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MASTER THESIS

Challenges and opportunities that define the success of an FPSO project

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Preface

Two years ago a long journey had begun from the warm Eastern Mediterranean to the cold Arctic in order for me to further develop my knowledge. At this point, this journey ends with this thesis that concludes my Master in Energy Management education both at the University of Nordland and at the MGIMO University in Moscow. This research paper except from the initial aim to examine the main challenges and opportunities that define the success of an FPSO planning, scheduling and execution in the offshore oil and gas industry, it also expresses the remarkable experience and knowledge that I have obtained as well as the friends and contacts that I have made during this program.

The process of completing the thesis was challenging and sometimes frustrating. However, with my supervisor's valuable guidance and experience it provided me with inspiration and motivation to complete the thesis. At this point, I would like to give my sincere thanks to my supervisor Mr. Frode Mellemvik and also to express my gratitude to everyone that contributed and provided me with important information to write my thesis as well as Mr. Anatoli Bourmistrov the director of our program. Last but not least, I would like to thank my family for their support during my studies.

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Abstract

During the last forty years, the offshore oil industry has introduced the floating production, storage and offloading units as an alternative solution for the traditional fixed oil platforms. This development of technology has happened due to the need for exploration and production of oil and gas in unfriendly and harsh environments to access. Floating units in general and FPSO installations in particular, include similar equipment to the one that a traditional fixed platform can carry, but in a form of a floating installation that can be relocated to difficult and unreachable locations. Statistical data show that the current market of FPSOs is quite promising and despite all the economic uncertainties, the growth of FPSOs continues and demonstrate an extensive amount of growth in the oil and gas offshore for the upcoming years.

The overall aim of this research paper is to describe and analyze the challenges and opportunities that can define the critical success factors that associate and influence the success during the planning, scheduling and execution phase of the FPSO conversion. Moreover, this research paper demonstrates the significance for both the oil companies and contractors to include all the relevant factors before any task of the project is executed. One part of the research paper is being focused on how do the different experts from oil companies, oil contractors, financial institutions and academics perceive the future perspectives of FPSO unit application in the offshore oil and gas industry. This research project investigates and analyses the crucial influential factors during the conversion of the FPSO in three categories, project management, stakeholders and other factors.

For the purpose of this research, the focus is on the success of the project and not to the failure since when introducing a new project in the portfolio of a company there is no intention to add failures. Moreover, the oil company or oil operator definition is used to describe the client and the oil contractor or EPC company is used to describe the owner of the FPSO, the responsible for the conversion of the vessel that the oil operator will later use for the hydrocarbon development.

The findings from the research paper focus on the importance of the project manager and the team, on the interface project management, on communication, on stakeholders, on the dilemma between leasing or owning an FPSO, on regulation and on HSE policy that should be followed. With the long experience of the oil contractors and companies in the offshore oil industry and in floating units it is proved that they have respective knowledge on how to deal with the main

challenges as well as on how to identify and take into advantage the opportunities for having a successful FPSO unit conversion and application. This research will investigate the major insights of each factor that are being considered in order to mitigate the risks and avoid the major modifications that most likely will occur and negatively influence the output of the task.

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Abbreviations

CAPEX: Capital Expenditure

CLC: International Convention on Civil Liability for Oil Pollution Damage

CSF: Critical Success Factors

CSR: Corporate Social Responsibility

E&P: Exploration and Production

EPC: Engineering, Procurement and Construction

FEED: Front End Engineering and Design

FLNG: Floating Liquefied Natural Gas

FPS: Floating Production Systems

FPSO: Floating Production Storage and Offloading unit

HSE: Health Safety Environment

IFC: International Finance Corporation

IC: Investment Corporation

IMO: International Maritime Organization

IQPC: International Quality and Productivity Centre

LLMC: The International Convention on Limitation of Liability for Maritime Claims

LNG: Liquefied Natural Gas

PDO: Plan for Development and Operation

PEM : Project Execution Model

PM: Project Manager

PMT: Project Management Team

SEER: State Environmental Expert Review

SOW: Scope of Work

Terms and Definitions

CAPEX: Are the money spent to invest, acquire or upgrade an asset in order to increase the efficiency and performance of the company (Damodaran).

Environment: refers to the world outside the project's boundaries with which project as an open system must continually interact (Artto et al, 2007:9).

FEED: It is conducted after the design process and feasibility study. It is a framework that identifies the technical issues and costs before the EPC process.

Financial Leverage: The amount of debt used to finance a firm's assets. A firm with significantly more debt than equity is considered to be highly leveraged (Damodaran).

FLNG: Is the floating production of LNG (Rigzone).

Insurance: The financial means to support the liability (Jilla:2012).

Liability: Legal and Financial Responsibility. Clarification of who is responsible to pay if damage or injury occurs (Jilla:2012).

LNG: Natural Gas that is being converted to liquid form for easier storage and transportation.

Scope of Work: Is an area of work in an agreement that describes the exact tasks with deadlines for the completion of the project.

Shuttle tanker: A ship designed for oil transportation from an offshore oil field to the shore (Rigzone).

Strategy: is the direction and scope of an organization which aims to achieve advantage for the organization through its configuration of resources within a challenging environment, to meet the needs of markets and to fulfil stakeholder expectations".

Topside Equipment: Offshore oil platform structure on which equipment is installed (OGP:2006)

1 Introduction

The introduction chapter gives a brief overview of the research project. Firstly, a synopsis of the offshore oil and gas is provided and then a brief reference of the advances of the floating units over the traditional platforms is given. Then the personal motivation for the research is mentioned, followed by the purpose of this particular study. In addition, the problem statement addressing the research is being analyzed in order for the reader to understand what this research aims to examine. Lastly, it was considered important to provide the limitations of the study and a synopsis of the structure.

1.1 Background

World crude oil is still steadily increasing while the population and emerging economies are growing, and therefore, the demand of energy consumption is also growing. However, the era of easy, conventional oil is soon coming to an end (Klare, 2008) and the production of unconventional oil is increasing. This implies that projects in remote, hazardous and unfriendly environments which are difficult to extract will be considered more in the nearby future. With the expanding petroleum activity in the North, new opportunities are present, although the discovery of those challenging fields along with lower oil prices makes those projects difficult to operate. One of these rapidly changing areas is the Arctic, where the global interest in oil exploration and development is increasing. With the transition to the Arctic waters increases the need for high technology equipment in an already intensive industry and hence, it is essential to develop strategies and technological innovations in order to confront the challenges, make the right decisions and avoid or mitigate the risks (Gautier et al., 2009).

During the recent years FPSOs have become the major production unit both for shallow and deep waters either in mild or harsh environments (Eide, 2008). Consequently, FPSOs introduce an alternative to take over oil and gas pipelines, making it worthwhile to analyze its competitive advantages compared to the traditional oil and gas platform. FPSO units are inevitably considered to be one of the major technological offshore solutions in the oil and gas industry and are either directly owned by oil companies or leased from an FPSO owner (Eide, 2008). Even though, FPSOs were originally developed as an economic solution for the marginal fields that otherwise might not be produced, thereafter, they become essential in developing remote fields with increasing production capacity and increasing of water debts (Eide, 2008).

1.1.1 Oil Platforms vs. FPSOs

The improvement of the mooring system as well as the improvements in the subsea equipment, have made FPSO useful in deeper and in harsher waters (Haney, 2012). In addition, the fields which are proven to be uneconomically viable for exploration, due to their small amount of reserves, can use FPSOs as a standard method for exploiting (Haney, 2012). Compared to traditional fixed platform production systems, FPSOs minimize the time for oil production developments and generally cost less to build in deep waters and they are installed at the oilfield for a long period of time to produce oil usually in the same way as a fixed platform (Eide, 2008). Most of the projects that implement floating production systems are located in fields, poor in infrastructure and connection to onshore areas, and it is therefore necessary to provide temporary storage at the production site before transporting the oil to shore by means of shuttle tankers (Haney, 2012). Furthermore, as field size decrease, installing pipeline infrastructure may not be economically feasible and using floating production systems lowers field abandonment costs at the end of a field's production lifecycle (Eide, 2008). As a result, the demand for floating production units has developed very positively over the last years.

More about FPSOs advantages compared to the traditional platform are the followings:

- They are faster to be developed than the fixed platforms and thus, they provide earlier cash flows (Haney, 2012).
- They reduce upfront investment (Haney, 2012).
- They can be moved to other platforms and as a result, they retain value and cost can be amortized over several fields due to their re-deploy ability (Haney, 2012).
- An FPSO is also efficient for smaller fields in which there is a high possibility to be depleted quickly. As a result, oil companies can avoid the cost of installing permanent pipelines (Dutta, 2015) and makes the decommissioning process easier and less costly in comparison with the traditional oil platforms.

FPSOs are installed on the surface facing the harsh environmental conditions, therefore, some challenges might occur. Even though the FPSOs are being designed and constructed in engineering detail, the process is based on limited knowledge related in the field of production (Odufuwa, 2014) that the specific FPSO conversion is addressed to. For instance, when flow rates, hydrocarbon mix and other specifications become clearer, the assumption of the specific FPSO design might turn out to be imprecise with regards to the location and a lot of cost overruns might occur due to the changes in the conversion phase (Odufuwa, 2014).

1.2 Personal Motivation

The idea of this research was firstly inspired from my personal interest in the offshore oil and gas technology. During our studies, some lectures presented by professionals coming from the offshore industry presented projects that involve the application of FPSOs. However, due to their technical functions no further knowledge was provided apart from the basic information. After attending oil offshore seminars, I was surprised by the challenges that the contractors are facing within the project management phase for the conversion of the vessel, delivering the projects on time and within their budget mostly due to their complexity. In the meantime, the fact that the conventional oil production has been in decline and the interest in oil and gas developments in the Arctic has been considered, the need for advance technological solutions becomes crucial in the direction of executing effective projects. Consequently, this increased my interest in examining FPSO as a technology solution.

All the above, combined with the potentials of FPSO unit application in the offshore industry due to its technical characteristics of being efficiently used in deeper, rough and harsh environments, its economic viability and the high record of safety and reliability, developed the idea of studying this research project. In more detail, the study of the main challenges and opportunities that will formulate the critical success factor of FPSO operation sounded as a very interesting topic for research.

1.3 The Purpose of the Study

The contribution of this research is to describe and analyze the application of FPSO and its potentials in the offshore oil and gas industry. This research shall identify the opportunities and challenges that mainly impact the conversion phase and how the companies develop their frameworks in order to avoid the challenges and identify the opportunities. Once the challenges, opportunities and the critical success factors will be identified, they can be taken under consideration from FPSO project managers in order to ensure that their potential projects will be delivered efficiently, on time and within budget.

Furthermore, this research aims to a greater understanding of how the application of FPSO through its functional specifications can add value. Lastly, this research aspiration is to provide information for future professionals in the offshore oil and gas and inspire young graduates to pursue a career in project management in the floating offshore industry.

1.4 Problem Statement

Based on the background and the personal motivation, this thesis aspiration is to describe and analyze the opportunities and challenges of implementing FPSO projects. It is necessary to investigate deeper how the unique characteristics of FPSO unit can benefit the contractor as well as the oil company. When planning and developing a technological solution within the conversion phase a number of crucial risk elements should be taken into consideration with the intention of delivering a successful project. Thus, it is important not only to identify the key issues to be addressed to each of these factors in advance, but also the key indicators that affect the FPSO industry. For the benefit of the contractor of FPSO project, it is also important to determine the guidelines to manage a successful FPSO project. It is also worth examining how the oil and gas companies embrace the chance of adapting this advanced technology and the potential use of FPSO unit as a competitive advantage in the dynamic environment of the offshore oil and gas industry.

Therefore, the main problem statement of this research is:

A framework for successful project management: *What are the main challenges and opportunities that define the success of an FPSO planning, scheduling and execution in the offshore oil and gas industry?*

In order to answer this question, two more sub-questions were built:

1. *What is FPSO?*
2. *How to analyze and describe the challenges and opportunities of applying FPSO?*
3. *How do different experts and interested parties regard these challenges and opportunities?*

There is no doubt that even the experienced vessel operators have to invest a lot of resources and effort to deliver the successful projects on time and within the budget. Thus, the need for excellent preparation, for maintaining good stakeholder relationships, implementing clear rules in favor of complying with the regulations and standards, as well as the need for a robust profitability and sustained development imply the need of setting up the critical success factors (CSF) that will lead to a strong framework for analyzing the challenges and opportunities of the FPSO unit application.

1.5 Limitations

Due to the limited time for conducting the research, the available resources and the availability of the potential participants to share their knowledge, some limitations had to be set. Firstly, the research was narrowed to focus on the CSF by analyzing the challenges and opportunities in the FPSO sector. The project managers that were chosen to participate in this research, even though

they formulate a small sample, they are top respective professionals in their field, coming from big companies with an excellent presence in the offshore oil industry. In this research, the answers taken from the participants will be compared towards the theoretical framework.

There are many technological advances and know-how knowledge within the floating construction, but in the meantime they are quite complex. Therefore, due to the lack of time to analyze all the elements, this research is mainly focused on certain aspects that are good enough to understand was is being analyzed and strong enough to represent the strategy of an FPSO unit conversion and application. Considering that the participants will be asked to provide us with confidential information, the focus area of this research is in the major internal and external aspects that influence the process of the FPSO unit application in a company.

1.6 Structure of the Thesis

This research consists of six Chapters in total commencing with the Chapter 1, the Introduction that provides an overview of the research project. It consists of the Background, giving some basic information about the FPSO industry and why this concept is important, followed by a justification of the researcher's motivation to focus on this topic. The purpose of the study, the problem statement, the limitations found applicable in this research, the structure of the thesis.

The Chapter 2, sets out the Theoretical Framework, providing a comprehensive literature with a variety of disciplines of project management in the context of the FPSO application with regard to the opportunities and challenges within the project management execution and to the stakeholders that affect the project. The Chapter 3, formulates a detailed description of the research design that has chosen to conduct the research. A detail explanation of the data collection and analysis is also provided. Lastly, ethical considerations are taken into account and principles to judge the appropriateness and usefulness of the research.

The Chapter 4, presents the empirical data from primary data that include semi structured interviews taken from three participants, while the Chapter 5, links the findings described in the Chapter 4 and the secondary data to the research question and therefore to the research problem. The secondary data includes information from articles, academic books, journals and business reports. The final Chapter 6, is the Conclusion part of the research, providing information for further studying and research.

2 Theoretical Framework

This Chapter sets out the development of a frame of reference that serves as a guide and provides the foundations of a logical identification of the most crucial elements for analyzing and describing the challenges and opportunities of FPSOs projects. Firstly, a description of the importance of developing a project management framework when introducing a new project is identified as well as the elements and the variety of disciplines that define a successful strategy. Secondly, SWOT analysis is used in the theoretical literature as an effort to uncover the strengths, weakness, opportunities and threats of offshore oil and gas developments and to understand and describe the opportunities and challenges of FPSOs as a foundation of empirical analysis, discussion and conclusion of understanding and evaluating the FPSOs developments. Lastly, a combination of different targets that can act as influential factors are being described and analyzed connected to FPSO projects followed by the theory of stakeholders, regulatory framework, health and safety issues as well as cost and finance are of major importance to be considered.

2.1 Project Management

When a company, either it is a construction company or an oil company, is planning to introduce FPSOs development in its portfolio, then it is vital to consider this project in the strategy of the business in order to obtain clear and unambiguous guidance to add value in the business.

> *"Project Strategy is the direction in a project that contributes to the success of the project in its environment".*
>
> Artto et al. (2007:8)

Project strategy is a narrow concept addressed in a single project and therefore, ensures that the goals and the plans of that project are aligned with the organization's strategy (PMI, 2008). It is important to comprehend and place the project correctly to its environment in pursuance of matching correctly the project goal to its environment as an effort to meet the opportunities and face the challenges. According to the theoretical literature, Artto et al. (2007) developed the definition of project strategy in order to clarify the meaning and the importance of the direction of the company, in other words the goal, plans, means, methods, guidelines and tools. All these elements will develop the capabilities of the project and will undeniably affect the achievement of the output.

The deepwater offshore industry operates in a complex organizational environment with several powerful stakeholders. Project strategy of such projects should relate the adaptation of the

dynamic, turbulent and uncertain environment of the offshore oil and gas in order to face the challenges. Project strategy relates to the competitive advantage to the survival of the project in its external environment (Longman, 2014) and this implies the need to identify the environment involved in key activities for the development of the project in different stages.

2.1.1 Project Management Success

It is understood that not all the projects are delivered successfully according to the expected results, but also failures are possible to occur, especially when a project doesn't transfer enough capabilities and therefore it is more likely not to add value to the business. However, the theoretical literature of this research focuses on the project management success since the importance of all the elements that will lead to a successful FPSO project direction it is highly recognized and since the company has no intention to add failures in its portfolio.

> *"Project Management includes the planning, organizing, monitoring and controlling all the aspects of a project in a continuous process in order to achieve its objectives"*
>
> (Denni-Fiberesima et al., 2011:379).

Therefore, a project framework is the key tool for implementing the strategy of the project. It is without any doubt that every company wants to achieve project success and in order to accomplish this goal, it is vital to clarify priorities among the different factors that can influence the project. Even thought the traditional challenges of time, cost and quality (Denni-Fiberesima et al., 2011) remain the crucial factors for project success, during the recent years, some other criteria were added such as stakeholder satisfaction, learning from previous mistakes, motivation, strategic alignment and sustainability (Artto et al., 2007) and therefore the decisive factors to be addressed to in order to characterize the success of an FPSO project are:

1. Safety - No harm to personnel, environment and equipment
2. Costs that will be followed according to the budget.
3. Early Planning - Focus on the Scope of Work (SOW)
4. Follow the Schedule - on time.
5. Capacity of a Shipyard for the conversion of FPSO
6. Lessons Learnt - To avoid potential changes during the process that will lead to delays.

According to Longman (2004:55) *"Communicating the rationale behind the project definition, planning and implementation are fundamental for the successful use of project management"*. Thus, the key to project success is to explain the reasons why each step is taken for supporting the processes and procedures. In addition, Longman (2004) suggests that for the success of the strategic process

implications, it is important that, project management should become an ongoing learning experience in order to build capabilities and therefore a number of questions should be answered when ending a process:

- What was done well and poorly?
- What strengths and weakness can be identified?
- What can be done differently next time, according to the lessons learnt?

In FPSO projects, regardless the different answers that might be obtained, they should represent a platform for learning and growth that will lead to valuable project developments. Feasibility studies, engineering costs, environmental protection, dealing risks and changes, are all expected to be identified when building the project planning and schedule.

2.1.2 FEED Development

Front End Engineering Design (FEED) is a part of the contract signed between the oil operator and the oil contractor and has to be done at a very early stage in the development of the project (Patel, 2008:8). After completing the feasibility study the FEED which consists of the engineering approach for the process of conversion must be clarified (Lacatena, 2010). FEED Engineers are increasingly pressured to make good investment decisions early in the project (Patel, 2008) mainly because a robust FEED will increase project reliability and improve project performance. However, it is very difficult for an organization to carry out a trustworthy FEED. Patel (2008) suggests that contractors with complex projects can improve their performance by adopting a multidisciplinary workflow that ensures all engineering decisions made during the design process and FEED is based on the on the best practices of the whole life cycle of the FPSO (see Figure 1).

Moreover, the creation of a document to include all the details of the basic design is vital for the determination of a more specific process design criteria and the identification of alternative choices (Lacatena, 2010). FEED aims to build a robust framework as an effort to have a coordinated procedure in early stages between the stakeholder and to understand the value of each stage by having the right people at the right place (Lacatena, 2010). In addition, Mierendorff (2011) pointed the FEED development as an important factor when proceeding with the conversion of FPSO since it is a framework of a great importance before considering converting an FPSO.

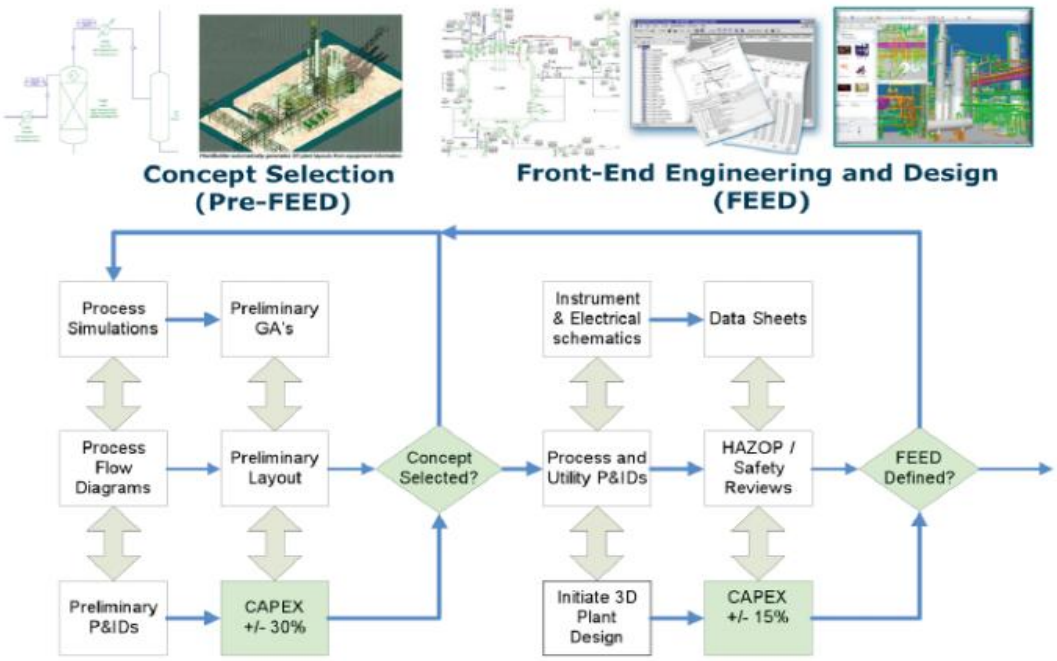

Figure 1: Typical Workflow in FEED, Source: Patel (2008:2).

