project organisations must get the yards to trust the design before pushing for construction start. This can be done either by assuming more risks by choosing FC or by addressing the execution flaws discussed before.

We have seen how engineering progress dictates overall project progress. **Mature engineering** design is therefore essential before construction can start, regardless of contract format. Allowing **sufficient time for engineering** highlights that engineering should not be rushed, or else more severe delays are likely to follow.

The FC set-up clearly lead to a project organisation that took much more part in the interface between yard and the engineering contract. A clear difference can be seen with the EPC projects, who to varying degrees left engineering responsibilities with the yards.

However, all the EPC project organisations in this study would benefit from using many of the same approaches used for Johan Sverdrup.

One might therefore very well envision a project with similar project organisation behaviour as during Johan Sverdrup, but with a EPC contract. EPC 3 was probably the closest to this, and also the EPC project that tackled execution challenges best.

For this to be a valid conclusion, however, we need to detect execution improvements over time. Later, we will further examine the role of contract formats by discussing organisational learning over the course of the projects in this study.

9.2.2.2 *Contract timing: timing is not everything*

Looking at these field developments in a longer time frame, we see that South Korean yard capacity was ample when EPC contracts were awarded in the planning stage, but quickly became strained during execution. Moreover, several of the projects experienced that the oil price plummeted during the execution, causing further financial stress and organisational changes at the yards.

Yard priority for the projects was negatively impacted by these developments. This illustrates the difficulty of getting the timing right for fields developments. The size and scope of the South Korean yards mean that most market fluctuations impact their operations. This is different from Norwegian yards, which are more specialised, and therefore face more specific competitive challenges and threats.

It is notoriously difficult to find the best timing for a field development, especially since the competitive environment seem to be an important driver for offshoring (Hahn et al., 2009). However, this once again highlights the positive role that **contingencies** can play in project execution to counter location specific risks. Since South Korean yards are more vulnerable to market volatility, contingencies for South Korean projects should be expanded to account for this elevated risk.

Yard priority is nevertheless essential for overall construction progress. Project organisations should cultivate **long-term corporate relations** with the yards to achieve the best possible priority, given any level of yard capacity. Involving top management is important in this work, but also that the project organisation develops a coordinated *Project Mission* with top management.

Interestingly, we see that good corporate relations are more dependent on prior relations between respective top management than the contact that happens during the project. This is similar to results of Pinto and Prescott (1988), which found that management support was a CSF for the planning stage, but not during execution. Good corporate relations therefore needs to be strategic in nature and established well ahead of the execution stage.

Long-term corporate relationship building should be supported by **cooperative operational relations** during execution, meaning a project organisation that is perceived by the yard as offering solutions rather than emphasising contractual obligations. As seen earlier, this would also contribute to better inter-firm coordination. Relationship building should be supplemented by **targeted financial incentives** to achieve priority for urgent tasks.

9.2.2.3 *Contract location: wrong match between project characteristics and yards?*

We know from offshoring literature (Doh et al., 2009; Liu et al., 2011; Ørberg Jensen and Petersen, 2012) that a fit between the offshored activity and the offshoring location is important. Since all the EPC projects experienced similar challenges, did these projects have particular characteristics that made them less suitable for offshoring to South Korea?

We see that both EPC 2 and EPC 3 refer to technological complexity as a driver for engineering challenges. This could be seen as evidence of a mismatch between yard capabilities and project characteristics. However, given the general trend among Norwegian projects in South Korea to use project complexity to explain delays (Taraldsen, 2015), that seems like a hasty conclusion.

All offshore installations are unique and this make its production more complex than say serial production of ships. However, there is not enough evidence that the three EPC projects were more technological advanced than other comparable offshore projects, including Johan Sverdrup. Rather, circumstantial evidence in this study suggest that the reference to project complexity should be interpreted as the projects putting forward the least harmful scapegoat.

In EPC 2, we see that "the complexity argument" was more a communication strategy than a full description of project realities. Given the history of other Norwegian projects, it is plausible that a similar logic was behind EPC 3's description of complexity.

Why would the projects portray project implementation issues as technological challenges? As mentioned in the introduction to this study, offshoring Norwegian projects to South Korea is controversial and delays often receive heavy public scrutiny. Describing issues as technologically complex makes the challenges seem project-specific, and not location-specific, minimising backlash from engaging in offshoring.

However, are there other project complexities that would explain the execution difficulties? As mentioned earlier, no Norwegian offshore EPC projects had been awarded to South Korean yards before the period in examined in this study. It can be argued that this creates new execution challenges and organisations that need to learn to coordinate and execute projects together.