2.1.3 Critical Success Factors (CSF)

There is no doubt that within a company a number of factors should be taken into account in order to execute successful projects. Therefore, what is more difficult it's to identify the most relevant factors that potentially will influence a specific project and to place everybody in the team at the same direction (MindTools). Consequently, D. Ronald Daniel, developed the term *Success Factors* as an effort to identify all the necessary factors to create a common point of reference and to help the direction and measurement of the success of the project (Bruno et al., 1984:23). CSFs are related to the strategic goals of a specific project and give the maximum impact for achieving the project's goals where a number of areas of activities should receive continual and careful consideration from the management (MindTools).

Even though not many researchers have identified the most relevant factors to have a significant effect on FPSO projects, Denni-Fiberesima and Rani (2011), have conducted a research with the aim to identify the prevalence of CSFs for successful projects in the exploration and production of deepwater oil and gas portfolio. Moreover, they point the relevance to address to four basic steps before evaluating the most significant CSFs that reflect the project management process.

After studying and researching about the CSFs which are considered to be relevant for mega construction projects for the deepwater oil and gas industry, nine CSFs or main areas were considered to be decisive for this research and were asserted in order to be analyzed during the data collection. Based on the literature review, a CSF map of FPSOs projects was created (see Figure 2). Each of these suitable factors must be considered as a frame of reference to examine the opportunities and challenges of FPSOs projects. It is noteworthy to mention that these are not the only factors in the successful outcome of an efficient FPSO project, but according to the literature review, these are the most likely factors to be investigated for an FPSO project development.

Figure 2: Critical Success Factors for FPSO, Source: Developed for this research.

According to the figure above, the role of the project manager with regard to the leadership, decision making and resource allocation along with the clear understanding of the SOW achieved within the Project Management Team (PMT) and stakeholder are considered to be important CSFs. The importance of having competitive and transparent agreements can also be considered as CSF (Denni-Fiberesima et al., 2011). Effective management of the stakeholders as well as environment such as the business climate, the economy, the competitors, the technological advantages that can influence the project are also revealed as factors behind the success of project efforts (Denni-Fiberesima et al., 2011). Moreover, critical success factors will influence the project management phase starting from the formulation to the planning, execution, controlling, and to closing process (Denni-Fiberesima et al., 2011). It is understandable that by

focusing on key success factors similar to the above mentioned, it will produce excellent results in many areas. Moreover, Mierendorff (2011) focused on lessons learnt from previous FPSOs projects and on the changes that must be taken into account during the execution process. Lastly, according to Denni-Fiberesima and Rani (2011) mega constructions in the oil field developments need a clear scope of the work and all the involved parties should ensure a wide understanding of the project in order to execute the work according to its specifications.

2.1.4 Interface and Responsibility Management

"Interface Management is a process to control the large number of project elements or to control the flow of instructions and manage the communication of the information needed between the various contractors involved in a project"

(Shirley et al., 1986:425).

In accordance with the statement above, the main objective of the Interface Management is to avoid surprises and misunderstandings and therefore, for the development of FPSO unit each phase has to be handled by a different department and sometimes by an external organization. Thereby, more interfaces are being introduced and the flow of information between those interfaces determines the process efficiency (Alawi, 2009). The aim is to identify crucial issues affecting the project in advance and to minimize them. In addition, the role of the project manager is to use Interface Management as an attempt to manage clear, accurate, timely and consistent communications for the exchange of information with schedule project tasks (Shirley et al., 2006). Alawi (2009) suggests, that this can be achieved by having a clear scope of work, communications systems available to the employees and the ability to face changes without having a negative impact on the project.

However, a lot of problems might arise within the Interface Management when the staff lack of experience, knowledge and recognition of local construction methods (CEIM, 2010). Also, it is more likely that problems associated with unrealistic schedules, limited applied budget, limited obtained access to the project work area and lack of authority of the project manager might lead to low levels of project satisfaction (CEIM, 2010). According to Shirley et al. (2006), scheduling, planning and communication conflicts could be resolved informally and verbally with minimum written correspondence. In contrast, complex projects such as FPSO construction and conversion are dealing with advanced technology representing larger facilities and capital investment, highly specialized processes, longer start up and completion concepts, expensive cost in case of delays and more sophisticated engineering and fabrication process (Mierendorff,

2011). Consequently, there has become a greater need for clear and understandable Interface Management for FPSO units in order to overcome the challenges.

In addition to employees, they also need to be responsible for their actions, and thus, organizations must manage the responsibilities of their employees with respect to all activities that are carried out daily (Cabanillas, 2011). As mentioned before FSPO projects are being developed in the turbulent and harsh environment of offshore oil and gas. Thus, the operating managers are responsible for the safe operation of FPSOs, security, environmental protection, social responsibility and for the compliance of all legislative and regulative framework.

When the company considers adding FPSOs in its projects, the need to clarify roles and responsibilities in the multi - functional departments of FSPO developments are vital for success. Therefore, companies should have a project management tool to describe the participation of employees in diverse roles for finalizing a project and with the aim to plan, organize and improve the communication within the project team (Cabanillas, 2011). It is important to clarify who is in charge of performing specific activities in order to remain productive and deliver the project without surprises.

2.2 SWOT Analysis

The effectiveness of FPSOs units is influenced by many visible and implied factors. Even though, FPSO projects can result in a competitive position from a long perspective, there are many important elements that need to be considered before the implementation of the project. The development of a strategy for an FPSO project must include all the potential challenges in order to manage the risks, identify the opportunities and to be prepared for the unexpected. Surprises are prevented by knowledge and control because according to Hox (2013:7) "*what you already know will not surprise you*". In addition, it is necessary to inspect all the relevant elements that influence the success of the project and never expect.

A useful framework to analyze a company and review its strategy is a SWOT analysis, where the strengths, weakness, opportunities and threats that affect the performance of a project can be analyzed (Daft et al., 2013). The strengths will identify the competitive advantage in comparison with other projects, while the weakness points will show the disadvantages of the project. Therefore, both strengths and weaknesses comprise the internal environment of the project, in contrast with opportunities and threats that consist of external influences. Opportunities are the elements of the external environment with the potentials to help the organization to implement

the project with success while the threats can prevent the organization from achieving its goals (Daft et al., 2013). As a consequence, a matrix should be developed from the company in order to link all the relevant elements for each point and clearly, the competitive strategy of the company should match with the SWOT analysis. As mentioned earlier not a lot of studies were conducted regarding FPSOs and thus, an exact SWOT analysis of FPSO application. However, among the available literature within the offshore oil and gas industry, some of the strengths, weakness, opportunities and treats that can be identified and might affect FPSO projects can be seen in the Table 1 below. Consequently, the below elements could set the frame of reference while conducting this research.

STRENGHTS	WEAKNESS
• Experienced business units/projects. • Talented people. • Strong growth in the demand of oil and gas. • Strong focus on safety, environment and operational standards. • Strong relationship between the company management and oil and gas companies.	• High loan rates are possible • Future competition • Technological challenges • Cost overruns
OPPORTUNITIES	**THREATS**
• Growth rates and profitability. • Global markets. • New products and services. • Growing demand. • Venture capital. • Growing economy. • Flexibility of the units.	• Government regulations. • Financial capacity. • Rising cost of raw materials. • Increasing rates of interest. • Growing competition and lower profitability. • Price changes. • Increasing costs. • Alternative energy resources. • Economic instability in the world at the moment.

Table 1: SWOT Analysis, Source: (Eide,2008)

2.3 Elements that influence FPSOs projects

There are many factors that can influence the FPSOs successful delivery and implementation followed by the successful technology advances and a framework with the most relevant factors should be examined as a frame of reference for the analysis of the empirical data. Firstly, a stakeholder framework is considered to be a major influential factor for success. This research is mainly interested in examining how do experts and different groups are interested in the

challenges and opportunities of FPSOs developing and what kind of frameworks they develop to addressed to potential challenges. Secondly, agreements in such big and complex projects are very important not only for understanding the rules and regulation, but also for being able to comply with the law and meet the legal obligations. Thirdly, health, safety and the environment are very important elements to be examined in order to realize whether the HSE guidelines for managing risks with FPSOs operations is less harmful than the operation of oil platforms. Lastly, cost and financial targets are mentioned, for having balance as scheduled when delivering the project.

2.3.1 Stakeholders

"A stakeholder in an organization is any group or individual who can affect or is affected by the achievement of the organisation's objectives".

(Freeman, 1984)

Freeman (1984), points that stakeholders are vital to the survival and the success of the corporation. In addition, within the years more definitions were developed to explain what a stakeholder is (see Table 2).

Definitions of Stakeholders	
Hill and Jones (1992)	*"Stakeholders are the constituents who have a legitimate claim on the firm".*
Clarkson (1995)	*"A stakeholder has some form of capital, either financial or human, at risk, and, therefore, has something to lose or gain depending on an organization's behavior".*
Stanford Research Institute (SRI 1963)	"*Stakeholders as those groups without whose support the organization would cease to exist".*

Table 2: Definitions of Stakeholders (Jacobsen, 2011).

The basic idea of the stakeholder theory is when executing a project, managers should take into consideration the interests and motivations of the persons, groups or entities that can affect or be affected by the project and similarly, to understand how the relationships between the business, customers, suppliers, employees and communities interact with each other to create value (see Figure 3). It is worth mentioning that no specific literature exists with regard to the major group of stakeholders that influence FPSOs and thus, after reading various reports and articles about FPSOs the major groups of stakeholders will be later analyzed for the purpose of this research, such as the employees who are responsible to plan and execute the project, the clients, the suppliers and the shipyards were the conversion of FPSO will take place. By having as a frame of reference the general stakeholder theory, as explained by Freeman (2010), the aim

is to explore how they interact with each other to create value to the organization's goals as well as to satisfy their own interests and expectations.

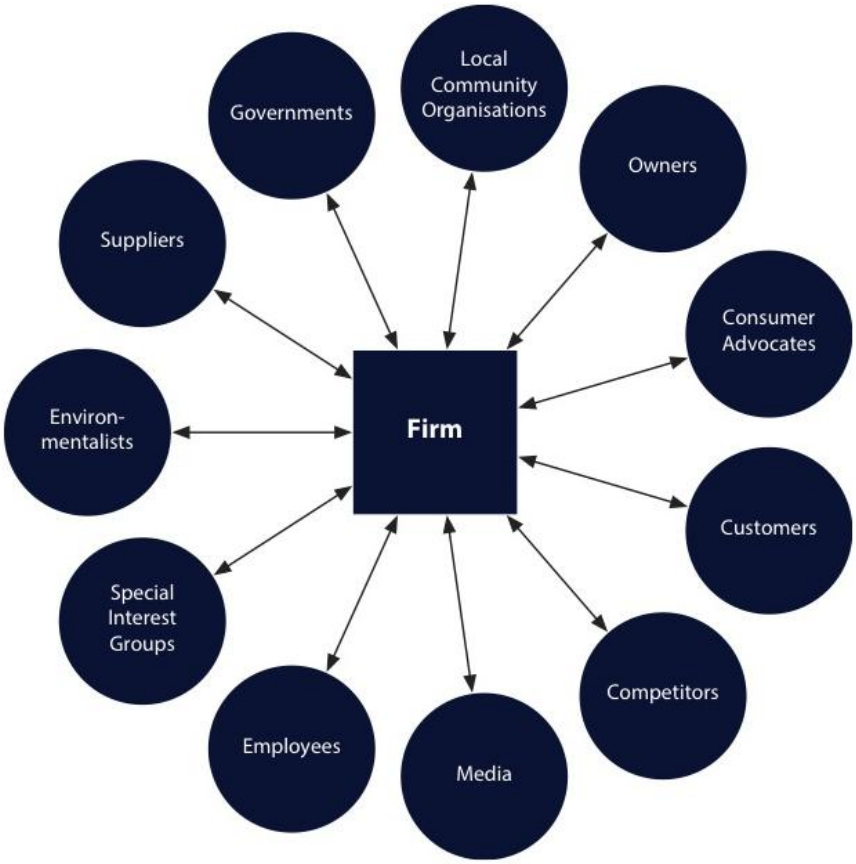

Figure 3: Stakeholder View of Firm, Source: Freeman, E. R. (1984).

A lot of changes are occurring not only in the internal environment of a company, but also in the external, therefore, the need for strategies and for dealing with each particular group are essential to understand their expectations. A point worth bearing in mind is the companies that might not take stakeholder analysis seriously since the identification of their economic payoff is not clearly identifiable (Freeman, 1984) and therefore, they should realize in advance the need to translate the demands of stakeholder groups into organizational objectives and procedures which will result in the required output for delivering FPSOs with success. The increase number of stakeholders depends on the complexity of the company's developments and the pressures from the outside environment and managers should always bear in mind that stakeholders have the power to be a threat or a benefit (Jakobsen, 2011). Although many of the stakeholder groups can act as an obstacle to the success of the business, Freeman (1984) argues that by being responsive to the needs of all these groups, a company will provide itself a competitive advantage in favor of their good and long term relationships. However, Yee (2013) mentions that by having a country

representative at the exact location of the project, it will be easier to handle the stakeholder's requests, to have meetings on a regular basis for the latest updates and to develop a framework followed by an agreement on common goals.

In complex development, such as FPSO responsibilities must be clarified accordingly and the selection of skilled personnel is vital. Human resources should have long experience in the field, should be trusted and motivated to work in teams (Longman, 2008). In case the company fails to understand how the experience of the personnel will contribute to the SOW the project will also fail since they are the ones to cover the execution line.

Moreover, for choosing the best shipyard to sign a contract with, there are some criteria that should be followed and when the contractor does not own a shipyard, the choice can be made by shipyard bidding offers (Maroulis, 2004). The fabrication shipyard should have operational integrity, equipped to accommodate FPSO projects among the wide range of projects that they offer, to ensure quality control and strict delivery schedules, management commitment, safety standards, assessing and controlling serious workplace hazards, identify and prevent conditions that might lead to accidents (Shipyard Industry Standards).

2.3.2 Regulations

Regulations influence the operations of FPSOs and according to the reading literature no clear regulation regarding FPSOs are available, as a result, it makes it complex for the companies attain their competitive advantage. The big question to be arise when introducing FPSOs is how are these developments going to be handled from law and regulation point of view (HFW, 2012). *Will FPSOs be treated as trading ships such as tankers and ships or as traditional oil platform installations?* It is vital that all the interested parties, such as owners, operators, insurers, financiers, governments to have a clear understanding of the legal and regulatory risks that are involved, even though their interests might differ. As a consequence of the complicated structure of FPSO been regarded both as a ship and an offshore platform and also because of its ability to be deployed in more than one place, it makes it difficult to define its multiple characteristics and thereafter to apply the proper regulations and laws (HFW, 2012). Even though, FPSO units might seem like ships in construction, they have an ongoing, but not permanently connected to the surface or to the seabed.

Bumiarmada (2014) statement clarifies that regulations are mainly referring to the concerns of safety of those who work in the offshore and associate with the facilities. In addition, to the

protection of the environment while processing oil and gas exploitation, to the harm by pollution, to licensing and permits, to the working conditions for employees on offshore facilities, to the integrity of the facilities to address various normal and abnormal situations in favor of the design and to the operating procedures and systems. It is well understood the complexity of the regulation and therefore, companies that lack of specialized human resource to handle regulatory compliances might confront difficult situations. According to Brown and Dean (1995) companies operating in difficult environments might consider cooperating with regulatory agencies in order to ensure that they comply fully with both regimes at the same time. In addition the need to take multiple regulatory approvals for projects like FPSOs implies the need for hiring employees with regulatory and legal experience in the offshore deepwater oil and gas industry to ensured that these concerns are low as practical, that the process is executed by capable people and that the systems remain as robust as initially designed (Bumiarmada, 2014).

2.3.3 HSE

Health, Safety and Environmental (HSE) Management is an essential element of the organizational culture (Høivik, 2009). Cameron et al (2006:4) points out that the purpose of HSE is to protect the health of the personnel from the risks that arise from work activities and to preserve the safe environment in which they work and live. Therefore, it is vital for the company to run all operations without injuries and without damage to equipment that might pollute the environment. Since the regulatory framework of the HSE has already been designed and stays unchanged, the big question is how the company will formulate and change its strategy to approach the HSE regulation of the industry as an effort to implement improvements in health and safety standards. Høivik (2009), points that a robust and dynamic HSE strategy should guide the company in order to execute appropriate action plans.

Many questions arise regarding the challenges around the FSPOs developments in comparison with the traditional oil platforms. However, the most important one is whether FPSOs are safer from the traditional platforms. Many researches that investigate the operational safety of FPSOs are being concerned about the frequency of collisions between a shuttle tanker and the FPSO in a tandem off loading configuration (Vinnem, 2013). The possibility of a collision between the two of them might lead in harmful for the environment pollution. Furthermore, fire and explosion hazards as well as serious accidents and potentials of minimizing major accidents should be beared in mind when executing an FPSO project and thus, determine whether this development is safer instead of an oil platform (Vinnem, 2013).

2.3.4 Cost and Finance

No matter how well the project management and schedule is adopted, the high costs involved in the project is of major consideration (Yee, 2013) especially when the exploration and production is moving into deepwater regions where there is luck of infrastructure and high costs are involved in mobilizing the drilling rigs. The theoretical literature and previous researches on cost overruns, even though they are insufficient, have shown that cost overruns mostly occur due to the imperfect designing techniques and due to the complexity of the project involving construction (PMI PMBOK Guide, 2008). Therefore, complex projects such as in deepwater oil and gas developments are more likely to encourage cost overruns.

In the meantime, when Financing an FPSO, two are the options that must be considered, equity and debt (corporate financing). When using the equity method of financing, a company issues shares of its stocks and receives money in return. In contrast, when using debt the company is borrowing money on credit with a promise to repay the amount borrowed plus interest and according to Damodaran it is the debt that is more likely to be chosen in complex projects as it is considered being of being cheaper.

In addition to the above mentioned, financing the FPSO project is crucial for the contractor in order to convert the FPSO and for the oil operator in order to lease or own the FPSO. For the oil company that introduces FPSO system in their offshore developments the issue whether to lease or buy an FPSO facility is of major importance. Their decision is being determined by crucial factors after examining their consequences and is mainly driven by economic aspects. According to the Figure 4 below, the majority of FPSO vendors prefers to lease (Dept) a unit instead of owning (equity) and operating one. When plenty of liquidity exists in the market the leased model is more preferred and this is because operators are able to access a lot of debt and leverage the project and the pricing on the debt very low (IQPC).

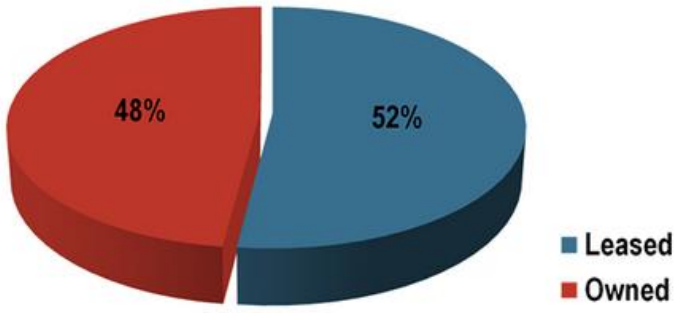

Figure 4: FPSO Ownership, Source: Offshore Magazine, Wood Group Mustang 2014.

FPSO developments are operating in an intensive industry that requires a large amount of capital expenditures (CAPEX). Despite these factors, most deepwater developments remain viable at current oil prices, therefore deepwater expenditure is expected to grow slowly for the next few years, with a rapid increase in 2016, and $260 billion to be spent in the period of 2014 until 2018 (see Figure: 5).

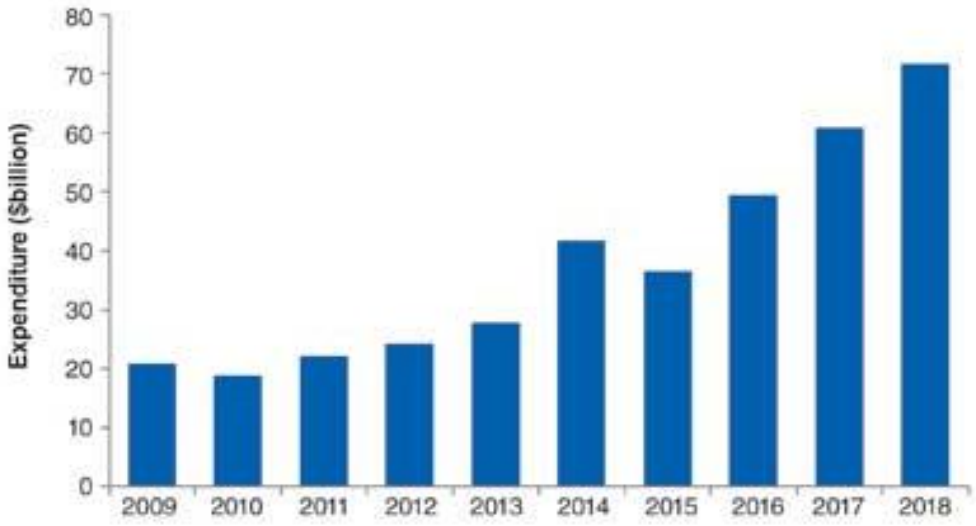

Figure 5: Global Deepwater CAPEX 2009-2018, Source Douglas - Westwood, World Deepwater Market Forecast.

In order to have better cost estimating, budgeting and controlling, a process of project cost management should arise to ensure the completion of the project on time and within budget (PMI PMBOK Guide, 2008). All in all, the financial reporting and progress analysis is incorporated in whole project and the Finance and Cost Management function is most likely to be a critical success factor for the FPSO conversion which will also affect the efforts of getting financing (Mierendorf, 2011).

2.4 Conclusion

When a new project is considered to be developed from a company, a further examination of the strategy and the project management process is needed in order to determine how this project can increase its credibility and be aligned with the company's objectives in order to ensure the desired output. The literature review has covered the Strategy, Project Management, SWOT analysis and Critical Success Factors disciplines and frameworks that will set the frame of reference for conducting this research. However, there is a lack of a relevant disciplines available upon the examination of the challenges and opportunities and their interactions for the efficient execution of FPSO projects. The identification of CSFs is without any doubt essential to ensure

that the FPSO projects is well focused and to avoid the implementation of unnecessary resources, to waste effort on less important areas and to determine the criteria upon the evaluation will be made (Denni-Fiberesima et al., 2010). The FPSO industry is also under the influence of differences in the working environment legislation affecting the profitability in the industry, followed by the absence of a clear and common international accepted legislation. It is also significant to review the best practices for managing HSE strategy in the FPSO developments for the safety not only of the employees but also for the environment. All in all, it is important to identify and evaluate the interfaces, how to combine environments and examine different aspects connected to the project due to the involvement of different elements in the projects, to determine the level of their importance and finally to develop an action plan to improve the interfaces and mitigate the project risks.

3 Methodology

Easterby-Smith et al. (2012:xv) describes methodology as a *"the way that research techniques and methods are grouped together to provide a coherent picture"*. This chapter will illuminate the rationale behind the methods for building the structure and the design of the research that is used to facilitate answering the research question. Throughout the research a consistent approach should be applied in order to relate the literature material to the research question.

Furthermore, this chapter will provide a synopsis of the exploratory design as the most appropriate to formulate this research. Similarly, it will introduce the strategies of data collection and explain how the gathered data will be analyzed for supporting the process of the research. Followed by a description of the decision criteria for choosing the participants. Lastly ethical considerations and the judgement of the qualitative research will be taken under consideration.

3.1 Research Design

A research design suggests how the research should be organized, including the ways of gathering data and all the ways that shall be performed in order to accomplish the research direction (Easterby-Smith et al., 2012). The research question of this thesis has been developed and according to Stebbins (2001), this will constitute the parameter that is going to determine the method that shall be used to formulate the research design. In addition, Booth et al. (2003), insist that research should be focused on finding the proper information, on evaluating its accuracy and on describing it clearly in order to clarify and solve the problem statement, while, Yin (2008), states that research design is not only the plan of the work but most important is to avoid gathering data that are not corresponding to the research question.

For the purpose of this research, it is vital to understand that an effective design that is question based must be developed. This means that the research question where the design should be based on must be firstly comprehended in order to answer a question or solve a problem (Easterby-Smith et al., 2012).

3.1.1 Social Constructivism

Epistemology, "*the theory of knowledge*" (Easterby-Smith et al., 2012), is the different ways that the knowledge can be acquired and therefore it will affect the epistemological perspectives of the research design. It is the philosophy *of* knowing, whereas a methodology is the approach *to* knowing. Within epistemology, there are two contrasting views, positivism and social constructivism. The distinction between these two views is essential for understanding the

reasons why a research is being conducted in a specific way. This represents contrasting ideas about truth, generalization and validity of findings (Easterby-Smith et al., 2012).

Positivism supports that the social world (reality) exists externally and its properties should be measured through objective methods and therefore there must be a clear separation between the researcher and the reality (Easterby-Smith et al., 2012). More clearly, the positivism starts with the assumption that the truth is out there and we need to grasp it through experiments (Lindberg, 2014). Concepts are firstly defined so they can be measured and the research is being developed through hypothesis and deductions (Easterby-Smith et al., 2012).

In contrast to the Positivism, the Social Constructivism sees the reality, not objective and exterior, but socially constructed and given meaning by people (Easterby-Smith et al., 2012). Dr. Lindberg stated in his lectures on March 2014 that individuals create meaning through interactions between people, their background and the environment they live. The researcher is being part of what is being observed while the human interests, feelings and experiences are the main drivers of science in pursuance of increasing the understanding of the situation.

In this research, a study of social constructivism that studies people shall be developed. The aim is to generate an understanding of project management principles that the managers follow and how they act in order to strengthen their strategy and the actions they perform to avoid wrong estimations. This implies that this research can be based on social constructivism focusing on a small number of participants, taking part in the process of collecting data, trying to understand the situation of each participant in order to provide a general understanding through the collected data.

3.1.2 Explorative Design

When choosing a research design, Stebbins (2001:43) states that a researcher should understand that the use of a meaningful description can enhance the understanding of findings, develop the theory and make the descriptive text more attractive both for the researcher and the reader.

An exploratory design is used when there are few studies related to the research problem which is about to be examined, therefore, not a lot of information is provided to rely upon and predict the outcome (Cuthill, 2002). The exploratory design is flexible and allows to form questions of all types such as what, why, how and provides insights in order to understand phenomena (Cuthill, 2002). For instance, it is possible to collect background information and clarify the

existing concepts or even define new terms. The idea of this method is to get a well grounded picture of the situation that is being developed, to generate new ideas and assumptions and to establish research priorities were previously had not been clearly defined (Easterby-Smith et al., 2012). It is well worth mentioning that the exploratory research process can use interviews that will reflect the experiences, comparisons and finally the results will be analyzed in an understandable way (Small, 1995).

Among a number of different research designs, the exploratory design seems to be the most appropriate for conducting this particular research. Firstly, because the researcher is involved in the investigation of the area of FPSO in which not sufficient knowledge is available and no clear research question has been previously developed about the opportunities and challenges of this technology solution. The purpose of the research is to collect all the necessary data, to understand the phenomenon as much as possible and to get new information and insights in order to develop the exploratory study. Also, it is focusing on a continuous collaboration between the researcher and the participant resulting from their mutual interests (Small, 1995).

3.2 Research Strategy

3.2.1 Qualitative Research Approach

In research methodology, there are two basic categories of designs that can be applied, quantitative research and qualitative research. Quantitative research reflects individual perspectives when a hypothesis is being developed and it must be tested in order to verify the proposed hypothesis, whereas qualitative research approach highlights the existence of a common reality in which people tend to agree (Newman et al., 1998:2).

The aim of the research is to describe and analyze the opportunities and challenges connected to the application of FPSO, how vessel contractors can reduce their costs and how they can enhance profitability by adding value through their functional specifications. Since the researcher is not perfectly aware of this matter and not a lot of information is being provided, a qualitative approach to conduct the research seems to be the most feasible. Such an approach should contribute to better insight decisions for grasping the meanings of the data, the context and to understand the perceptions of a small sample by maintaining their individuality in their analysis (Maxwell, 2008:221). Moreover, it will allow to examine through detail the background of each person in order to understand their behavior, the factors influencing their decision making and their plans when developing particular actions and events (Easterby-Smith et al., 2012).

Qualitative method is decidedly the most prevalent for collecting data from a smaller sample of participants in the form of interviews and thus, the most applicable to permit in depth investigation of the phenomenon.

3.3 Data Collection

Data collection is the process of how to gather the information that will be used in the research (Maxwell, 2008:2). The main methods of collecting qualitative data are the interviews, focus groups and observations. According to Booth (2008), despite the methods that the researcher is choosing to focus on, all of them are meaningless and impractical until the moment they are used to support a specific and significant claim that answers the research question. Therefore, this implies the importance of understanding that the development of a good data collection plan requires creativity and not a mechanical translation of the research questions into methods (Maxwell, 2008:236).

This specific research collects both primary and secondary data. In addition, it is expected to use different methods of gathering all the necessary info and each resource is expected to present different results. Primary data collection in this research is based on interviews, while secondary data source information is based on documented research on the industry, scientific articles, reports from the companies, books, conference and lecture presentations.

3.3.1 Primary Data

Primary data are being collected directly by the researcher and according to Easterby-Smith et al. (2012) this tends to provide new insights and greater confidence in the outcomes of the research. Therefore, primary data collect relevant information with regards to the research study and provide better control. The participants are the most important source of information for the research so the quality and accuracy of the data was of major importance and undoubtedly the interviews provided with valuable information.

It is important to bear in mind that a lot of difficulties and challenges had to be faced while conducting the primary data collection. Firstly, it was time consuming since the relevant information had to be gathered directly with face to face interviews and secondly, the access to relevant participants for conducting interviews was quite challenging especially when participants were approached without any previous relationship. After contacting with few Project Managers in the offshore oil and gas, it was understood that they were quite skeptical whether to participate or not because as they replied, their companies do not provide support to the

students. Therefore, due to time and location constrains available managers that are not directly linked with FPSOs but have a long experience in the offshore oil industry as well as well aware of the FPSOs opportunities and challenges were asked to provide basic information and not project details since it was understood it is confidential. In order to provide motives for the participation of the potential informants and as an attempt to facilitate the process I agreed to keep their anonymity when developing the research. Thus, as an effort to ensure their confidentiality interviews were transcribed and then each participant was coded.

One of the interviews was conducted by the phone and some difficulties occurred, such as the time difference (since the researcher and the interview were in different parts of the world), poor call quality and misunderstandings due to the lack of control since the interviewee reactions, gestures and facial expressions were not able to be observed. It is worth mentioning that the questions via telephone were less complex due to the concerns about the participant to hang up the phone in longer conversations. All these could possibly lead to collect and analyze incorrect information and a brief rather than detailed data collection.

The procedure started by inviting these people to participate in the interview while explaining the purpose. In case of acceptance, the next step was to arrange the date and the time and to ensure the confidentiality of the process. To ensure that the interviewees will be better prepared and give relevant information during the interview, an interview sample was sent in advance. At the end, a gentle notice was given to the participants that there is a possibility of contacting them back in case some of the information given is unclear during the process of data analysis and as an effort to maintain an ongoing communication.

Among a variety of interview types such as highly structured, semi structured and unstructured, semi structure type of interviews is considered to be the most appropriate with regard to the research design. The interview includes a series of open ended questions based on the topic, allowing to discuss some topics in more detail. Semi-structured interviews have also been chosen for this research because of their level of confidentiality in one to one situation (Easterby Smith et al., 2012). Offshore oil and gas is a constantly changing industry and due to its dynamics, it is very often that the managers are not willing to share information that is considered to be confidential. This flexibility of semi-structured interviews allowed the creation of additional questions in order to provide further clarification of the discussed topic and investigation in depth. Therefore, this resulted in having control and ensuring a great

understanding of the topic. All in all, with great surprise it was realized that all the participants were feeling comfortable sharing their experiences and knowledge.

3.3.2 Secondary Data

Very often the use of secondary data has been very crucial and for this particular research it is very important to support the explorative design. Secondary data already exist from private or public reports, documents, articles and published literature. Thus, there is no doubt that the secondary method provides crucial support for the research project. In this research an effort to explore relationships and patterns within this existing data is being made as Easterby-Smith et al. (2012) suggests. In addition, the research study should be related to the existing data, should provide the opportunity for further investigation and should be built on what has been done before (Easterby Smith et al., 2012).

Brodeur et al. (2011) insist that there is no doubt that some risks might occur while using secondary data, therefore, this research was essential to firstly answer some questions:

- *Are the data up to date?*
- *Is there a logical relationship between the secondary data and the primary data?*
- *Are the objectives, goals, and nature of the primary and secondary data the same?*
- *Is there enough data to provide me with the background information and make it useful as an extra source?*
- *Is the secondary available for public use?* - Sometimes payments are required to grant permissions to view reports.

The secondary data used in most of this research parts are journal articles, books, reports from business forums and organizational charts regarding the company's project management methodology. In addition, the use of scientific articles surmounted the use of books as the researcher's point of view is that scientific article can provide the latest and more concrete information. Moreover, in order to gain further understanding of the offshore oil and gas industry some books were read in advance. It is important to mention that after my request to participate online in the FPSO Network, the analysis of notes and presentations from the FPSO Euro Congress, February 2015, were the most crucial and influential for the research. The information provided by using this method was helpful to develop background knowledge and assisted in building a stronger foundation in FPSO knowledge. Also, it was helpful for the creation of the interview guide as a primary method of data collection.

3.3.3 Participants

By talking to different it will decisively contribute to the analysis and development of the frame of reference that was developed in chapter 2. Participants with expert knowledge of the area under considerations are preferred (Dick, 2000) for conducting interviews and therefore, the first step was to determine who has substantial and extensive experience in the field of the FPSO or in oil offshore industry. To make it more clearly some questions were asked before formulating the interview guide.

How to conduct a successful interview?

Who is the most appropriate to share the relevant information?

Who has extensive experience in that field?

The decision was that the most appropriate participants would mainly be project managers from the oil and gas industry in the field of technology/ engineering services and more specifically from global owners and operators of the FPSO. The Participants are being described below:

Table 3: Respondents Data

Respondents Data					
Code	Company's Nature of Business	Work Base	Title of Position	Years of experience	Description
P1	EPC Company	Norway Russia Canada	Vice President	40	Experience in the construction of offshore facilities. He is working at the Business Development Department of the particular EPC Company. He has a long experience as an engineer in the construction and conversion of floating facilities working for major Norwegian companies.
P2	Oil operator	Russia Italy	Operations Manager	23	He has been directly involved in major oil developments in various locations worldwide.
P3	Oil and Gas Contractor Company	Russia Brazil Gulf of Mexico Singapore	Offshore Project Manager	11	Directly involved in offshore and FPSO developments. He has been responsible for the development of design, FEED, specifications, contract negotiations for the conversion of three FPSOs.
A.Z.	Gubkin University	Russia	Petroleum Industry	50	A long experience in the oil industry not only as a professor in oil engineering research, but also as a project manager in major Russian projects.

3.4 Data Analysis

Maxwell (2008:234) claims that data analysis is how you handle the gathered information to make sense of it. The analysis of the data for this research was a time consuming process that led to frustration when handling the huge amount of information. In order to simplify the process for the collected material, the combination of *meaning condensation* and *meaning categorization* were used as an approach to analyze the interviews (Kvale et al., 2009). The purpose of the meaning of condensation is to reduce the lengthy statements given by the participants to shorter formulation and to rephrase in few words (Kvale et al., 2009). Meaning categorization implies the use of categories in order to classify the findings (Kvale et al., 2009) and support a better analysis.

The evidence from interviews were recorded and then transcribed into written text. Data were transcribed in a text form without using software and despite the large amount of information and the time that was spend it was considered to be manageable. The benefit of recording is the ability to save and archive the evidence for closer view later (Salmons, 2012). There is no doubt that this procedure allowed me to focus on the questions and familiarize with the responses at the time of the interview. It is worth mentioning that the choice of a recording method was considered in advance in order to minimize the possibilities of error. Moreover, having the data collected from the interview transcribed as soon as possible was considered to be essential for resulting accurate results. The importance of this procedure was realized after previous experience, where data had been transcribed later and not all of the information and meanings were fully remembered by the researcher.

Furthermore, the main topics from the transcriptions were identified as well as potential subthemes and also key sentences. While categorizing the data there was also the possibility to discover more potential aspects for analyzing (Taylor -Powell et al., 2003) and therefore, two documents were created in order to maintain better categorization. Firstly, one folder, including all the relevant topics that aimed to be covered and another one for keeping what is left. After creating all these categories, some patterns and connections were identified as Taylor -Powell et al. (2003) suggest, helping to interpret the data by identifying the relevant details and the meanings of the richest descriptions. As for the secondary data, the challenges involved in archiving the large amount of reports, articles and documents were significant, mainly because a lot of them were provided on the web. *Systematic Text Condensation* (Malterud, 2012) was used in this research as a strategy for analysis the wide range of secondary data collected, such as articles, texts and documents. The basic steps of the systematic text condensation were used to decrease

the chaos of information converting them to themes, identifying and sorting meanings from themes to codes and then identifying the relevant codes as the major topics that were later discussed (Malterud, 2012). At the end a large amount of unnecessary information was gathered and as a result, it reduced the amount of data that were necessary to be managed.

3.5 Ethical Considerations

It is vital for an ethical researcher to ensure that all the collected data will be used only for the purposes of the research (Salmons, 2012). Therefore, Easterby-Smith et al. (2012) identify ten principles of ethical practice. Firstly, when a participant agrees to take part in the interview process, there is always the risk of ruining his reputation after giving his personal thoughts on the particular topic. Thus, during this research the researcher was aware of the obligation to protect the participant's ***anonymity*** as an effort to respect their voluntary participation and since they wished their anonymity in order to protect the confidential information given, I was obligated to ensure the ***confidentiality*** of the research data. In addition, the ***dignity*** of the informants was respected.

Moreover, as Easterby-Smith et al (2012) suggest when approaching a potential participant, the researcher must ensure a fully ***informed concept.*** This was achieved by sending emails before the interview as an effort to clarify the research topic and explain the purpose of the research. In addition, following the key principle of a fully informed concept, the potential participants were informed that the interview will be recorded and will be later transcribed.

It is worth mentioning that an effort to develop my knowledge about the FPSO concept was considered in advance, as an attempt to avoid any ***misleading*** or false reporting of the research findings while reproducing the participant's opinions. Easterby-Smith et al.(2012) suggest that a common cause of ethical challenge is the ***conflict of interest*** between the researcher and the participant. When conducting the interviews in this research no such issue was faced since this research was not supported or funded by a specific organization and therefore, no declaration of affiliations (Easterby-Smith et al.:2012) was needed.

Lastly, ***honesty and transparency*** in communicating about research was finally achieved since the data analysis was performed in a way to assure accuracy when interpreting participant's statements. All the participants had the opportunity to make suggestions for improvements and at the end to approve all the data that should have been included in this research before

publishing it. It was with quite a pleasure to realize that none of them had disapproved the way that the given material was handled.

3.6 Judging Qualitative Research

According to Easterby-Smith et al. (2012) validity is the extent to which the research findings provide accurate representation of the things they are supposed to be describing. Therefore, it is important to establish well structured interview questions in order to avoid confusion and errors while elaborating the data and thus, to lead in a weak validity-credibility.

Even though many researchers have attempted to respond to issues of validity and reliability in their qualitative research, other researchers such as Guba and Lincoln, strongly support that the trustworthiness of qualitative research cannot be addressed in the same way as in quantitative (Shenton, 2003) and hereby, they prefer to use a different terminology. Guba and Lincoln (1994) support that all research must have "truth value", "applicability", "consistency" and "neutrality" in order to be valid. However, they strongly support that different criteria between a quantitative (rationalistic) research and qualitative (naturalistic) research must be addressed in order to check that trustworthiness. For instance, while applying the traditional criteria for judging in quantitative research, Guba and Lincoln (1994) suggest alternative criteria that should be considered by qualitative researchers with the aim to pursue a trustworthy study. These proposed criteria are listed below:

Traditional Criteria for Judging Quantitative Research		**Alternative Criteria for Judging Qualitative Research (Guba and Lincoln)**
Internal Validity	*vs.*	*Credibility*
External Validity	*vs.*	*Transferability*
Reliability	*vs.*	*Dependability*
Objectivity	*vs.*	*Confirmability*

Table 4: Comparison of criteria for judging the quality of quantitative versus qualitative research

After reading different scientific articles addressing to the concept of Validity and Reliability, the for the purpose of this project, it was decided to employ Guba's and Lincoln's criteria. As mentioned in the previous part, qualitative research uses a naturalistic approach that seeks to understand phenomena in contrast with the quantitative method that uses experimental

methods to measure and test hypothetical generalizations (Hoepfl, 1997). Consequently, their outcome should require not only different type of generating knowledge (Morse et al., 2002) but also a different set of criteria that are comparable to a quantitative research.

In this research, Hoepfl's (1997) suggestion was followed, to maintain an ongoing communication with the participants in cases where something was not well understood in order to well establish all the data. As an effort to ensure the credibility of the findings and to get honest information, it was indicated to the participants that there are no right answers to the question. In this research transferability is being achieved by providing sufficient content that can be transferred to a new situation beyond this project. As Guba and Lincoln (1985) suggest, in order to ensure dependability and confirmability the data collected were double checked in order to ensure they follow the theoretical framework as glasses and that any form of data change will not affect the research.

3.7 Summary

This chapter describes the research methodology, explained the choice of participants and represent the procedures for collecting and analyzing the data. In order to answer the research question a qualitative approach was chosen, providing a large amount of information for enhancing the researcher's and the reader's knowledge. However, the decision to use qualitative methods was carefully considered since it is costly, time consuming and facing the risk of unsuccessful interpretation of the data. The exploratory design seems to be the most appropriate as a means to acquire depth knowledge for conducting this particular research and strength the conclusions. Needless to say that the researcher is responsible to develop its knowledge and gain full understanding of the topic that is being examined before conducting semi-structured interviews and ensure a correct and accurate interpretation of what is being observed. In this research the consideration of practicing unethical research in order to obtain data was prevented. Lastly, the main principles of credibility, transferability, dependability and confirmability were taken under consideration for checking the trustworthiness of the research instead of using the traditional criteria that might be more suitable for a quantitative analysis.

4 Empirical Data

In the previous chapter a description of the procedure to find the relevant material in order to understand FPSO as a technical solution was provided. Then, the next step is to develop knowledge by talking to different people and lastly to analyze and develop more the frame of reference that was developed in chapter 2. The aim of this Chapter is to present the relevant findings from the data collection, including interviews and the reading documents by using as a frame of reference the theoretical framework that has been previously described.. The secondary data that have been collected and described in this section are based from the company's reports, earlier studies, articles and presentations from the annual FPSO Congress. The information of the primary data is obtained from interviews from different experts. The first part provides an understanding of what FPSO is and the market trends. The chapter is followed by the discovery of a successful framework of project management and by the identification of the major applicable elements which constitute the areas that determine the success of FPSO project. All these topics are being discussed according to the data collection both in view of the opportunities and challenges. Furthermore, possible solutions are being discussed in order to overcome the threats and how the interested parties of the offshore oil industry, including manufacturers, analysts, investors, academics and oil operators embrace the introduction of the FPSO. The chapter is completed by a descriptive conclusion.

4.1 Floating Production Units

At the start of oil production in the offshore locations, oil platforms were built and anchored directly onto the seabed supporting the processes of oil extraction. Even though the offshore oil and gas industry begun more than seven decades ago, it continues to grow (GE, 2010) due to the new challenges that have emerged mainly because of the difficult environment that the offshore facilities have to operate under and the increasing production expectations (GE, 2010). In addition, as the oil reserves in shallow waters are declining and oil production is moving into deeper waters incurring greater risks, has led the development of different floating production solutions and in nowadays two major offshore facilities can be classified in the offshore Industry, the traditional oil and gas platforms and the floating production systems. According to Prosafe Production there are four main types of floating production units (see Figure 6):

- **FPSO**: Floating production, storage and offloading unit. Vessels equipped to lift process and store oil, as well as offloading possibilities.
- **FLNG**: Floating Liquefied Gas Units. It is a water-based liquefied natural gas (LNG) operation employing technologies designed to enable the development of offshore natural gas resources.