This suggests that the offshoring location is not to blame for the execution problems, but the inter-firm coordination issues that follow from projects between two unfamiliar parties. This is similar to the results in Norwegian Petroleum Directorate (2013a) that found no relation between yard location and delays for field developments on the NCS.

9.2.3 *Organisational learning*

We have in earlier discussions seen that the Johan Sverdrup execution fared much better than that of the EPC projects. Johan Sverdrup is built to last twice the standard lifespan for offshore installations, indicating that the project is not less technological complex than other projects. Besides external factors, that leaves two elements that might explain the different results: (1) contract format, which we have already covered, and (2) organisational learning.

Johan Sverdrup is operated by Statoil, the most experienced operator on the NCS and the operator with longest South Korea experience. 3 of 4 projects in this study are Statoil projects and the company has awarded at least three other major EPC contracts to South Korean yards during 2010–2015.

This clearly gives Statoil invaluable experience with executing projects in South Korea, and it is arguably also from this perspective that we should understand the performance of Johan Sverdrup. While the FC format encourages behaviour that increases the likelihood of effective project execution, individual and organisational knowledge is necessary to implement this.

In the EPC projects, this knowledge is incomplete and inconsistent, but appears to improve as each project progresses. Understanding of yard decision-making structures and ways to coordinate with the yard are examples of project internal improvements, meaning that the project organisations learn. In Johan Sverdrup, this knowledge seems to be available from the beginning, pointing to knowledge transfer from earlier projects.

Organisational learning is a well-established concept that explains how organisations develop capabilities through past experience. By developing routines from past activities, future performance improves (Whitaker et al., 2010). This also applies to the inter-firm context, in which firms become better at managing partner relationships and transfer knowledge to its partner, among other improvements. We saw this earlier in (Hätönen, 2009), which found that offshoring experience leads to future internationalisation success. Our findings indicate that past offshoring experience also predicts future offshoring success.

In the context of the projects in this study we can envision that learning happens on many levels. First, individuals learn from their direct experience in the projects. The moment these individuals share knowledge with each other, we see the kind of project internal improvements highlighted in the findings. Moreover, we observe that

Statoil projects improve over time, which means Statoil as an organisation is able to both accumulate and disseminate project execution knowledge.

This has implications for contract strategy, because using FC to solve general execution issues will deprive operators of important organisational learning from project implementation in South Korea. The key to long-term project success and competitive advantages is therefore not the FC format, but to learn to execute projects with South Korean partners. The cooperative and problem-solving approach seen in Johan Sverdrup and partially in some of the EPC projects, is an example of this.

9.3 IMPLICATIONS

In this section, we look at what the results implies for both practitioners and researchers.

9.3.1 *Implications for practitioners*

The CSFs developed in this study are crafted from the perspective of the project organisations. This gives concrete and practical advise to operator companies, project organisation managers and team members how best to approach project execution in South Korea. By following these recommendations, the likelihood of project progress and project success will increase.

Operator companies should acknowledge that offshoring projects to South Korea require more attention both during planning and execution in order to deliver the intended strategic and financial benefits. Moreover, capacity issues and cost trends are largely driven by industry cycles. It is therefore important to consider the effects economic cycles have on individual projects when making strategic decisions about contract location, contract strategy and portfolio management.

Another valuable insight is that Norwegian operators with South Korea experience would benefit from a continued engagement with South Korean yards, as execution appears to improve over time. Potentially, this could develop into a strategic capability. After years of trial and error, now is the time to reap the full potential of Norwegian–South Korean cooperation for companies with South Korea experience.

Project managers should build understanding for the CSFs among top management and team members in order to forge the common *Project Mission* necessary for project success. Team members should be empowered to solve issues with its counterparts at the yard and thereby creating the cooperative environment critical to inter-firm coordination.

Last, but not least, South Korean yards can utilise these results to improve their competitiveness in the offshore segment. Training and retaining workers with specific knowledge about Norwegian requirements and offshore projects is one such strategy. Improving incentives structures for overall project coordination to increase project efficiency is another. During the difficult restructuring that is currently underway, South Korean yards should try to accommodate the development of such capabilities.

9.3.2 *Implications and suggestions for future research*

This study has examined project execution in the context of offshoring, thereby linking project management and offshoring literature. Researchers have shown limited interest in this intersection, and those who do tend to narrowly focus on the management of continuous offshoring operations like manufacturing plants or service centres.

Future studies should therefore explore this overlap further by studying organisations in other industries that also engage in what we might call discrete offshoring. This will shed light on how managing discrete offshore projects differs from other types of project management.