- **Production semis**: Semi submersible rigs that vary greatly in size and complexity.
- **Spar platforms**: The platform consists of a large cylinder supporting a typical platform. The large cylinder serves to stabilize the platform in the water.
- **TLP**: Tension leg platforms that are permanently moored by means of tethers or tendons grouped at each of the structure's corners. A group of tethers is called a tension leg.

	Main characteristics	Potential drawback	Main geographical areas
FPSO 	• Storage capacity • Deck area • Deepwater capabilities • Redeployment possible	• Riser quantity limited • High-cost risers • No access to wells	• West Africa • Brazil • North Sea
Semi 	• Drilling capabilities • Riser quantity • Favourable motion characteristics • Deck area	• High-cost risers • Well access limited • Limitations on deck load • Storage capacity	• Brazil • North Sea • US Gulf of Mexico
Spar 	• Drilling capabilities • Steel risers • Deepwater capabilities • Access to wells	• No harsh environments capabilities • Riser quantity limited • Limitations on deck load • Storage capacity	• US Gulf of Mexico
TLP 	• Drilling capabilities • Steel risers • Access to wells • Past achievements	• High-cost design • No deepwater capabilities • Limitations on deck load • Storage capacity	• US Gulf of Mexico • West Africa

Figure 6: Overview of different floating production units. Source: Prosafe Production (2008).

This research considers FPSO units, the most promising type of floating systems, as a competitive solution to be considered for the development of offshore fields that are facing challenging environments. The FPSO industry contractors are continually searching for new markets and therefore, the oil and gas companies are proactively willing to embrace new technologies (Dutta, 2015) as an effort to reduce the risks and increase their profitability from

the new challenging fields. There is no doubt that the oil and gas industry relies on technology and thus, technology is constantly moving forward. The Oil and Gas industry invest a respective amount of money in technology, whether it is for introducing new technology, or for maintaining and upgrading the existing technological assets (Dutta, 2015). There are a lot of different project management methodologies to set up a successful framework in order to prevent the failure of the FPSO projects. However, a lot of companies fail in setting up strategic frameworks in order to meet the critical success factors, face the challenges and combine the different aspects connected to an FPSO project that will enhance profitability (Harri, 2015). A great example is the first installed FPSO unit installed in the Goliat field, at the northern - most offshore development in the world, in the Barents Sea, which is expected to start its operations in the summer of 2015 after delays in the fabrication and thereafter in the production (Harris, 2015). Consequently, the phenomenon of how to produce, store and offload the oil and gas by using FPSO units is becoming more crucial to discuss.

4.1.1 What is an FPSO?

An FPSO is a floating production storage and offloading vessel and is one of a range of floating systems used by oil and gas companies in order to process and store hydrocarbons. FPSO vessel usually is a converted traditional oil tanker that provides processing equipment and storage facilities for the produced hydrocarbons similar to what would have been installed in an oil platform that is known as the "topside". Hence, it is popular for its major advantage of being a adaptable platform, meaning that it can be easily relocated and installed to neighboring platforms, once an existing field has been depleted (OGP, 2006).

After processing the hydrocarbons, the crude oil is stored until it is offloaded to shuttle tankers or the processed oil is transmitted via pipelines. The procedure of loading the oil from the FPSO to the shuttle tanker is known as *tandem loading,* and provides easy transportation of oil to tankers or pipelines. However, gas is mainly transferred to shore through pipelines or re-injected into the field to expand production (CCSL). FPSOs are usually moored permanently at a specific location and it is worth mentioning that their mooring system allows the vessel to be anchored to multiple positions on the sea floor (Dutta, 2015), preventing a potential movement of the tanker (see Figure 7). In addition, FPSOs can easily be detached from the moorings in case of extreme weather conditions.

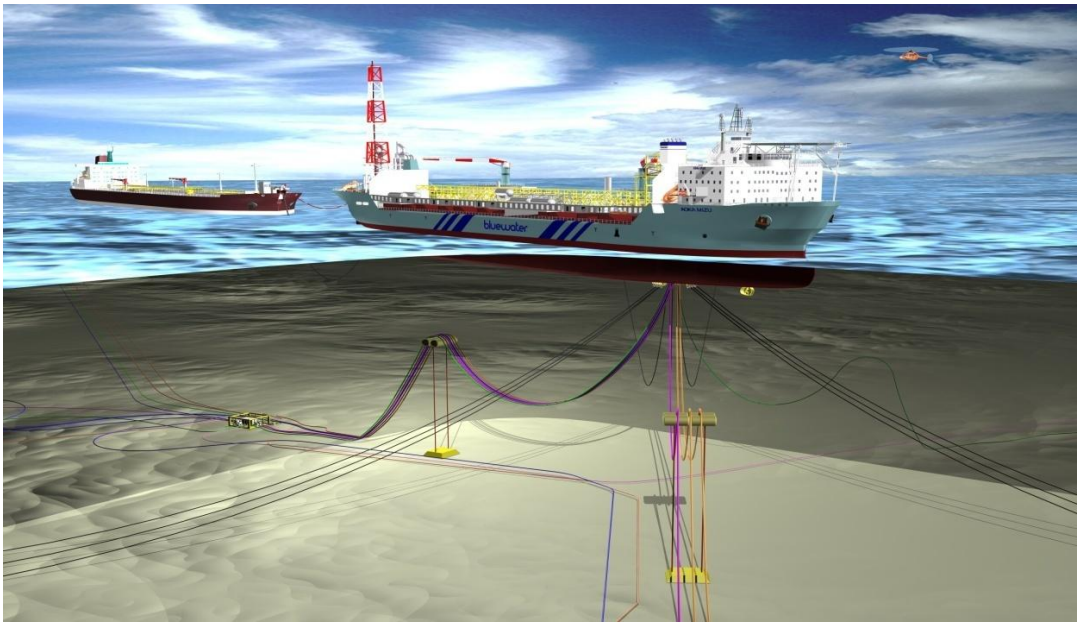

Figure 7: Field Production and Moorings, Source: (Dutta, 2015).

History data are going back in the late 1970's when FPSO unit came into use for first time, at the same time when the exploration of oil and gas moved to deeper waters. The first FPSO was installed by Shell in Castellon field in Spain, while, the Terra Nova oil and gas field, operated by Petro - Canada, is the first harsh environment development in North America to use FPSO vessels. At the moment there are approximately 190 FPSOs in commission around the world and more than 170 are actively operating in the fields (IQPC). Since then, its use has proven to be safe and reliable (OGP, 2006). FPSOs can carry 1000 tones of topsides equipment over its large deck supporting around 100.000 barrels per day oil production.

4.1.2 The FPSO Industry

The overall floating production market has displayed a strong growth with a compounded rate of 10% around the last 10 years with the largest markets operating in the North Sea, Latin America, North America and Asia Pacific (Eide, 2008). It is noteworthy to mention that global demand is expected to double this decade, 127 of the planned 200 projects in the next years are expected to use FPSOs (CCSL). As the emerging economies continue to grow at a high speed, a growth in energy demand is also increasing and therefore oil demand is expected to follow (IEA, 2013). China accounts for about 71% of the global energy consumption growth. In the meantime, the easily accessible oil projects have come to an end, and now the operators have to invest for effective solutions in a cost efficient manner they can benefit from. Therefore, the future oil and gas developments might lead to FPSO applications at a higher level.

Despite all the economic uncertainties, the growth of FPSO seems to continue, demonstrating an extensive amount of growth in the oil and gas offshore. However, statistical data show that a lot of companies in the FPSO sector believe that FLNG is going to emerge in the upcoming years (IQPC, 2013) due to the composition of the energy mix and (IEA, 2013) the effort of the companies to diversify their energy supply (see Figure 8).

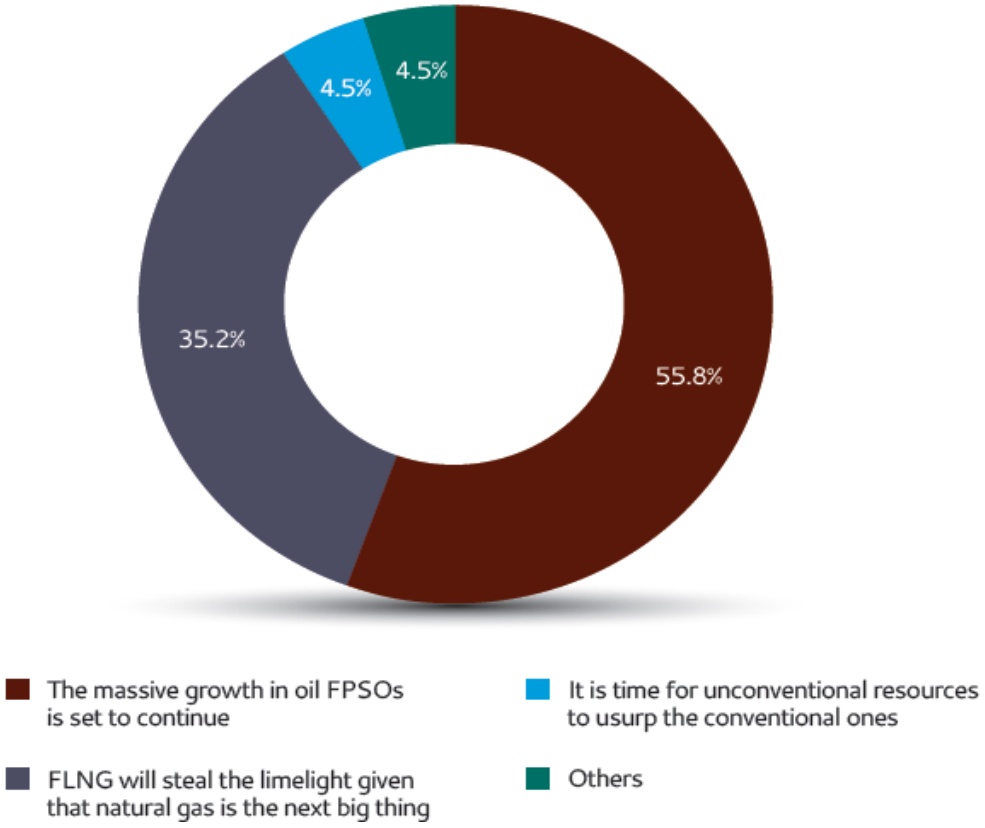

Figure 8: FPSO Network Survey 2013, Source: IQPC.

It is worth noting that according to the Floating Production Systems Outlook Report, Energy Maritime Associates (EMA), in 2014, 10 FPSOs contracts were awarded despite the decline in the oil and gas prices over the past months, with Singaporean yards to have received the largest amount of contracts. 11 FPSOs units were delivered, mostly in Asia and Brazil while 4 FPSOs were decommissioned. Among all the types of floating production systems, FPSOs are expected to remain as the largest category 45% in the orders and to hold 60% of the capital expenditure (see Figure 9).

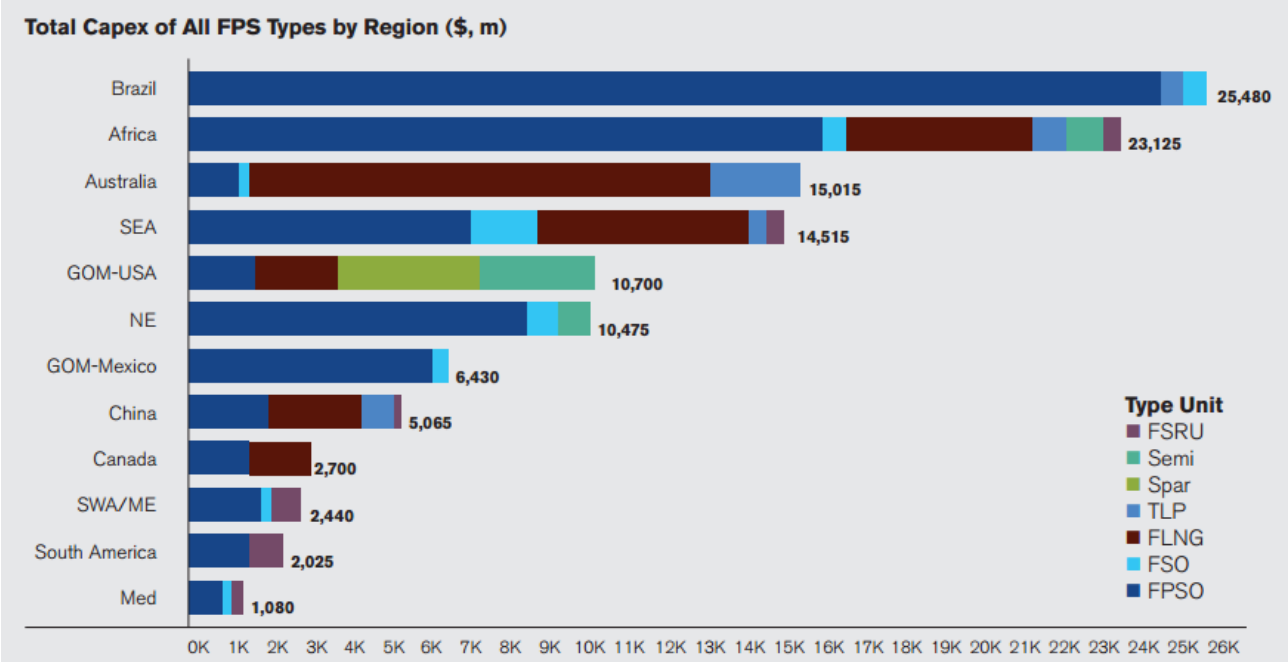

Figure 9: Total Capex of all FPS types by region ($,m), Source: EMA:2014

4.1.3 Is FPSO growth for real?

The findings from the MODEC's report shows that despite all the promising numbers, there might be a possibility of not having a large number of FPSOs projects to be developed in 2015. EMA's Managing Director David Boggs, points out that "*a great deal of corporate restricting and asset sales is expected*". Nonetheless, after this pause in 2015, the project activity of FPSOs is expected to increase in 2016 (see Figure 10) even at higher levels than the ones in 2014.

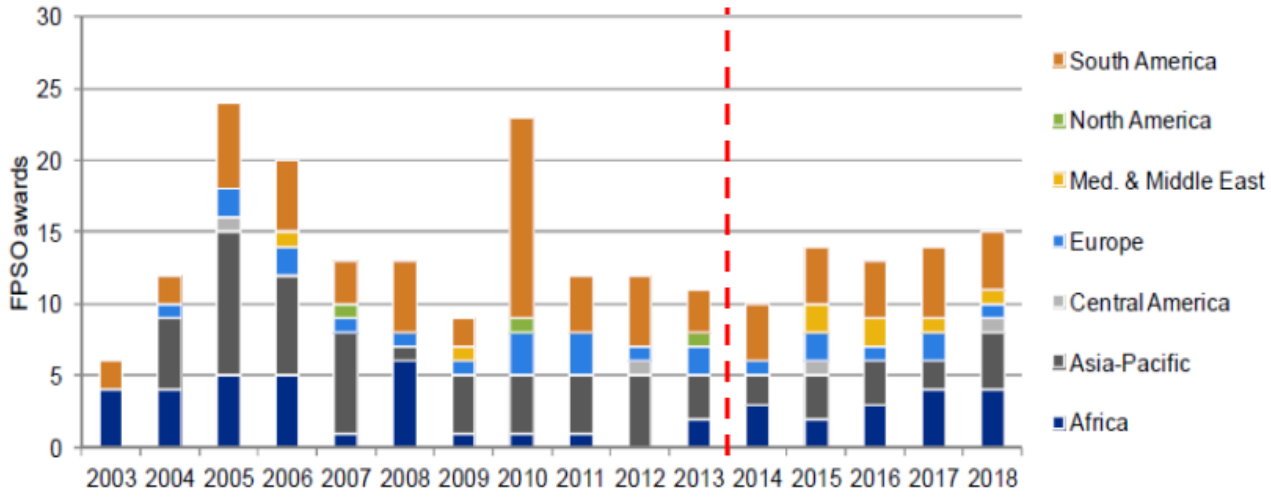

Figure 10: Historical and forecast FPSO awards (n,$), Source: Modec (2014).

Jerry Joynson, Director of Proposals & technology Development at SBM Offshore, during the FPSO Congress explained the dynamics in the FPSO industry.

> "The numbers of oil production are significant, with an increase in offshore production from 21 to 27 million b/d between 2008 and 2013. This trend is continuing, which adds up to a lot of new facilities required. The major growth opportunity is in deeper water which guarantees a healthy demand for floating production solutions for quite some time. And around 60% of those are predicted to be FPSO projects, both new-build and conversions" (Joyson, 2015).

Despite the crucial numbers for 2015, the participants at the FPSO Congress in February 2015 pointed out that the sector in favor of FPSO market will remain *"Lively and Vibrant"*. Orders are expected to increase as the number of projects that depending upon FPSO solutions is rising.

> "Strategic partners at the shipyards, robust relationships with the oil operators, proven execution capabilities, engineering skill set and balance sheet strength", are the key elements for underlying the demand growth of FPSO" (Joyson, 2015).

4.1.4 FPSO Major Advantages and Opportunities

The most important question to ask is: *Why the oil and gas industries prefer FPSOs?* Focusing on the opportunities of FPSO developments the participants confirmed our literature findings by focusing on the below the drivers for the use of FPSO units:

- Advances in FPSO and subsea production system technology, quicker time of production.
- A very good safety performance record, economic viability, decreased time for conversion and cost.
- Reduced upfront investment as well as abandonment costs and higher residual value
- The ability of relocating the FPSO to another location and be used in another oil production projects.
- FPSOs are more environmentally friendly than the fixed oil platforms.
- They eliminate the need for costly underwater infrastructure.
- The flexibility of the FPSO and easier decommissioning. Abandonment costs are significantly less than for fixed platforms.
- Technical solution for oil production from small, inaccessible, uneconomical viable reserves for supporting the construction of an oil fixed platform.

According to IQPC (2013), in comparison with other floating systems the turnaround and the process of completing the conversion of an FPSO unit can be relatively short, whereas a semi-submersible oil rig needs an average of four years to be prepared and a jack-up rig around three years. The big advantage of FPSO is that it could take only a year for its establishment or even less if a tanker is going to be mortified into FPSO.

The participant P2 agreed with the literature findings that one of the biggest advantages of FPSO is that there is no need to start its life as a unit of production, storage and offloading. For instance, the first ever floating production, storage and offloading unit, BP's Castellon, was an oil tanker in a former life, and many of today's FPSOs are also vessels that have been converted from transporters to a producer of hydrocarbons (IQPC, 2013). This way of converting existing assets can lead to cost saving benefits. However, participant P2 explained that problems with the engineering design might occur due to the strict regulations.

A great advantage appointed by the participant P3 is that due to the ability of FPSOs to be moving units it allows them to navigate away from potentially harsh weather conditions. In consequence, FPSOs have a strong advantage over permanent installations, particularly areas with strong hurricane activity zones like the South China Sea and icy waters around the Arctic Circle (IQPC, 2013). Also, their ability to move easily from field to field, it can be a great solution for fields where the reserves are depleted to the next field. This element supported by all the participants confirms our findings from the literature review, where the relocation is a major advantage because it minimizes costs and adds value to the whole FPSO project.

A question that arises is why the abandonment costs are significantly less than for fixed platforms? Participant P1 explained:

> "When a drilling well is economically unviable due to the lack of sufficient amount of hydrocarbons or due to depletion, then the removal of equipment and any environmental cleanup that has to be done before the well can be abandoned could reach a huge amount of money".

An FPSO can considerably minimize this expenditure since no permanent infrastructure has to be included. Also, a great advantage is that when using FPSOs there is no need for building costly oil pipelines for oil transportation.

Safety and maintenance when using fixed structures, especially in harsh climates and rough waters can raise not only risks but also costs. FPSOs can be operated by smaller crews and this allows better control (IQPC, 2013). In addition, the participant P1 believes that the ability of FPSO to avoid extreme weather conditions and its ability to approach a pier for regular repair and inspections could be a solution for urgent maintenance issues and technical inspections due to unexpected challenges.

4.2 Description of challenges and opportunities

In this subchapter a synopsis of the most relevant insights that the participants provided us with from oil companies and contractors are being mentioned as an effort to understand their importance during the project planning, development and execution of FPSO development. While in the next chapters the answers will be analyzed and discussed in accordance with the frame of reference.

4.2.1 Project Management

The question that arises during the project management is what frameworks and directions should be followed in order to successfully deliver an FPSO project and what are the major CSF to determine the challenged and opportunities during the planning, scheduling, controlling and execution of the FPSO unit. In addition, the participant P3 argued that despite the development of a project management framework in advance that will lead the project to the right directions, it is still more likely to find cost overruns and difficult issues to deal with depending on the situation,

> "When you have a new built project, it is very difficult to develop a robust schedule and follow it. But when it comes to FPSO, conversion jobs have a sequence that must be followed during the construction and it can be adapted to overcome delays".

In addition, participant P2 gave his reason why planning and schedule should be the main reasons to drive the success,

> "Schedule is always the main driving force for the success. For example, if not too much attention will be paid to the schedule, then a lot of cost overruns will occur followed by extending project durations. But if the schedule becomes the main driver then also costs will increase due to the fact that there are other risks that might be developed during the conversion".

According to the participant P2, a detail predictability of FPSOs engineering costs and schedule is one of the major indicators to show the overall project performance. The oil company C2

follows the Project Execution Plan (PEP) to define the best approach to follow when executing a project. Before developing the project plan the PEP answers the following questions:

- Who will participate in the project?
- When will they participate?
- What roles will they take?
- How will the project be contracted, sequenced, managed and controlled?
- When will phase transitions and specific activities take place?

According to P2,

> "PEP is very important in the interest of providing helpful guidance when selecting the most efficient approach to execution in terms of sequencing and timing, selecting the right staff and planning the resource requirements, selecting the contracting approach and procurement plan that best supports the staff, objectives and comes with strategy alignment".

Participant P2 believes that by inspecting all the departments from the beginning, it can prevent over costs and getting out of schedule. With regard to these factors, he claims that different outcomes will occur and therefore, a scoring system is provided in order to identify how strong or aggressive is the project planning,

> "When the score is low, it shows a "threatening" score meaning that the schedule is not appropriate in favor of the company's capabilities in terms of technology, process, size, capacity and cost. Therefore, it is better not to proceed with the execution at this point or re-examine the possibility of building a stronger project plan".

Moreover, participant P1 gave a brief presentation of the project management framework that his company follows with the name "Proekt". He mentioned that firstly all the approvals for technical, regulatory process must be earned, for example the FEED, which is important for getting the Plan for Development and Operation (PDO) as well as the State Environmental Expert Review (SEER). All these along with the feasibility studies, detail engineering and construction they compose the Proekt and the conversion of the FPSO can be executed only after having the Proekt. It is important to mention that all stages need the approval of the senior management in order to move to the next phase and employees need to understand what exactly they are doing in each phase for the good flow of information.

It is worth mentioning a brilliant example of project success that P1 suggests that all contractors should pay more attention in executing strategies like this,

"A great example is the Design One Built Two, ExxonMobil's strategy, which is proved to be very successful in managing properly and executing FPSOs. It reduces the project cycle time and cost. Delivery of the equipment to the yards can reduce the cost more than 10%. Discounts could be also offered when repeating the construction contracts to new projects".

Design One Built Two is a process where the key project conditions were identified from previous projects and when executing a new FPSO the same should be followed. For example the same engineering designs, fabrication contractors, yards, suppliers, project teams, management systems, familiarity with the scope of work. However, some differences like the location, safety standards and align the expectations of the client while the conversion of FPSO is taking place, should be adjusted accordingly.

With respect the different project frameworks that the companies develop for their success, EPC Company represented by the participant P1 follows the Project Execution Model, PEM (see Figure 11).

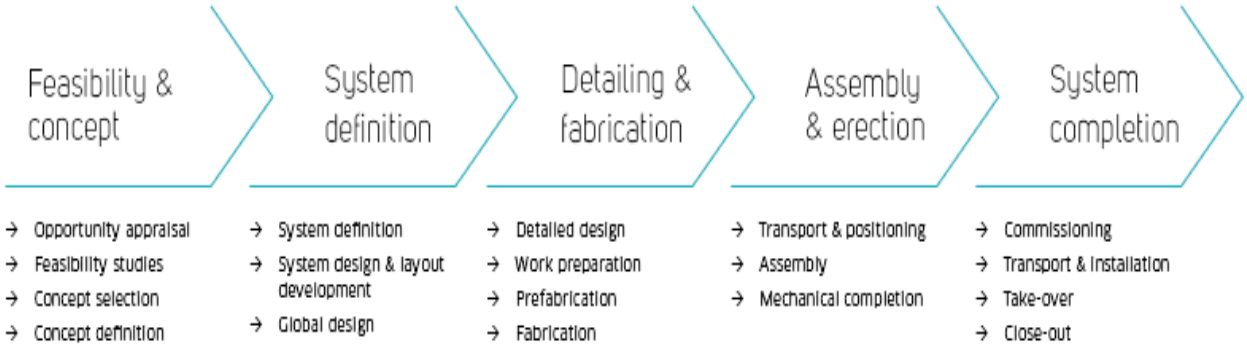

Figure 11: PEM, Source: EPC Company represented by participant P1.

Company C1 covers all the technical and administrative tasks in order to execute the engineering project of FPSO development. According to the participant P1 due to the offshore value chain accomplishments and knowledge, it enables the development of a detailed FEED, procurement and project management. PEM aims to determine, explain and confirm the proven and the predictable performance. According to the participant P1, their company has many years of experience in executing floating installations and due to its long experience there is a higher rate of success,

"For the adoption of detailed and great value of engineering, the company ensures cost effective project execution for its customers by using not only local resources

but also global expert engineering partners. PEM is being developed to provide efficient project execution and risk management. The highly qualified workforce of the company ensures that all the projects are executed following the steps of PEM".

Lastly, participant P2 mentioned the lessons learned that must be taken into account before starting a new project,

> "Despite the past failures, we should always remember that explorations are moving into deeper waters and FPSOs are constructed to deal some certain criteria. Due to technological advances, nowadays there are more possibilities to cover complex engineering aspects that during the past years that was almost impossible.

P2 also mentioned that the company keeps all of the information and especially all the investigations at the end of each project explaining the procedures, all the regimes, documentations, comments, internal and external communication. This policy is adopted with all the kind of projects when they are saved in the archives of the when the whole history of the company can be found. Participant P2 gave an example, when a new project is about to be developed the project manager always searches in these archives to investigate any previous lessons learnt,

> "Lessons learned is a part of the development of all the stages in the project and should be referenced back."

4.2.1.1 FEED Development

Most of the participants mentioned that the coordination for successful FEED execution is the element that will define the efficiency of the project. The main question is how to take into advantage all the opportunities and make sure that the development of the FEED is strong enough to face the challenges and mitigate the risks. According to the participant P1,

> "Two elements are decisive in order to build a competitive FEED, firstly, the SOW has to be identified. In our company, we use a document where we are defining the extent and specifications of the work, expected derivable and the content of the final outcome."

It is worth mentioning that this document includes a description of the engineering specifications and also controls the required work. Participant P1 also emphasized that despite the robust of the FEED, changes might occur which definitely influence the FEED process as well as the quality of the work,

> "It is not unusual for the FEED to be developed during the process, but unfortunately many of the people involved in the project tend to follow the

> structures without considering the possibility of changes according to the client's needs. Secondly, the quality of performance should be guaranteed since it is of major importance. In addition to this, a document that identifies all the performance requirements is being created as an effort to specify all the process guarantees. However, this document not always transfers the full expectations of the project."

Usually, for the FEED development, the person in charge is the project manager or the engineering manager and in order to motivate the employees, the project team should also take part and involved in the decision making. In the meantime, the participant P2, as an FPSO client, supports that the oil company prefers to take part in the development of FEED by providing feedback and comments since the conversion phase will later affect their oil production plans. Participant P1 confirmed this argument by saying that,

> "In reality the majority of clients that want to control the FEED, they just provide a report with basic inputs with regards to safety, environment and engineering process, while the contractor is developing more detailed inputs".

Indeed, it is mandatory for the client to explain to the contractor the SOW in order to develop a concise and detailed FEED according to the client's needs. All the participants agreed that FEED has to be conducted as early as possible in the project and have experienced personnel and P2 admitted that,

> "There are cases when the FEED is being defined by the oil operator after the involvement of a third party engineering contractor who put together all the specifications for the FPSO contractors. It can be done in two ways. Either, the oil operator to suggest an initial design of FEED to the contractor and based on that to continue with changes according to their experience, or by a competition between a number of proposed FEED".

Participant P3 disagreed with that statement by explaining that this method of developing the FEED is more likely to cause project failures due to the lack of FPSO project experience of the oil operator.

Once again the importance of lessons learned has been briefly mentioned in the development of FEED. Participant P3 pointing out the importance of lessons learnt and the assessment of all the risks that cover the life cycle of the FPSO.

"At the early stage when specifications and parameters of the project are being discussed an effort to analyze previous operational history of FPSOs should be made",

In addition to this, it is interesting to note the participant's P3 statement:

"Past experience has shown that the conversion part is similar to all the cases. The maximum amount of new changes is 20%".

This implies that FEED is a process that can be built upon past projects and not necessarily start from the beginning with some changes based on the location of FPSO. However, it is important to ensure that the FEED aligns with the situations of the current project. Participant P1 claimed that:

"It is important for the oil contractor to know the location of the area of operations to avoid the risks of unfamiliar environment, such as fiscal, environmental, logistical and marine conditions", in order to adjust the project accordingly.

4.2.1.2 Interface Management and Communication

All the participants agreed that the use of an interface manager within the team enables a better flow of information and communication between the employees and this is also confirmed in our previous findings from the literature review (Cabanillas, 2011). When dealing with FPSO projects it is most likely that changes will occur, therefore, the development of effective Interface Management is of high importance. P2 mentioned that:

"This process will run every action at every level in the organization with the aim to safeguard the FPSO project strength and ensure the ability to manage interface risks. Therefore, apart from the project manager, an Interface Manager is also needed in the company to ensure that the procedure is simplified and greatly organized. In our company, the procedure is quite simple, firstly an Interface Management Register is created describing all the procedures and process to manage all the key interfaces that might arise".

In addition to this statement the Interface Manager is responsible to coordinate this process. P2 explained that a unique number is provided for each interface issue that might occur, pointing out the specific location of the process that might arise and the level of importance. Lastly, he added that:

"The Interface Management Register should be accessible to the project team and should record all the interfaces identified from all the areas of the entire project such as between people, stakeholders and activities in order to minimize potential conflicts throughout the project".

Moreover, it is worth noting an important issue that participant P1 brought into the surface. *What happens in case changes will occur?*

> "In the case of changes, delays in production, delays in completing the negotiations and general delays with matters that affect the operation, it is the interface manager who is going to develop a robust process to identify all the interfaces in the project, point out the areas of concern to the FPSO Project Manager and propose corrective actions."

Answering the question earlier mentioned it is also important to note that the Interface Manager is also responsible to hold regular meetings with the supplier's stakeholders for the correct flow of deliveries. The communication between the contractor the operator and suppliers should be effective and thus, this will be achieved by promoting the collaboration between them and according to participant P3 this could be achieved by document interfaces with details in agreements that will allow solutions before they become risks that could impact the project. In fact, participant P3 also hinted that

> "Open communication between contractors is important not only during the identification stage of an interface agreement during front end planning, but also in managing activities through to completion and commissioning".

Furthermore, one of the problems that there were briefly discussed by the participants, it was the benefit of realizing the increased importance of the role of Interface Manager:

> "In case the project stays behind, it is the Interface Manager that has to bring the project back into schedule. From personal experience, I remember when I had to contact with the clients to inform him about major delays. In that case it was necessary to sit down together in corporate level, review the contract and discuss how the process changes after these delays", P2 participant said.

In addition to the Interface Management, another important element is that it can be related to the process of communication. *How does the company ensure the communication between the team in order to deliver a successful project?* Participant P1 says that the project manager is responsible to ensure that all the relevant data are being reported and distributed in the system as required:

> "Anybody can have access to this internal system and download reports that describe the procedures, provide charts, frameworks and comments. The purpose is

for everybody to be well aware of the principles, especially when decision making is evolved".

Another participant, P2, argued that the right flow of communication is achieved by having a reference system when all the internal or external information provided to the organization is being registered with codes:

"Usually employees use emails, reports and formal documents to share information between the interested parties. In that way, a systematic control is being achieved to identify gaps and prevent the major risks due to lack of information".

The participants agreed that when they were in the position of project manager they needed to handle both the internal and external information. P3 pointed out that,

"There is a big necessity to establish a systematic referencing system to distribute data and to appoint the person in charge for this distribution as well as who actually has to know the information." he also continued by emphasizing that:

"[...] a successful project has good vertical communications and heavily depends on the people how to handle this information".

However, even though the Internal Manager is mainly dealing with controlling the rich flow of information and procedures in the external part, it is vital at the same time to have the responsibility to regulate the internal communication. One way to achieve that is by developing a *document controller* with the aim to focus on strict communications referencing and formal controls of all the inputs and outputs of the project. The aim of this document controller as also suggested to the theoretical framework (Mierendorff, 2011) is to control what kind of information each member of the team should know, in order for them not to lose time generating unnecessary for their task information. Lastly, the participant P1 agreed that:

"It is important each team member to develop a document describing all the kinds of difficulties and changes he had to face and provide comments about the progress of the project. Then, this clear and understandable project reporting can be saved in the archives of the company and can provide important information not only for the existing project but also for the future ones".

As a result, a better communication within the team will be achieved, especially when changes in the process occur as well as using all the documents as lessons learned when future projects will be developed.

4.2.1.3 Changes during the Project Execution

Another risk element to take into consideration is the one of changes, occurring while executing the project. According to the participants, changes during the project execution occur either after their client's request to change parts of the process during the conversion or as an effort to deal with unexpected issues and therefore, change must be tracked and be prioritized. *The question is how changes can be mitigated and how much they influence the success of the project?* Participant P3 focused on the importance of having clear, understandable and unambiguous contracts:

> "Stakeholders should understand the contract terms and solutions. Contracts should be comprehensive and correctly formulated otherwise the contractor will take advantage of poor contract administration and will change the variations of the project development. Ambiguities should be avoided as much as possible, otherwise a lot of changes will occur afterwards and this will affect the whole process of the project".

Therefore, such an approach of having strong contracts should contribute in mitigating potential changes. The participant P2 coming from an oil company emphasized in possible changes that might occur and insisted that changes are very difficult to be managed,

> "Changes or variations can appear in the core of specifications within the engineering and production process of the project. The best option is to avoid the change unless it is a very serious issue that probably will affect the next process".

Once again the emphasis was given at the contracts by adding that when having a robust and clearly explained contract changes can be prevented. The participant P1 also agreed that:

> "Changes are the most time consuming and difficult process to deal within the project management".

This implies the need to be well organized from the beginning of the project. A project manager wants to avoid as much as possible the possibility of changes to occur and this because according to P3,

> "In case of any delay the senior management will interfere and take the role of the project budget and time delays. From personal experience this does not tend to make things better rather than lead to strict and non productive approaches".

In cases like this P3 believes that it is better to give the authority to the responsible person in favor of correcting his or her mistakes with the project teams guidance and support and then move forward with a backup plan in order to cover difficult situations.

The participant P1 mentioned his personal experience and how a project manager can learn from previous experience.

> "In my case, I remember that the first project I had to deal with it was not handled correctly due to delays. At the end, I figured out that if I had a robust and systematic approach from the beginning, none of the changes would have occurred".

From this statement it can be assumed once again that a clear and understandable approach for developing the project as well as early development of the planning and schedule will lead to the success of the project with a minimum amount of changes.

4.2.2 Stakeholders Relations

As mentioned in the theoretical framework the aim of the stakeholder theory is the need for the companies to understand their stakeholder relationship, their interest to the company and how these relationships can influence the process of the project. The questions that arise when analyzing this influential factor are: *Who the primary stakeholders in the FPSO industry are?, How they can affect the company?* and *How the contractor maintains good relationships with them?* It is undoubtedly an important discipline that only successful companies are using it to understand the importance of the key people and groups role (Freeman, 2010). The following subchapters will provide better understanding of the factors and challenges that influence their relationships as explained by the informants.

First of all, it should be clarified within the company who is the person in charge the company for the development of the stakeholder framework. In addition to this, P3 mentioned that

> "A country manager is usually been assigned to build relationships with the stakeholders and develop a throughout understanding of their expectations, concerns, perspectives, to solve technical and interface ambiguities and the key drivers of stakeholder engagement to the project in order to ensure the success of the project to the highest level".

Furthermore, the participant P1 specified that contractors in the FPSO industry are dealing with the most difficult and high demanding projects therefore it is vital to maintain good relationships with their stakeholders, add value to the projects of the oil operator companies and effectively engage with the local communities where the company is operating,

> "All stakeholders play a significant and usually equal role, even though the efforts, motives, and budgets may vary within the groups", P1 said.

Therefore, for each group a different approach should be developed.

4.2.2.1 Human Resource

The human resources in the contractor company consist of the management, the project team, the employees and the workers. Successful projects highly depend on skilled labor, with different requirements depending on the process and operations. However, the availability of human resources and especially of highly skilled staff is being questioned. In addition to this, it is acceptable from all the participants that the availability of high skilled staff with the necessary competencies and knowledge is crucial and will affect the effectiveness of the project.

4.2.2.1.1 Project Manager

According to the participants everything starts from the project manager who is going to guide the project and motivate the project team. Even thought it is very difficult to define what a good project manager is in our days, the Participant P1 emphasized that the project Manager has to have a history in the field and a number of successful complete projects. In the meantime, participant P2 agreed that:

> "The project Manager is the person to manage and control the project results. So it is very important that this person has a long experience and the qualifications of the project manager in various levels of the process from exploration to drilling and from engineering design to business development and execution".

The participant P3 noted that in case of lack of experienced in FPSO developments, it might lead to interface issues:

> "It is very important for the manager to understand the demands of the client when the conversion of the project will take place. This will be a good understanding of the risks, having excellent knowledge of the international standards for the offshore industry and excellent communication skills to provide guidance to the team. All these are depending on his previous performance".

Additionally, there is the question of the technical skills that the project manager needs to be acquired with, which is certainly pivotal and is at the top of the requirements that a project manager needs to have. A project manager should also control the people involved in FEED and the cost management during the conversion of FPSO as P1 discussed about it:

> "One of the most considerable role of a project manager is to reveal the technical capabilities of the company. The project manager reports to the project director and he is authorized for the general performance of the FPSO project. He has to support the development of FEED through a detailed engineering design, manage all the activities of FPSO, contribute to the development of the project and monitor the team that prepares the FEED package and execution".

Communication skills are of high importance in order to lead a successful outcome.

> "An exceptional project manager needs to have outstanding communication skills not only within his project team but also with the stakeholders in order to ensure that all of them understand what is expected from them during the process of the development", P3 suggested.

This implies for good negotiation skills in order to figure out the needs of the stakeholders and negotiate their relationships, to lead the FPSO developments to move forward as planned, as well as motivating, inspecting and managing the workers at the shipyard who are the ones to execute the final project.

Furthermore, P2 from the oil company also argued that the project manager who is going to operate the FPSO after the conversion needs to be experienced to handle unexpected situations and problems that might arise:

> "A project manager in FPSO developments needs to have strong qualifications to improve CAPEX for new projects with great results on returns on investments. Ability to control ambiguities, clarify complicated issues by providing robust solutions and to reduce serious problems", P2 added.

4.2.2.1.2 Project Management Team

With regard to the project management team it is accepted that they need to have a variety of analytical and critical skills. They must be highly organized and good multi taskers.

> "The success or failure of a project is very often depending on the highly organized project team. If a project team is spending more time trying to evaluate where information is rather than managing the project, failure is more likely to be occurred", participant P2 added.

With reference to the relations between the employees P1 claimed that it is better not to replace a person from the project team in case some conflicts arise between their relationships:

> "In some cases the management has to decide to remove a person with an external source. I believe that this will cause some kind of form of disconnection between the existing team. Of course the ability of controlling the new team will be soon solved, but the time spent until they got to know each other and work as a team is crucial for delivering the project in time."

Even though P1 and P2 supported that the PMT must be selected from the PM, a different approach was expressed by the participant P3 who presented a different approach between the PM and the PMT. Instead of the project manager to select the team, as most of the companies do, he suggests that the project team and manager should be appointed independently by the senior management or by another partner company. After completing all the relevant documents and specifications of the project, such as selection of suppliers, yard and signing the contract, each person will be assigned for each task. On the other side, participant P1 strongly disagrees and remains skeptical about the success of this approach pointing that:

> "From personal experience it can be assured that this type of practice could lead to disadvantageous results, it can cause cost overruns and exceeding time completion due to misunderstandings and disagreements".

The project manager is the one who knows the capabilities of each employee according to their performance from previous projects and how they can perform as a team. Therefore, he is the most appropriate person to choose the project team. While participant P2, with regard to the strong collaboration between the manager and the team added that,

> "We must ensure that no previous conflicts or economic interests between the PM and the PMT exist, coming from previous project execution".

As an effort to motivate the team the companies put a lot of effort to give the employees appropriate responsibilities, provide them with support for success and clearly define the relevant authorities in the decision making. In addition to this, the participant P3 explains how to achieve that:

> "All the members of the project team should attend the meetings during the FEED process as an effort to familiarize with the process and understand how their performance while executing their tasks will create value to the organization's goals. It is very often that the PM expects from the team members to express their own suggestions on how to proceed with the project and also take part in the decision making".

Moreover, this happens as an effort to gain their involvement in the project and to take responsibilities. Lastly, informants P1 and P3 pointed out that meetings between the project manager and the team are taking place in regular basis, in contrast with P2 who mentioned that meetings are taking place in managerial level and the team is participating when major risks are expected to occur due to the high level of complexity.

4.2.2.1.3 HSE

Health, Safety and Security (HSE) is without any doubts a core value strategy for the companies operating in the harsh environment of offshore oil industry. By gaining a wide experience in the execution of demanding and difficult projects companies should fully understand the importance of having a strong HSE performance in order to execute projects in a responsible and hence, in a successful manner. Risk elements within the HSE application should be taken into account according to the participants who mentioned about HSE commitment and safety regimes.

> "It is important to provide a set of guidelines in favor of controlling all the features of FPSO from the very beginning of the project until the end. For example the relevance of safety starts from the development of FEED, to the safety of personnel during the conversion, to the operations and maintenance phase until the decommission of the FPSO", participant P3 said.

Moreover, participant P3 assured that their company is continuously improving the HSE initiatives by enhancing the existing programs and developing new ones.

> "The company is committed to protect the environment by generating policies to prevent pollution as well as efforts to facilitate employees to work in good faith as an effort to prevent accidents".

According to P3 the company is continuously working in order to improve HSE performance and this is mainly achieved by introducing e-learning classes to improve the knowledge of employees, by developing a group risk matrix to ensure the efficient flow of information related to HSE risks, by monitoring the safety performance measurement and lastly by taking pro-active corrective actions. Another approach to improve HSE performance is the effort taken to strengthen the HSE capabilities and resources especially in the shipyards.