Given the importance that organisational learning seem to play in improving project execution, knowledge dissemination in firms that engage in discrete offshoring would be a promising area for future research. The literature on organisational learning in the inter-firm context is mostly focused on alliances and sourcing (Whitaker et al., 2010). Discrete offshoring is arguably distinct from these two types in its finite nature and the geographical distance between the project organisation and the rest of the firm. This might affect how and when best to disseminate knowledge in an organisation.

The Norwegian offshoring of EPC projects to South Korea represents a clear shift in industry offshoring practices. Several useful concepts like *managerial intention* have been developed to explain why firms offshore, but the "when" question, or the timing of offshoring, still remains unanswered (Schmeisser, 2013).

Researchers should therefore study offshoring shifts like this one to offer theoretic concepts that go beyond the intention of individual firms. In a global economy where offshoring locations change rapidly, such concepts would greatly enhance our understanding of contemporary offshoring practices.

9.4 FINAL REMARKS

The EPC projects examined in this study were conducted by yards and operators unfamiliar with each other and that both wanted to cut costs. Clearly, this was a potent mix for implementation issues.

This study contributes to better project implementation by identifying 15 Critical Success Factors (CSFs) for Norwegian offshore projects in South Korea. At the same time, this study shows that contract format can play a role in mitigating execution challenges, especially during engineering.

We also see that external cycles can greatly influence individual projects. Periods of capacity issues and cost cutting measures replace each other as an industry boom turns to bust. Since the offshore business is a cyclical industry subject to ever changing economic conditions, this a repeating pattern that will continue to challenge future projects.

The EPC contracts examined in this study represent a boom period for the industry, and this might have affected the results. At the time of writing, a prolonged industry downturn distinct from this period has once again put downward pressure on industry costs. If the current oil price slump also marks a permanent shift towards lower petroleum prices, this will only increase the importance of good project implementation for the long-term prospects of the Norwegian oil industry.

Part VI

APPENDIX

A INTERVIEW GUIDE

Appendix A presents the interview guide used during the semi-structured interviews. The interview guide is divided into three parts: research introduction (Section A.1), project timeline questions (Section A.2) and topical questions (Section A.3).

A.1 RESEARCH INTRODUCTION

Clarification before interview:

This research is conducted in the spirit of free and open research, and participants are encourage to use their full names. However, should the interviewee wish to remain anonymous, the researcher will comply with such a request.

Audio from the interview will be recorded, but neither the recording nor the transcript will be distributed to anyone other than the researcher and his supervisor without the interviewee's explicit consent. The interviewee will be given the opportunity to review and comment on a transcript draft, before a final version is used in the research.

Introductory questions to the interview can be seen in Table 35.

Topic	#	Question
Person	1	Name
	2	Age
	3	Position and role in project
	4	Work Experience

Table 35: Introduction questions

A.2 PROJECT TIMELINE QUESTIONS

Questions structured on the project timeline can be found in Table 36.

Topic	#	Question
Project timeline	5	What major decision points has the project experienced so far?
	6	Please elaborate on why these decisions were important for the project.
	7	What milestones has the project reached so far?
	8	Please elaborate on why these milestones were important for the project.
	9	Please elaborate on how the project proceeded before, between and after these decision points.
	10	Please elaborate on how the project proceeded before, between and after these milestones.

Table 36: Project timeline questions

A.3 TOPICAL QUESTIONS

Table 37 presents the topical questions in the interview guide.

Topic	#	Question
Project	11	Size & Value of project / Number of expats assigned
	12	How would you describe project uniqueness?
	13	How would you describe project urgency?
	14	How would you describe the project mission?
Organisation	15	How would you describe project org. structure?
	16	How would you describe top mngmt's involvement?
	17	How would you describe project mngmt's involv.?
	18	How would you describe funct. managers' involv.?
Project manager	19	How would you describe PM's perception of role?
	20	How would you describe PM's ability to coordinate?
	21	How would you describe PM's ability to delegate?
	22	How would you describe PM's ability to trade-off?
	23	How would you describe PM's competence?
Team members	24	How do you asses TM's technical competence?
	25	How do you asses TM's troubleshooting skills?
	26	How do you asses TM's communication skills?
	27	How do you asses TM's project commitment?
Tech. tasks	28	Which tech. tasks has been most challenging? Why?
	29	How do you troubleshoot typical tech. tasks?
Communication	30	How would you describe project internal com.?
	31	How would you describe com. w/ yard?
	32	How would you describe com. w/ third parties?
Performance	33	How are consultations with the yard done?
	34	Has the availability of resources been adequate?
	35	How would you evaluate overall coordination?
	36	How would you describe the outcome of the project?
	37	Which factors do you think contributed to this?
Final remarks	38	Is there anything you would like to add?

Table 37: Topical questions

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