From the other hand, participant P1 admitted that safety was not always the first concern of their company. Additionally, due to the risky environmental, operational and technical changes over the time, the HSE attitude of the company is now the top priority. Participant P1 explained that their company's HSE policy is based in the belief that all incidents can be prevented and this works as a motivation to the employees in order to follow the principles and work within health, safety and the environment. Their HSE framework is symbolized by a framework called "*JUST CARE"* which emphasizes to the personal elements of the HSE and especially in training:

"By using an operating system, it requires a continual process of improvements. In addition, the training system will identify skill gaps and thus, enhance the knowledge and strength the skills of the staff", participant P1 said, before explaining the importance of having a system to monitor the HSE performance:

"Our company has created many achievements, but also many failures have occurred in the HSE performance. So a lot of corrective actions have been taken place to advance the standards. Following the rules is crucial and the way the workers work influences the output".

By following such approach, the company is expecting from the employees firstly to take care of themselves and secondly to actively care for their colleagues.

Lastly, the participant P3 pointed out that safety and health is important not only when the FPSO will be installed in the offshore but also in the yard during the conversion. HSE standards should be continually upgraded and based on risk reviews of company's HSE experts. Then, relevant advice is being given to the staff and security plans are being developed for each specific location. Also, P2 apart from the personnel's safety importance, he introduced the operational challenges of FPSO such as environmental performance, health security and safety which must be identified, assessed and managed. He also mentioned that an accident occurs after a series of events and missteps that will finally contribute to the accident. For example, he mentioned the recent accident in Brazil, where an FPSO was exploded due to a series of failures in maintenance, training of personnel and weak risk assessment. However, P2 is confident that by thoroughly examining all the important issues before developing the project planning and scheduling the risks will be minimized.

4.2.2.2 Suppliers

The equipment that is used for the conversion of FPSO is usually acquired by a third party company that after the conversion is going to be controlled by the operator company (Lombardo, 2003). Therefore, the sequence and relationships with the suppliers involved in the construction phase is important for the planning of the process. This involves agreements and alliances with the suppliers, use of local contractors and purchase of local materials from areas in which the work will be carried out (Gerwick, 2007).

"There are plenty of suppliers that they wish to collaborate with us and our company is very careful when selecting its suppliers since we are well aware that the selection of the right suppliers is vital to ensure that later we will be able to deliver the final project on time, at the right price and in compliance with all the standards of the

company. Usually the company prefers direct suppliers as an effort to have better control", said the participant P3.

The question is how do they make the right choice among a number of potential suppliers. Participant P3 added that:

> "We have established a specific framework that helps the decision making for the right supplier based on criteria that our clients have to meet."

In the meantime participant P1 also agreed that without having a framework for quality assurance the company will never have a competitive advantage. The aim of this framework is to prioritize the suppliers and P1 mentioned the main questions that should be asked are when selecting suppliers:

- Is the supplier willing to sign a long term contract?
- Is our supplier using the latest technology and continuously upgrading their technical skills?
- Does the supplier keep available documents showing how he complies with regulations?
- Is the supplier's process capable of responding quickly to new orders?
- Does the supplier keep a record of measuring his performance?
- Does our supplier follow the ISO guidance for the equipment and materials?
- Can they provide technical support?"

Specifications of the equipment should be mentioned in the contract, as well as the service support and the duration of their partnership for the specific project. Usually the PMT is inviting suppliers to take part in a bidding process in order to get the best offer in favor of quality and cost (Lombardo, 2003). P2 confirmed this process, since the quality assurance of the services and supplies is of major priority and therefore, having the best technology is important for strengthening the quality of the organization. Participant P2, also claimed that quality controllers are being assigned to execute response plans and also a quality control audit framework is being developed.

With regard to the agreements that both parties should develop, participant P3 said that,

> "Agreements for early delivery placements of the equipment and material orders will enable the project team to start early the conversion of FPSO".

Early placements will also benefit the suppliers because they will be familiar in advance with such agreements and in the future they will be able to develop deals with other contractors and place

similar purchases immediately (Yee, 2013). It also takes a lot of effort to avoid delivery delays to the shipyard which will be later used for the conversion of FPSO. In order to place the right agreements between the supplier and the contractor, it is vital to understand the SOW and this depends on the final client, the oil operator (Gerwick, 2007). In addition to the literature findings P3 added that:

> "The contractor should understand what the client wants, which operational method is going to be used for the oil production and when the FPSO must be delivered. In case the contractor fails to understand the scope of work, then the wrong orders will be placed".

Answering the question what strategies the contractor follows in order to ensure that the materials will be delivered in time, within budget and with consistent quality, P1 mentioned that:

> "Auditing and inspection can provide the company with a competitive advantage, certification of services and reliability. This will help to distinguish the supplier from the wide availability. Also, we are looking for a supplier to build long term partnership as an effort to develop trust in the workplace and good relationships."

P3 also mentioned inspections at regular intervals before approving the supplier as an authorized supplier and investigation of the accomplishments on previous projects before approving the supplier. In addition to this P3 emphasized that:

> "[...] inspections and monitoring will still continue during the execution of the project to ensure the correct allocation of resources. In case something goes wrong, it must be reported to the management before it becomes a serious problem that will lead to major failures."

In favor of the local content, the participant P1, mentioned that their company is also considering of giving opportunities to hire sub-contractors coming from local business and local labor. From the other hand P3, even though he supports the local contract he comments on the reality that FPSO projects are complex and very demanding and therefore,

> "It is very difficult to find professionals and highly qualified managers with long experience in that field, therefore, complicated FPSOs should engage suppliers from all over the world. However, local content can be achieved during the process at the shipyard. Also, the logistic offshore base where the fabrication and conversion of FPSO needs to be done, should take place at the closest location of the project, so in that case local content can be involved."

4.2.2.3 Reliance on Shipyards

The decision upon which shipyard should be chosen to convert the FPSO should be also be taken into serious consideration. During the interview participant P1 indicated that:

> "Deliveries of the equipment and materials must be obtained as agreed. In case of any delay it would surely cause impact on time and cost."

While P3, insisted on the effort of the company to maintain good relations with the shipyards:

> "FPSO Industry is tough and for the benefit of our projects our company decided to develop partnerships with specific yards were local content is also considered."

In order to have control in the yard the participants suggested that a representative of the management team should be transferred in the yard in order to stabilize the operation. P1 mentioned that:

> "When management controls are been developed at the shipyard it is easier to monitor and manage the process and will act as a great motive for local workers to be promoted to higher positions".

He also continued by emphasizing that:

> "With such approach anyone can believe that this approach will cost to the contractor, but in reality is the opposite. This will contribute to the success not only with the current project, but also with the ones in the future. Also, in that way we win the trust of the shipyard and we become the most preferable contractor to develop agreements with. When examining our competitors, they also develop similar strategies in different locations with Indonesian and Malaysian yards, while others with South Korean and Chinese yards."

In addition, participant P1 also pointed out the importance of imposing control at the shipyards by mentioning that even though the responsibility for conducting relationships with the shipyards is the PM, he has the authority, later, to delegate his role to the Interface Manager for better monitoring the developments in the conversion of FPSO.

In the question how much does a contractor depends on the shipyards for the successful fabrication of FPSO, participant P1 supported that they are highly depended,

> "Capacity in the yards is limited and project schedules are very tight so we really need good relationships with them and to focus on delivering the materials, equipment

and services in advance. Trust is the key word. The contractor should trust the yard and to give them some of their responsibilities to achieve project success".

The interviewee from the oil operator company, P2, also agreed to this by adding that:

"Any delay at the shipyard, automatically means that commercial delays will also occur, apart from the technical and it will affect our initial schedules for the oil production".

However, P3 mentioned that disputes can arise even before conducting agreements with the shipyards:

"There was a time when the initial proposed agreement with the shipyard could not be mutually agreed and this caused many delays for the FPSO conversion and later, commercial problems with our client".

Cases like this are being confirmed from previous projects (Parker, 1999) where contractors and shipyards could end up having legal battles related to the specifications and contractual obligations. At this point a question that arises is *how to trust the shipyards*. The participants agreed that this depends from the previous experience of the shipyard P1 mentions that:

"For FPSO projects it is easy to choose a shipyard because as a contractor company, we tend to award contracts with yards that we have cooperated in the past for the same projects. We review the previous projects and examine if something went wrong in previous FPSO conversions, why and what went wrong, how it was solved and the impact on the whole project. The shipyard partner should provide improved control and management. In any other case, the complicated project of FPSO will become a big challenge even for a top ranked yard."

It is also very important to mention that the yard should be capable to handle additional work for mortifications in case the client request for some changes that will affect the conversion of FPSO (Yee, 2013). Ultimately, FPSO industry is growing fast and it is very important to ensure that the agreements with the shipyard are executed accordingly as the initial commercial and the contractual approach requires to avoid delays and cost overruns (Parker, 1999).

4.2.2.4 Cooperation with the Clients

As the theoretical literature in the chapter 2 recommends, the relationship between the contractor and the oil company is governed by the contract itself and therefore these contracts should describe and justify the responsibilities of each one in a clear and understandable way (Yees, 2013). In addition, it is very important to built strong client relationships based on coordination as mentioned by the participant P1:

"We need to be on the same page with the clients for the process to move within the stipulated period. The relationship with the client is a big challenge and in the meantime a key to the success. The best way to maintain great relationships is to define a set of roles and responsibilities. Also, continual communication needs to be developed between all the parties."

After the conversion of the vessel, the FPSO is being delivered directly to the oil company, therefore, meetings between the clients are very important. This allows them to maintain a well organized schedule and develop their agreements accordingly (Mierendorff, 2011). P3 agreed that

"The FPSO delivery manager ensures that the contractor delivers a facility that meets the client's technical requirements, coordinate installation activities between the working groups such as drilling and operations and interface communication between those groups to ensure that the FPSO conversion meets the long term customer requirements."

While the participant P2 from an oil company pointed out how important is for the contractor to understand the oil company's specifications and SOW in order not to affect their plans:

"Cost overruns might occur, for the oil company, in the balance sheet, when delays in engineering, construction and commission process occur. Consequently, delays in bringing the oil to the market will occur and maximizing the financial returns will be then questioned."

This implies the need of having clear and robust agreements.

The participant P1 brought into the surface another challenge between their relationships with the oil companies. He claimed that usually the client try to influence the procedure of the FPSO conversion.

"We must ensure that we, as contractors have achieved to develop a good contract to clarify the terms and conditions and avoid misunderstandings", he said.

On the other hand the P2 from the oil company explained the reason why the oil companies usually want to interfere by supporting their right to take part during the conversion of FPSO:

"The final project will have an impact on the oil production and as a costumer we should be updated of the progress of the conversion, in case of any delays and problems."

Therefore, in case issues occur, this will not only influence the capex of the contractor, but also the estimations of the operator will be changed. In addition, it is vital for the operator to be involved during the conversion process and this can be efficiently achieved by the

communications channels. It is worth mentioning that as an effort to avoid delays, according to P2 they offer to the contractor bonus payments if they deliver the FPSO earlier as initially planned.

In the meantime, participant P1 focused on how they approach a client and how they get to know them in a better way,

> "We usually start to get to know our potential clients at different conferences. For example, the annual FPSO Congress that takes place in London, the World Congress in Singapore and the Offshore Technology Conferences in various locations such as Houston, Aberdeen and Stavanger. Many contractors and operators attend these conferences to meet potential clients, develop deals or even to find sources for financing. To share their experiences about the offshore projects, the opportunities and challenges, how both the contractor and operator could benefit, the factors that should be examined before establishing FPSO and the latest updates on how to overcome the complexities of the deepwater oil field developments."

4.2.2.5 Key Financial Challenges

When developing the complex and demanding projects of FPSOs both the oil contractor and the operator have to be financially strong in order to support the conversion and operation of the FPSO. The question that arises is: *What are the main sources for financing and how difficult for the company is to get financing?* Michael Lin Sheng, an Investment Analyst for FPSO projects, during the FPSO Europe Congress said that:

> "Right now there is a combination of high demand of FPSO financing driven by the high demand of FPSO and of financial uncertainties in the market caused by the EE crisis. From one hand, we have high demand of FPSO and from the other hand, there are increasingly shallow terms of the banking market so challenges of getting financial arrangements might occur".

Despite the challenges to get financing for the project Michael Lin Sheng, claims that there are several ways to mitigate this threat. One of them is to escape from the traditional way of getting a financing from a bank and to create an unconditional source of funding from insurance companies, developing banks, bond markets and from upstream partners.

Before seeking financing, what must be understood is that the companies need to face the cost overrun challenges and participant P1 claims that this can be achieved through the long experience of the company in the field. The most common elements to influence the project

success are: a well defined project execution plan, well educated and skilled personnel, a good flow of information and communication between each step of the procedure and detailed agreements. Moreover, P2 mentioned that the finance department should work closely with the PM not only for identifying the present costs but also for ensuring correct estimations for the future spending costs. He emphasized that:

> "The proposed cost estimation and the budget base should represent the reality and be able to meet the budget expectations."

As a solution to this potential issue, a conversion budget should be created from the project team as soon as the cost of the materials and equipment will be identified instead of the senior manager. First line employees can play a key role with their involvement for budget empowerment. In the meantime, P1 mentioned that at the end of each month a detailed budget is reported in order to include and identify any changes within the project and this financial responsibility needs to be provided by the PM. While the participant P3 pointed out that budget restrictions that do not reach the reality can influence the employees,

> "Sometimes due to poor budget projections the PMT can be discouraged for moving forward the projects and therefore this will lead to delays".

The importance of having correct cost estimations and is huge since financial institutions are asking for this information before proceeding with the financing.

Answering the question how easy is to get financing after allocating all the risks with regard to the cost management, the participant P1 pointed out that usually they do not have problems of getting finance due to the reputation of the company:

> "Due to the long experience of our company to the deep offshore industry and FPSO we manage to get financing by bank institutions, where we always negotiate and take a favorable interest rate which is a big achievement and excellent opportunity for the contractor."

Nevertheless, the participant P3 believes that a major concern is the credit risk and the external political or economic changes in the environment that could have a huge impact on the FPSO development. P3 provided examples of this kind of risk:

> "(...) the risks of receiving the payments after leasing FPSOs, the stability of the country, politics and exposure limits, the financial availability, internal control and reporting, exchange rate risks, tax and changes to law. As an effort to mitigate those risks the company ensures to develop forecasts and response plans in order to mitigate unexpected situations".

Clearly, the responsible person for developing the budget is important to be appointed before the proposal of the project. According to P3 it is important to fulfil the customer expectations:

> "The PMT must ensure that the proposed cost schedule is achievable, delivery times from suppliers are punctual and that the assessment is realistic, otherwise alignment with the company's strategy will fail and a lot of obstacles might occur".

According to P3 it is very important to understand that the cost management applies to the whole life of the project and should be assessed very carefully. Estimations are very difficult to be created, thus, the cost manager has to go back, look at the previous projects and have a continuous collaboration with the PM in order to ensure the reliability of the future estimations.

4.2.2.5.1 Lease or Ownership

Financing, seems to be the biggest barrier that prevents ownership from the oil and gas companies. In addition to this, Dr. Roger Knight from Infield Systems, during the FPSO Congress, explained the rationale behind the preference of oil and gas companies to lease FPSO instead of buying,

> "The key driver for the decision to buy as oppose to lease comes from the particular nature and duration of the field itself, how this relates to solutions and associated charges presented within the leased market, and whether the operator is able to fund the capital required to own an FPSO".

However, if the individual has enough access to capital, then they will be able to fund this ambitious project themselves.

According to the participant P3, to lease or not, it depends from the duration of the field, the financial situation of the oil company and where the company wants to focus on drilling and exploration or owning an FPSO. While P2, noted that in general a lease is a better option when developing a field with a relatively short production life expectation. Leasing enables the oil company to minimize its CAPEX risk while the contractor, who owns the FPSO, has to confront with all the risk elements for building the FPSO. Moreover, P2 emphasized that the extra expenses will last for a small period of time and they will be later balanced by the decreased costs of dicommission, since the responsibility for the FPSO removal from the offshore to onshore it is of the contractor and not of the operator's responsibility.

4.2.2.6 Regulatory Factors

According to the literature review, complying with the laws and regulations in the FPSO industry might be the most complicated task due to the fact that no clear international regulation exists for the conversion and operation of FPSOs. Sometimes the regulation for a "ship" must be used, even though in reality the FPSO is not a ship. The question that arises is: *How difficult and confusing is that for the companies and what kind of impact the regulation has for successfully delivering the project?*

The participant P3 agreed that there are some ambiguities about the ship status of the FPSO:

> "When the FPSO is being detached from the seabed and starts moving, its jurisdiction is under the law and safety standards for a ship. On the other hand, when the FPSO is attached to the seabed and start its operation as an oil platform facility, it is not anymore considered to be a ship and different regulation should be applied".

Therefore the FPSO needs to comply with both sets of legislation in one application and according to the participants this is very difficult in practice.

Moreover, P3 also mentioned that it is very difficult to find highly qualified lawyers specializing and practicing FPSO legislation especially in environmental issues, so the best option for the company is to outsource an oil and gas law firm for technical legal advice. In addition, P2 points out that the contractor not only needs to comply with the international standards, but also to comply with the company's policies and guidelines:

> "We expect from the contractor to apply zero flaming policies or to have prospects of reinjecting the produced water, which results after the separation of water from oil during the oil extraction, rather than to disposal it at the sea" he added.

According to the participant P2 when FPSO project is being developed, it is necessary for the companies to appreciate a long term contract relationship which might be last up to 20 years (see Figure 12),

> "The oil companies definitely expect from the construction companies to provide them with FPSO for hydrocarbon production and the contractors expect from the oil and gas companies to start producing hydrocarbons immediately in order to get their payments. They need each other and it is important to understand what each part can provide. Each one's requirement must be read carefully from the contracts and understand the expectations of each part by also taking into account that there are unwritten expectations as well".

Therefore, the participant P2 is recommending that it is for the benefit of all to get to know each other very well in the early phase of the project. Above all, the contractors should know what the operator company is looking for and if the contractor is able to fulfil this demand or not.

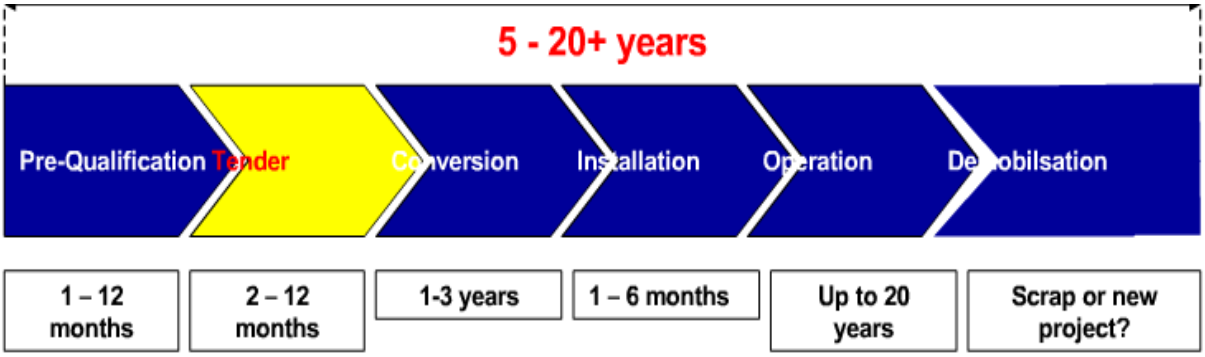

Figure 12: Long term relationship chart, Source: Provided by the company

Participant P2, agrees that the contract between the oil operator and the oil contractor is being signed in order to clarify the service agreements and the level of responsibilities over the FPSO,

> "The FPSO oil company along with the oil contractor have to set up the SOW in their agreement, general terms and conditions, remunerations, insurance and the policy of the company that the contractor must adhere to. From our point of view, the advantage of having this agreement is to retain the direction and control over the whole process of the project."

P2 explained that the aim of these agreements is also to avoid some ambiguities within the law of FPSO. It is a big advantage to clarify FPSO arrangements of the whole project within these contracts or agreements. While P1, from a contractor's point of view argues that:

> " These agreements specify how the contractor company can avoid some regulations addressing to "ships", how to limit responsibilities and impose some of them to the oil company and lastly, to clarify who is going to operate the FPSO during the oil project development".

But what happens in case the oil contractor discovers new resources and wants the FPSO unit for longer periods of operations? During the interview, P2 revealed this major issue that needs to be carefully defined,

> "The Company needs to consider the possibility of discovering new resources in the current field, meaning that the FPSO will be needed for longer periods than the one mentioned in the contract. The problem is that the contractor might have already

> signed an agreement to relocate the FPSO to another location for another client and the particular FPSO will not be available for our further developments".

Focusing on this issue, a proposed solution by P2 is to formulate the contract from the beginning of the conversion of FPSO until the commercial production will come to an end ensuring that the FPSO will not be leased to another company.

P2 mentioned that the agreement should also consider the case of total FPSO loss:

> "It depends from the kind of loss. The company can ask for the termination of the contract immediately without giving further information or ask for another FPSO to replace the one that is damaged".

While P1, a contractor's point of view mentions that:

> "It depends on what kind of insurance the contractor has. But usually the contractor despite the loss of FPSO will still ask for a compensation for a certain period of time or ask for a deposit that covers the cost of FPSO".

Nevertheless, the company usually has the ability to terminate the contract before its expiration by paying an early termination fee.

According to the regulations, the company is responsible for decommissioning the FPSO upon the expiration of the contract. P2 argues that:

> "The company is responsible for shutting down the subsea equipment, pipelines and removing the wells in accordance with the terms of legislation. On the other hand the contractor is responsible for transporting the platform to the yard".

Thus, it is vital that the technical and operational responsibilities are clarified in the contract, mentioning who is the responsible for handling responsibilities. Neglecting of recognizing the potential threats that should be mentioned in the contract can lead to major misunderstandings.

4.3 How do different experts perceive FPSOs opportunities

4.3.1 Financing the future FPSO unit

Michael Lin Sheng, during the FPSO Europe Congress expressed his personal belief that the FPSO industry should have an unlimited source of funding for example, from combined investment companies, developing banks or maybe from other sources of funding like bond market and upstream partners who might want to internalize their FPSO. The traditional way to get a financing for the FPSO contractor to finance the asset and the conversion work, as well as for the operator to lease the FPSO, is bank financing (Minn, 2014) and the advantage according

to Michael Lin Sheng is that the banks know the market and are very well educated. On the other hand, the bond market is less being informed and familiar with the sector. Despite that, according to Mr. Sheng there is huge potential in the bond market because the insurance companies prefer long term steady cash flows and thus, the FPSO financing is a good investment product for them..

In the question how do the financial analysts of FPSO regard the challenges in the FPSO industry, Mr. Sheng noted that:

> "In order to provide financing to an oil contractor, the first principle that the investors have to investigate is the credit risk of the company and the lease contract. These two elements are important when determining the ability of the company to move forward with the project".

Moreover, experience is required for both sites in order to ensure that all risks are properly allocated and then that the deal is profitable. The next important challenge that an IC is looking at before financing FPSO projects is what risks is the IC expected to take. Mr. Sheng adds that"

> "At the moment, ICs that are lending the money, are not ready to take any reserve or technical risks, even though a part of the operation risk might be taken. Thus, some of the risks have to be covered by another part". For instance, Mr. Sheng, suggests that: "What is preferable is the EPC contractor to guaranty some of the risks, while the operator to cover the operation risk. These are risks that the bank should definitely not take so a proper allocation of the risk is demanded from the bank".

Regarding the future trends of FPSO industry, Mr. Sheng, agreed that an increased in demand is expected for FPSO due to the continuous offshore oil developments particularly in the deep offshore in Brazil and West Africa. He also emphasized that it is very difficult to avoid delays in delivery due to the very busy shipyards and he added that:

> "Complex and deep water FPSOs tend to have difficulties to get financing mainly because of the debt of the bond market therefore some effort to think alternatives is needed in each individual deal".

Mr. Sheng as an investor in the FPSO market admits that development banks, they always look for FPSO opportunities, especially in developing countries:

> "Helping their FPSO finance it is a critical part in the development of their economy and in their physical revenue growth".

4.3.2 EPC Company Perspectives

The concept of floating solutions in general is a great potential for the future as oil developments move to inaccessible waters. The informant PI pointed out that for the Arctic waters, a reloadable concrete-base drilling platform will be a great solution instead of the FPSO steal vessel. The EPC Company that he is representing, has performed various FEED studies for their clients all around the world and a lot of solutions are still under evaluation. Nonetheless, according to P1, for the Arctic developments the reloadable concrete base drilling platform, has proven to be a technical feasible solution.

> "This is a concept has already been used in the North Sea, but the aim is to extend it to ice regions" P1 added by mentioning an example at the Hibernia field in Canada with the application of the Hebron platform.

Furthermore, the informant P1, insists that for Arctic waters, it is a moving gravity base solution that will be the most relevant for the hazardous environmental situation in the area:

> "When we talk about areas like the East Siberian Sea, the open sea waters last for a short period of time and thus exploration drilling is being restricted. As a consequence, the fields in the Arctic region remain unexplored even though they considered of having high potentials."

In addition to this approach, that should contribute to better insights for using floating solutions, P1 explained why concrete is considered to be better material for the Arctic instead of the FPSO:

> "It can resist the harsh environment and the ice can be crushed on the legs of the platform without later requiring repairs. Platforms like these can resist temperatures around -44ºC, seismic activities on the seafloor and allow a year round drilling exploration and production activities".

The concept of concrete platforms, according to P1, already exists, but in that case, all the existing properties are being transferred to develop a new platform that is going to be reloadable by using ice breakers and with the capacity of 22.000 tons of equipment which is more than the normal requirements of a moving rig. However, challenges might occur in logistics and when obtaining resources, both personnel and equipment to the drilling rig in such remote locations.

4.3.3 Oil Company Perspectives

Towards the emerge of the FPSO phenomenon, P2 seemed to be very positive with the introduction of the FPSO in the offshore industry and especially in the Barent Sea where it is ice free. He described the dramatic development of the technology as the main influencing factor in decision making whether to use FPSO or other facility for the oil exploration and production.

"The industry is moving forward with reference to production drilling and water debts. At the moment the deepwater industry has the ability of producing in more than 10.000 feet and technology continuously moving underwater in order to unable the operator companies to drill deeper", he said.

The FPSO is assumed to be a standalone development with no connection with onshore facilities except for the communication links during the oil production phase and the gas export to the LNG plant if it is a gas production phase (see Figure 13). The oil company represented by the participant P2 is also focused on Natural Gas developments and thus their projects include LNG FPSO which work under the same principles and process as an oil FPSO with the only difference that it receives LNG from offloading vessels to the floating unit which provides natural gas ready to be transported to the shore by using other facilities such as pipelines.

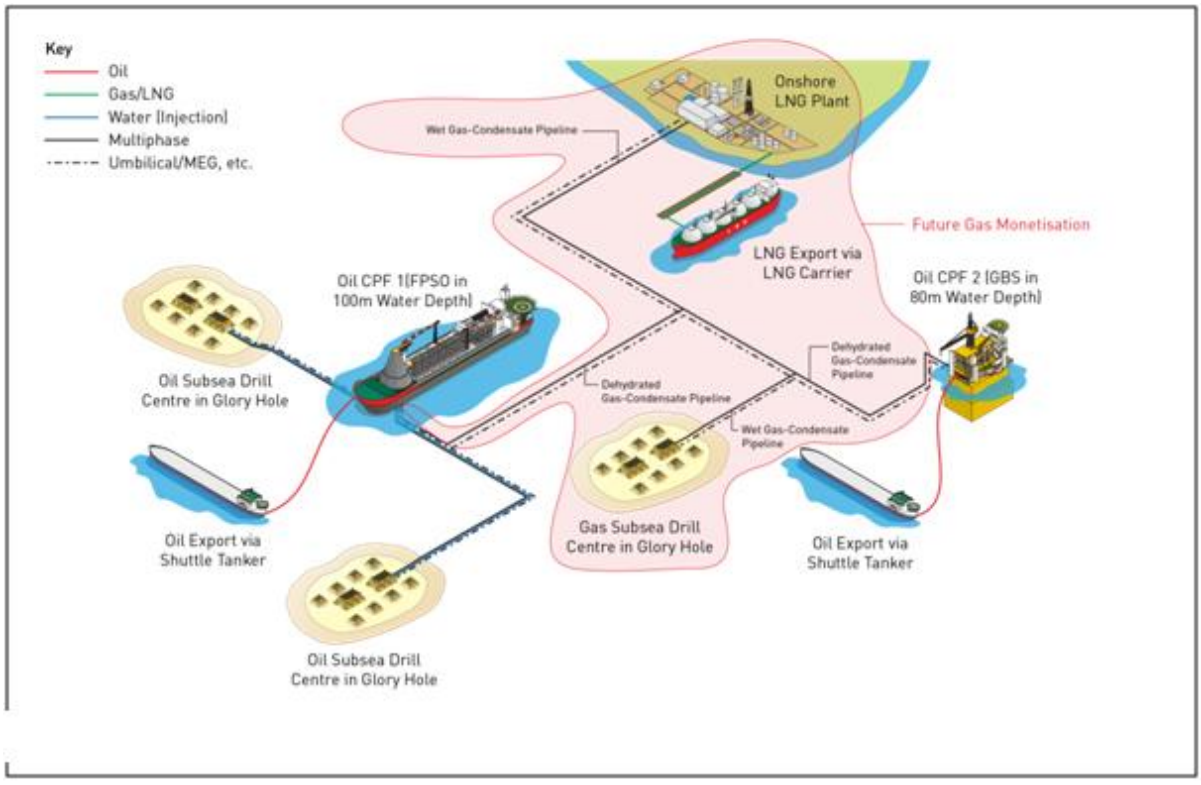

Figure 13: Selected ADEPT Demonstration Case for Block 2: Barents Sea, Source: Provided from Company C2 for the purpose of this research.

Furthermore, P2 claims that FPSO is a prosperous technical solution with major technical advantages such as the large amount of topside equipment that can be carried, the lightweight of the vessel and their flexibility to be modified according to the specifications of the field and relocated after field depletion or detached during extreme weather activities. In the meantime, FPSOs have their disadvantages. According to P2, lot of costs can occur if something goes wrong and even though their big advantage it's their re-deployable ability, it can turn out to be a

serious problem due to the fact that a lot of changes must be done to the complex machinery before introducing it to another area for oil developments and this also includes high maintenance costs.

4.3.4 How do Academics embrace the FPSO in the Arctic waters

Mr Anatoly Zolotukhin, Director of the institute for Arctic Oil and Gas Technologies at the Gubkin Russian University, expressed his opinion that FPSO is a brilliant and an excellent innovative technology. However, he revealed his concern about the locations that it can be used:

> "A lot of FPSOs are working worldwide, but in lower latitudes close to Equador, in warm areas. The difference of these areas to the Arctic is the icefields and icebergs which are considered to be the biggest threat. As far as we are talking for open sea and deep water with no ice fields, then it is easier to manage the sea environment".

For example, in Canada and Alaska FPSO is very difficult to be applied because of the ice, but for other arctic locations without ice is more technical possible. Nonetheless, the economic viability should be firstly examined (Gerwick, 2007).

> "The risk is there, but it can be mitigated due to skillful management system and with the minimum threat to the environment. In Russia, Laptev sea and Siberia are considered to be the future, but it would be very challenging to consider any project development with FPSO because the waters are mostly covered by ice."

According to Zolotukhin, ice fields are a threat for FPSO because the ice is moving with instrumental force and it is impossible to use ice breakers constantly.

> "Ice is very thick and only the most powerful icebreakers could manage to operate. It would turn out to be very expensive even though technical risks will be minimized".

Zolotukhin argued that at the moment it is very questionable if FPSO can be develop, but in the future there might be more possibilities due to the fact that technology is developing, the cost is decreasing and the opportunities for expanding are increasing. Moreover, in any case a realistic development should be created. The process to identify in which areas this concept can be used in the Arctic should be done very carefully"

> "FPSO can be developed in the Canadian waters, and maybe in some deep seas in Russia such as in the Barents Sea and some locations in the Kara Sea. In the Barents Sea it is ice free almost all the time. In Kara Sea almost all the time is covered by ice and that could be a threat, however, it can be used in Shtokman and up north where there is no ice", he said.

Zolotukhin explained that this happens because in some locations of Kara Sea it is not only ice fields that exists, where they can be dealt with ice breakers but also icebergs can be found

traveling together with the ice fields and thus, moving toward FPSO where there is no force to compact that and ice bergs remain as a threat.

> "FPSO could also be a good candidate for a number of smaller numbers of fields in the same area that justify FPSO application. For example, one can be a processing unit and the other a floating terminal".

All in all, these areas can be justified, then the project of FPSO can be a realistic approach rather than hypothetical cases that cannot exist and therefore, it can be linked to these areas and Arctic.

4.3.5 Conclusion

In this chapter the overall aim is to present and describe the empirical findings mainly gathered from the informants. The empirical data will be later, in the next chapter analyzed in comparison with the secondary data. This chapter aims to understand the major elements that affect the challenges and opportunities that are most likely to occur during the process of FPSO planning, conversion and application. The chapter is divided in three parts.

Firstly, an explanation of what floating solutions in general are, with emphasis on FPSOs is provided, followed by a brief overview of the industry and market growth expectations as well as the main advantages and the reasons that oil operators and contractors prefer this solution according to the literature review from business reports, journals, articles and presentations from the FPSO Congress.

Secondly, the most crucial elements that define the success of an FPSO project during the planning, scheduling and application are being described by the informants. Factors such as the process of developing the plan, schedule and execution framework, the importance to complete a strong and clear FEED in an early stage, financial challenges, the dilemma for an oil operator to lease or to own an FPSO unit, relationships with the stakeholders, as well as a description of how to develop unambiguous and understandable arrangements with the stakeholders. The above elements can give information about the complexity of the project if favor of the above elements. If they will be well define they can create opportunities for the successful development of the FPSO project. In any other case they can be transformed to threats and lead to failures.

Thirdly, the last part of the chapter describes how different experts in the floating offshore industry perceive and embrace the opportunities for future FPSO developments. Information was provided by representatives from: a financial investment corporation focusing on FPSO financing, oil company, EPC company and a professor in the field of offshore oil developments.

5 Analysis

This research connects with what FPSO is and the various perspectives that describe and analyze the major challenges and opportunities of this phenomenon. For those elements, I have developed a theoretical framework in chapter 2, then in chapter 3 a description of the methodology to analyze the empirical data, followed by the chapter 4 that provides a description of those elements in accordance with the empirical data. In this chapter the aim is to analyze the primary data that were previously presented in comparison with the secondary data. This chapter will analyze the findings by using the theoretical review as a frame of reference and what is the most important when introducing each of those elements as well as the differences in understanding when focusing on them.

5.1 Project Management

This subchapter analyses the four main elements that were identified as critical factors for distinguishing the challenges and identifying the opportunities that lead to the success of the project during the conversion of FPSO. Firstly, the process of project planning and scheduling in favor of the project management that the informants described earlier, secondly, the robust FEED development, thirdly the Interface Management and Communications and lastly, the influence of the changes during the project execution.

5.1.1 Project Planning and Scheduling

As Napoleon once said:

"Tactics is the art of using troops in battle; Strategy is the art of using battles to win the war"

Meaning that the strategy selects the areas to act and the tactics decides the way of execution. One can say that the same applies to FPSO project. The project is difficult to be solved when a framework (tactics) is not being clearly described and applied to the specific areas that will affect the project outcome.

As the theoretical literature suggests, the description of the frame of reference, is essential for the oil operators and contractor to develop and clarify their project management frameworks in advance (Longman, 2004). The main objective is to prevent any form of crisis, mitigate the risks and any form of unexpected events and therefore to guide a successful project (Longman, 2004). Such an approach is well understood by the participants when they describe the frameworks they follow. Moreover, challenges during the development of a project may vary depending on the project's nature, context, size, complexity, cost and scope (PMI, 2008). Focusing on the

problems and opportunities related to the project management the participants during the interview process pointed out common aspects that can greatly influence the outcome of the FPSO project. For example, FPSO projects need to have clear SOW that is understood by all the interested parties and objectives and ensure that these objectives are clear, realistic and achievable. It is accepted by all the participants that a clear and feasible planning of the various management stages and processes is essential to reduce the risks. In case of any misunderstanding it will cause gaps between the process and this will lead to huge delays to build the facilities or to provide the relevant service and it will cause CAPEX increase as well as a lot of effort should be put for catching up the lost time.

Project Management represents one of the biggest matters covered by the analysis of opportunities and challenges of FPSO conversion. The effort of making sure that you have the project management foundations for project achievement was pointed out from all the participants. Proper planning is vital for the FPSO projects since the progress of work activities depends on the robust planning (Longaman, 2004).

Lessons learned from previous projects must also be taken into account. FPSOs operations have been active in the oil offshore industry more than 40 years now and therefore, before developing the current project, a research can be done to identify past operations within the conversion part and learn from the mistakes (PMI, 2008). However, it should be taken into consideration that despite the previous failures, nowadays the technology is rapidly developing and this contributes in making the projects more feasible.

The major elements to define the opportunities and challenges as descried and analyzed both from the theoretical framework and the participants are the below:

- Overall understanding of SOW and well defined specifications and expectations of the oil companies, suppliers, shipyards and other partners.
- Detailed engineering design, planning, schedule and control.
- Identification of important areas within the process.
- A project fails when there is a lack of project visibility.
- Support and involvement of the stakeholders to safeguard and control the development of the project framework.
- The application of a reliable project management framework should contribute to better insights for selecting a contracting approach and the resources.

- It is mandatory to get approvals for each stage in order to move further.
- Before developing the project management activities and processes, to examine all the risks that might appear during the execution.

5.1.2 FEED

Participants and studies from previous literature have shown that FEED, when converting an FPSO, is a process that can be built upon past projects and follow the same sequence of engineering designs, fabrication contractors, yards, suppliers, project teams, management systems and familiarity with the SOW (Artto et al., 2007). Therefore, it was hinted that it is not necessary to start a new framework from the beginning, but only to proceed with some changes based on the location of FPSO (Denni - Fiberesima et al., 2011). The informants claimed that it is important to know the area of operations in order to adjust the project accordingly and to avoid the risks of an unfamiliar environment. Thus, it is important to ensure that the FEED aligns with the situations of the current project.

In the respective description of the empirical data, both primary and secondary, the most crucial factors that were identified for the FEED development were the below:

- FEED needs to be conducted very early in the project management.
- FEED is the basis for setting up the specifications of the project.
- FEED should have standardization input based on previous projects with changes according to the location of FPSO.
- People involved with the development of the FEED should have the authority for decision making.
- FEED includes all the specifications of the project from planning, engineering design, schedule to execution.
- Oil companies should provide feedback and comments in order to ensure that is being developed according to their needs.
- In order to avoid failures and ambiguities the FEED must be developed by the contractor company instead by the oil operator. Contractors are more expert and oil operators can focus on oil production.

5.1.3 Interface Management and Communication

All the participants mentioned that there is an Interface Manager or Coordinator appointed as a member in the PMT. The importance of having interface plan in order to control the flow of information between all the involved parties was pointed out in the literature review (Cabanillas,

2011) and it appears to be verified by the participants. Moreover, contractors recognized that projects such as FPSOs find difficulties in checking the interface progress and risks (Mierendorff, 2011). Meanwhile, the main influential factors for having effective interface management and communications between the employees is to ensure that all the conflicts between them are solved in order to overcome barriers and have clear communication channels understood by all. Thus, this implies a well structured and a strong Interface Management Register, as the informants suggested that will lead to a successful implementation of the project.

Project communications involve the flow of information within the project team as an effort to control and structure the necessary information that is of high importance (Alawi, 2009). Communication, as seen by the managers, is the way that FPSOs contractors communicate with their clients, suppliers and all the relevant stakeholders in order to transfer the right information in order to carry out the project in an efficient manner. Therefore, in case of failure of efficient flow of information, it will lead to project failures.

However, all the participants agreed that despite the early formulation of the FEED it is very difficult to avoid changes in complicated projects like FPSO and it is obvious that changes can be a disadvantage for the project to move forward without difficulties. Our empirical findings proved that changes during the project execution occur either after client's request to change parts of the process during the conversion or as an effort to deal unexpected issues therefore, change must be tracked and be prioritized. The key issues for success that were identified in case of a change occur are:

- The project manager should be always aware of these changes.
- Ensure that the project plan can control these changes and variations.
- Contracts should be clear and well structured in order to avoid ambiguities.
- Changes are time consuming and very difficult to be handled so in cases they can be avoided, this will be the best solution.

5.2 Stakeholders

By previously thorough examination of the main challenges and opportunities that can be gained from the management of the stakeholder relationship this subchapter refers to the process and strategies in managing the stakeholders related to the company as a part of the project management. The elements of this framework are the main interested parties such as contractors, operators, partners and suppliers in order to understand their responsibilities, the contract terms,

the objectives of the project and solutions. When the identified stakeholders are being managed correctly by the project team every decision made by the contractor has a direct impact on the stakeholders. Every stakeholder is interested in FPSO project, either because they provided financing, or they are clients, or suppliers or even because they are working for the particular project. There are various stakeholders that are linked to the FPSO project and the main groups are being analyzed below as suggested in the theoretical framework.

5.2.1 Human Resources

The selection of an experienced, highly skilled and capable PM and PMT is a key factor for delivering successful conversion of the FPSOs. It is undeniable that a PM needs to demonstrate an excellent knowledge of the project management procedures as well as a strong character to influence its project team to ensure the right flow of information between the different parts associated within the project and to inspire the team to optimally accomplish their goals. There is no doubt that a PM needs to have knowledge of multiple technical disciplines in the field such as hydrocarbon processing, marine and offshore systems (PMI, 2008). All the participants agreed that a good PM he must be a good communicator, have correct and realistic estimations and have the technical ability.

As for the PMT, the participants suggested that it must be obligatory for them to take part in the meetings that are being set to develop the FEED and have the authority to also participate when choosing the suppliers, shipyards and during the selection of the vessel that will be later converted. The PMT should be highly qualified skilled to fulfill the requirements of the project and cover the disciplines within the scope of work and clarify their responsibilities.

The conditions for success that were identified when describing the empirical data for the PM and the PMT by also having the literature review as a frame of reference are:

- PM should have the experience and qualifications to deal with complex projects in FPSO field.
- PM should cooperate with the Cost Manager, to provide basic information.
- It is better for the PM to select its team rather than being appointed from others.
- Both project manager and the project team should be involved in the process of creating the specifications and the formation of the contracts.
- The right choice of people for the team to ensure that they have the required skills for FPSO execution.

- Motivation, collaboration and a greater awareness of each other's responsibilities.
- The PM and the PMT should have a clear understanding of who is doing what and why as this might be an influential factor in the execution of the project activities.
- The PMT should take part when developing the FEED.

5.2.2 Suppliers

It was suggested by the informants that it is important for the company to realize the capabilities of each supplier in order to decide which are the most qualified and also to identify gaps and possibilities of improvements with the existing suppliers. It is vital to identify the risks that might occur from the choice and be able to arrange these risks and allocate the company's resources effectively. In addition, a framework like this could have the form of a scorecard as an effort to prioritize the suppliers (Gerwick, 2007). In FPSO projects it is very important to ensure that the suppliers will deliver the equipment as schedule with no delays. This implies a good understanding of the agreement so the suppliers can meet the deadlines. In addition, the framework should be developed in order to choose reliable suppliers to ensure that the work sequence will not be affected by unclear SOW and delays. In addition, client's specifications need to be fully understood and this will be achieved by having coherent agreements. Thus, the challenges and opportunities that arise from the cooperation with the suppliers are:

- Understanding client's specifications in order to choose the suppliers who can offer the relevant materials and equipment aligned to client's needs and targets.
- Quality assurance of the engineering deliverables, latest technology, record of measuring performance.
- Regular quality control inspections to ensure that specifications are met accordingly.
- Inspection of materials and equipment that affect the process of conversion.
- Relationships involve long term contracts, agreements, alliances and local content
- Ability to provide technical support during the execution.
- Early placements to avoid risks.
- Understanding the SOW of the oil operator in order to order the equipment and materials in accordance with what the client needs.

5.2.3 Shipyards

All the participants agreed that the shipyard has to be selected in a very careful way since it is a major factor for influencing the cost of converting the FPSO. Usually the choice is taken based on previous collaboration with the specific shipyard, their current workforce experience in FPSO, on the availability of materials, on the support they provide, on the location and their

capacity (Mierendorff, 2011). According to the empirical findings, there are cases that the shipyards are owned by EPC companies and some other cases where the shipyards are clients of EPC companies. There is no doubt that with the right personnel it will allow contractors to execute FPSOs accurately, exactly as planned from the starting point of the process. The matter of shipyards has been a major worry for the participants, who are looking for better cooperations in favor of the FPSO fabrication. Therefore, the long experience of the workers at the shipyard will mitigate major challenges. Moreover, the empirical findings show that if a manager is assigned to the shipyard for controlling the processes during the conversion of the project, then greater results will be achieved since the workers will gain a better understanding of the SOW.

In addition, the participants confirmed the ideal selection process for the right choice of shipyard as Maroulis (2004) and Mierendorff (2011) suggested and is based on the factors below:

- Reputation of the shipyard in terms of performance and reliability.
- Previous collaboration, excellent relations based on trust.
- Maintaining good relationships based on long term agreements.
- Availability of human resources and Capacity for project execution.
- Flexibility of the shipyard in case the owner needs to make changes or ask for extras on top of the basic design.
- Location and Environmental conditions.
- Previous experience of the shipyard in handling similar FPSO specifications.
- Ability to handle changes or modifications in case the client request for changes in the project and the ability to provide support during the conversion.

5.2.4 Clients

Even though the conversion phase is being controlled by the contractor, after analyzing the empirical data we came to the conclusion that it is also vital for the clients (oil operators), to be involved during the conversion of the project since this influences their project. However, the responsibilities of each part should not get confused and in the contract it should be clarified that the client has no responsibility for decision making during the conversion phase and FEED development FPSO but only the authority to monitor. It is undeniable that in order to deliver a successful project, it depends on the client's good communication that is required in favor of putting forward all the necessary information. Poor communication will lead to misinterpretation, wrong direction, delays to get approvals, or even misplaced activities during the work execution, which will lead to costly mistakes (PMI, 2008). Once again the importance

of Interface Management was pointed out by the informants, as a daily process between the contractor and oil operator in order not to miss important information and data caused by project delays and as an effort to respond in advance in case of changes. The challenges and opportunities that arise from the cooperation with the clients according to the empirical data are:

- A clear and continuous communication network should be built between the client and the contractor.
- Clear definition of the scope of work.
- Continuous Interface Management.
- Clients should have the access to provide important input and changes.
- Involvement of the client during the conversion of FPSO.
- Clients should mention and clarify their key criteria in the contract and their expectations for the conversion of the project in an early stage.

5.3 Contract and Legal

5.3.1 Regulations

From the description and analysis of the empirical data it is understood that the regulatory framework for the FPSO industry is not straightforward and there is no international recognized regulatory treatment. As mentioned in the frame of reference since the FPSO is considered to be a "ship" it is mandatory to comply with the standards of a ship that must be registered under the flag state where the vessel is registered (Lombardo, 2003). However, this signifies that the flag state has the right to exercise control over matters such as conversion, material and safety practices, and thereby, come into contrast with the regulations for platforms that must be followed as soon as the FPSO is detached to the seabed. By arguing between the two different regulations, PMs are worrying about misunderstandings and especially in this field where there is a lack of skilled lawyers to build robust agreements (Brown and Dean, 1995).

Moreover, it is well understood, that issues towards the liabilities of the contractor and operator may arise. For instance, the empirical data showed that in case of pollution and injury of the employees the contractor would want to limit its liability, in contrast with the case of property damage which should be of contractor's responsibility. Due to this unclear regulation between the levels of functional responsibilities that oil and construction companies should follow independently, it might lead to a poorly defined project. Thus, the negotiations should be strong enough in order for the contractor to avoid as many liabilities as possible.

The major factors that were identified as influential elements for the success of the project within the development of agreements are the below:

- Long term contracts based on trust.
- Robust agreements to meet client's requirements.
- Make policies live documents.
- Corporate with processional law agencies.
- Developing a good contract to clarify the terms and conditions and avoid ambiguities.
- Each part should understand their obligations and requirements by taking into account the unwritten ones, f.e who is responsible in case of an accident, for decommission ect.
- Contracts from the beginning of the conversion until the end of the commercial production to ensure that the FPSO will not be leased to another company in case it is needed for a longer period.
- Comply with the international environmental standards and law, as well as with the company's environmental policies and guidelines.

5.3.2 HSE

The importance of the environment as an investment for the future and the health care of personnel is of increasing importance (Cameron, 2006). The risks that the company is exposed to when there is a lack of interest for developing an HSE framework, are well understood by the oil companies and contractors. As briefly discussed in the theoretical framework, the most critical risk event that might arise and affect the HSE framework, are the explosions and collisions between the FPSO and the shuttle tanker during the process of tandem off loading configuration (Vietnem:2013). Indeed, during the interview process the participants estimations showed that high probabilities are associated with events like this by giving an example of the recent explosion of FPSO in Brazil, followed by a number of wrong events caused by a weak HSE framework.

What is the most important when it comes to HSE can be identified below:

- Strictly commitment of the workers to the HSE program.
- Careful selection of skilled personnel to ensure the quality of the process.
- Policies to prevent pollution.
- Efforts to facilitate employees to prevent accidents.
- Strong focus of the company on HSE training of personnel.
- Development of a set of guidance for controlling all the features that can mitigate or increase the risks and act accordingly.

5.3.3 Financial Challenges and Opportunities

5.3.3.1 Cost and Financing

The financial crisis in 2008 has increased the need for evaluating alternative methods of financing of FPSOs and the biggest challenge of the companies is to develop a reliable risk management framework in order to prove how well prepared they are to face the project challenges as well as the excellent operational procedures of the company (IQPC). As the literature suggested the companies prefer debt as a method of financing and financial institutions tend to give financing easier for experienced contractors, the market leaders that have already delivered successful projects (Minn, 2014). All the above were clarified by the participants who also added that getting financing usually depends from the reputation of the company, experience and previous performance. Moreover, participants stated that by having a well structured and strong project assessments it will determine the ability of the project to move forward and thus to get financing. This is also supported by the financial investors who are obligated to investigate if the company has already developed a proper risk allocation assessment. Financial analysts are well educated to identify the risks that are most likely to be occurred by an oil and contractor company and for instance, balance sheet risks, credit risks should be well defined in project management schedule and framework to prevent risks (Lombardo, 2003).

Technical and operational expertise is another crucial factor for the company to get the financing for a project and the level of their experience in safety operations according to their past performance. In addition to the literature review, the informants agreed to the below factors that influence the cost management of the project as well as the significant increase of CAPEX.
What are the most crucial elements in cost management as an effort to get approvals for financing the project are the below:

- Finance affects the whole life of the project and should be assessed accordingly.
- Cost management frameworks should be developed from the very first steps of the project until the conversion of the project.
- Cost management framework should be robust, statistically developed, predictions to be based on previous projects and on the inputs acquired from the project manager.
- The budget has to represent the specifications and the scope of work, a budget with too strict requirements will not allow the project to successfully compete.
- The budget must be strong enough to support any form of changes or risks that might occur.

- In order to have a good schedule to be based in reality it is important fro PM and PMT to provide updated information.

5.3.3.2 Lease or Ownership

As expected from the literature review (Damodaran), the informants agreed that most oil companies prefer leasing than owing an FPSO since it is a "cheaper" option and the risks are being reduced. In order for the oil operator to determine the best solution between leasing and buying an FPSO, an examination of all the motives and their consequences need to be concluded. The empirical findings have suggested that decision is mainly depending on the timescale of the development and how long the asset will be in operation. Also, the decision to lease or own an FPSO unit is driven by economic aspects and the ability of the operator to fund its own FPSO. Foe example, when oil companies are looking at the cost involved, they include the rate within a specific period of time and realize that it may perhaps be better to own the asset instead of leasing it (Yee, 2013).

According to the empirical findings, what is the most important when owning or leasing an FPSO are:

- The ability to maintain control of the process, extend the life of the project without the need of extending contracts with the owners of the FPSO.
- The ability to relocate the FPSO to another location for oil developments.
- When leasing the oil operator focuses more on the operation of the field and oil extraction rather than building the FPSO.
- Large CAPEX is associated with the ownership of the FPSO.
- Lack of technical capabilities for the conversion of FPSO within the company.
- Depends on the life of the field.
- When leasing there is an opportunity to mitigate risks and liabilities.

5.4 Tensions and Contradictions

This research advances the opportunities and challenges in the project development during the conversion of FPSO by arguing that this technical solution is best applied when the major elements of the project are understood as influential factors for the success of the project. After describing and analyzing the empirical data by having as a frame of reference the literature review, findings show that FPSO is not a straightforward phenomenon. Despite the fact that the key directions of each influential factor are well understood by the project managers, challenges

might occur in favor of the complexity of the project. Therefore, different solutions can be applied depending from the interested party, either the oil company or the oil contractor. The oil company is interested in building a framework to deal with the major risks during the operation of the FPSO while the oil contractor is interested in having the best process during the conversion in order to avoid mistakes that will later influence the modification of the FPSO and thus, its operation.

Moreover, by focusing on problems related to the regulation, EPC Companies are interested in building robust agreements in order to clearly understand the SOW and the specifications that the oil operator request, while the oil operator company is more interested to limit their liabilities and their responsibilities during the operation of FPSO, taking advantage the fact that they do not own the FPSO but they lease it instead, for the purpose of a specific field development.

However, despite the promising numbers for FPSO deliveries and application in the future, EPC Contractors suggest another floating technical solution that is believed to be the most appropriate for the arctic waters. This new technological solution refers to the relocatable concrete-base drilling platform that aims to provide the capability of efficient operation in the ice covered arctic environments. Interested parties of the oil offshore developments are quite skeptical about the FPSOs technical specifications, such as stability and lightweight and it is rather questioned if it is suitable and reasonable application in the arctic areas.

Furthermore the findings from the empirical data have suggested that there is no acceptable international law for FPSO units application and therefore, misconceptions might arise in project frameworks during the planning and execution. In addition to this, different approaches are being used by each party in order to address FPSO's biggest challenges.

All in all, in this research the direction is to draw the attention to some contributions that should be addressed in future FPSO project developments. Contradictions between the actions that each interested party is addressing to opportunities and challenges might exist if the development of FPSO is not depending on robust and understandable agreements and strong project planning and scheduling. FPSO project is a combination of creating inputs and based on this particular picture, when overestimating and being overconfident without having a correct plan, the overall project from the conversion until the operation, will not be completed successfully.

6 Conclusion

This chapter presents the findings from the secondary data and tries to combine and analyze them with the primary data. This thesis explores the three research questions. Firstly, a clear understanding of what an FPSO was provided. Secondly, the opportunities and challenges for the application of FPSO unit were analyzed and lastly, a description of how do different experts and interested parties regard these challenges and opportunities was provided. For this analysis, it was essential to describe and analyze the major critical success factors of this complex project within the project planning, scheduling and execution, the influential factors of stakeholders, regulation agreements as well as cost and financing insights. Further, an analysis of what is the most important for each factor, how to prevent unwanted changes during the conversion phase as well as how to achieve a clear SOW and understandable agreements were discussed.

A sum up in this chapter will be outlined related to the strengths, weaknesses, opportunities and challenges of FPSOs that were identified from the empirical findings and affect the value creation in the project execution. With regard to the research the main conclusion is that all the participants and interested parties believe that FPSO developments remain active and the portfolio of FPSO projects is constantly growing. As the offshore industry moves to deeper waters and thus to more complex projects, contractors are focusing even more on delivering their projects as scheduled. Thus, companies with high experience in delivering difficult and demanding projects that specialized in difficult and demanding projects, have more possibilities to develop successful projects due to their experience in effective project execution. There are several opportunities and challenges that the FPSO industry is facing. Project Management, FEED development and regulatory arrangements have perceived to be the main factors that influence the success of the FPSO development. Having unambiguous and not understandable frameworks and contracts can be one of the main challenges for the existence of changes and problems during the project development of FPSO for the contractors and oil operators. However, great opportunities have been discovered for the companies to take advantage in contrast with the challenges and threats that they need to overcome in favor of developing robust and in early stage agreements. In the light of the previously outlined elements, it is very important to understand that if the PMT achieves to align the design of the schedule to the SOW then there is a big possibility of success.

By following SWOT analysis below is a brief analysis of the major strengths, weakness, opportunities and challenges that can be identified when applying an FPSO unit for oil offshore developments:

Strengths	**Weaknesses**
• Clear communication between the stakeholders. • Continuous flow of information. • Up to date flow of internal and external information. • Strong relationships between the oil company and oil operator. • Document controller to control relevant information. • Transparency will allow working efficiently. • Proven execution capabilities of strategic partners at the shipyards. • Clear, realistic objectives. • Having clear, understandable and unambiguous contracts. • Focus on HSE frameworks. • Standard frameworks and existing designs since they based on previous projects. • Experienced and skilled human resources.	• Lack of project visibility. • Unclear scope of work. • Poor cost management framework. • Weak agreements. • Inability to trace the key drivers of each factor towards the success. • Weak project planning execution. • Failures to understand client's specifications. • Delays in deliveries. • Inexperienced PMT.
Opportunities	**Threats**
• Due to their long experience time schedules are reasonable. • Provided examples of ideal situations from lessons learnt. • Evaluation processes to understand why errors occur, identify problems and improve performance. • Growing demand of FPSOs. • Technological Advances. • Financing opportunities. • Option to lease instead of owing an FPSO.	• FEED could be an external factor that influences the success of the project. • Changes must be avoided and this will be achieved by having a robust and clearly explained contract. • It is vital that a regulatory treatment must be internationally followed and recognized. • Economic instability in the world. • Lack of international regulation in FPSO. • Price changes. • Alternative floating solutions.

Table 5: SWOT Analysis for the purpose of this research

6.1 Further Research

The face to face interviews raised more questions that the ones that were originally proposed and a lot of new influential factors for the completion of FPSO project were discovered. Despite the promising demand growth of FPSO, its supply chain remains ambiguous and further research could be done to address the gaps that were created within this research, such as the logistical challenges and getting resources both personnel and equipment to the drilling rig in remote locations. Therefore, a further supply chain process consideration and investigation of the overall hazard assessment and risks that influence the challenging tasks and the factors that create a robust framework for choosing suppliers and having strong agreements within the logistics management can be explored.

Furthermore, the biggest part of our empirical findings was given over to the stakeholders. By having all these experts from different areas more questions were raised with regard to the influential insights that are coming from the stakeholders and by recognizing the importance of their influence a more emphasis can be given to the stakeholder framework. Based on what was investigated in this research, more questions can be addressed to the stakeholders as an influential factor in order to get closer to the FPSO operations practice. A stakeholder approach can be analyzed, in order to emphasize in the management of their relationships, their differences and later, a comparison of their shared interest can be provided to ensure the success of the FPSO conversion and application. This comparison should be addressed to questions such as:

- Who are the real stakeholders?
- When and how have they been taken into consideration, in practice?

Consequently, a more into detail framework can be buld to help managers to develop their strategic decisions and help them understand how to mitigate the risks and create opportunities.

References

Alawi, B. (2009). *"Interface Management in Transportation Projects"*. The international Community for Project Managers. Available from: http://www.theicpm.com/blog/item/3361interfacemanagement-in-transportation-projects (20-02-2015).

Artto, K. Kujala, J. Dietrich, P. and Martinsuo, M. (2007). "*What is project strategy?*". 12 July. Helsinki University of Technology.

Booth, C. W. Colomb, G. G. and Williams, M. G. (2008). *"The craft of research"*. The University of Chicago Press. 2. United States of America.

Brodeur, C. W. Israel, G. D. and Craig D. D. (2011). *Using Secondary Data to Build Strong Extension Programs*. University of Florida. Available from: http://pdec.ifas.ufl.edu/lrp/pdfs/EDIS_Using%20Secondary%20Data.pdf (29-01-2015)

Brown, R. L. and Dean, T. J. (1995). *"Pollution Regulation as a Barrier to New Firm: Initial Evidence and Implications for Future Research"*. The Academy of Management Journal. 38, 288-303.

Brunes, F. and Lind, H. (2014). "*Explaining cost overruns in infrastructural projects: A new framework with applicants to Sweden*". Department of Real Estate and Construction Management. Sweden. Available from: http://www.divaportal.org/smash/get/diva2:706121/FULLTEXT01.pdf (25-02-2015).

Bruno, A. V. and Leidecher, K. J. (1984). "*Identifying and using critical success factors"*. Volume 17. Issue 1, 23-32. University of Santa Clara. CA. USA.

Burmiarmada, B. (2014). "*Regulatory compliance and Topside processing facilities on FPSO"*. Available from: http://www.fpsonetwork.com/downloadContent.cfm?ID=2528 (22-02-2015).

Cabanillas, C. Resinas, M.and Ruiz-Cortes, A. (2011) "*Mixing RASCI Matrices and BPMN Together for Responsibility Management*?". University de Sevilla. Spain. Available from: http://www.isa.us.es/sites/default/files/paperJCIS11_cameraReady.pdf (27-02-2015).

Cameron, I. Hare, B. Duff, R. and Maloney, B. (2006). "*An investigation of approaches to worker engagement*". School of Built and Natural Environment". Glasgow. Available from: http://www.hse.gov.uk/research/rrpdf/rr516.pdf (25-02-2015).

CCSL, *"Floating Production, Storage and Offloading (FPSO) Facilities*", Available from: http://www.energyclaims.net/assets/FPSO-Presentation.pdf (02-04-2015).

CEIM (2010). *"The Use of Planning and Control Techniques in Construction Projects in Thailand*". Professional Management Education. Available from: http://professionalprojectmanagement.blogspot.ru/2010_03_01_archive.html (20-02-2015).

Cuthill, M. (2002). *"Exploratory Research: Citizen Participation, Local Government and Sustainable Development in Australia"*. Sustainable Development. Australia.

Daft, R. L. and Marcic, D. (2013). "*Understanding Managemen"t*. Chapter 3: Planning. South Western Cengage Learning. 8, 166-207. USA.

Damodaran, A. "*The debt-equity trade off: The capital structure decisions*". Stern Business School Available from http://people.stern.nyu.edu/adamodar/pdfiles/ovhds/ch7.pdf (25-02-2015).

Denni - Fiberesima, D. and Rani, N. S.A. (2011). *" Critical Success Factors in Deepwater Oil and Gas Project Portfolios: An evaluation of critical success factors, strategies, concepts and methods"*. VDM. UK.378-395.

Dick .B, (2000), "*Data-Driven Action Research*", Available from: www.uq.net.au/action_research/arp/datadriv.html (31/01/2015).

Dutta, S. (2015). *"Oil and Gas Technology: The Future is Now"*. IQPC. UK. Available from: http://www.oilandgasiq.com/strategy-management-and-information/articles/oil-and-gas-technology-resource-centre-the-future/ (04-02-2015).

Dutta, S. (2015). About FPSO. "*FPSO Resource Center: Introduction to Floating Production Storage*". Oil and Gas IQ. FPSO Euro Congress. February 2015. FPSO Network. London.

Easterby, S. A. Thrope, R. and Jackson, P. (2012). "*Management Research*". 4th Edition. SAGE Publications. London. UK.

Eide, W. A. (2008). "*Prosafe Production: Fundamrental analysis and valuation of Prosafe Production*". 20 December. Copenhagen Business School. Denmark. Available from: http://studenttheses.cbs.dk/bitstream/handle/10417/1567/anders_w_eide.pdf?sequence=1 (28-02-2015).

Eide, W. A. (2008). Prosafe Production. "*Fundamental analysis and valuation of Prosafe Production*". Masters Thesis. Department of Economics. Copenhagen Business School. Available from: http://studenttheses.cbs.dk/xmlui/bitstream/handle/10417/1567/anders_w_eide.pdf?sequence=1 (11-05-2015).

Freeman, E.R. (2010). "*Strategic Management: A Stakeholder Approach*". Boston Pitman. No 01-02. United States Of America.

Gautier, D.L. and Klett, T.R. (2009). "*Assessment of Undiscovered Oil and Gas in the Arctic*". US Geological Survey. Fact Sheet FS-2009-3037 .p.4.

GE Energy (2010). *"Offshore Platforms and FPSOs"*. Measurements and Control Solutions. Nevada. United Stated Of America. Available from: http://www.gemcs.com/download/appsolutions/GEA18186EN_offshore-production.pdf (14-02-2015).

Gerwick, J. (2007). "*Construction of Marine and Offshore Structures*". Third Edition. CRC Press.Taylor and Francis Group. New York. 1, 1-9.

Guba, E. G. and Lincoln, Y. S. (1985). *"Naturalistic Inquiry"*. Newbury Park. CA: SAGE Publications. United States of America.

Guba, E. G. and Lincoln, Y. S. (1994). "*Competing paradigms in qualitative research*". Handbook of qualitative research. Thousand Oaks. CA: Sage Publications. pp. 105-117. Available from: https://www.uncg.edu/hdf/facultystaff/Tudge/Guba%20&%20Lincoln% 201994.pdf (02-02-2015).

Haney, M. R. (2012). "*Market Trends in the FPSO Business*". The 2nd FPSO Vessel Conference. Douglas- Westeood. October 17th. Houston. Texas. Available from: http://www.douglas-westwood.com/files/files/731-FPSO%20Market%20Outlook%202012-10-16%20(WEB).pdf (04-02-2015).

Harris, P. (2015). "*Goliat FPSO sales away from Korean shipyard*". Oil and Gas Technology Magazine. Available from: http://www.oilandgastechnology.net/upstream-news/goliat-fpso-sails-away-korean-shipyard (14-02-2015).

HFW (2012). Holman Fenwick Willan. "*The Legal and Regulatory Treatment of FPSOs, with a focus on Limitation of Liability*". 2 Holman Fenwick Willan LLP. London. UK. Available from: http://www.hfw.com/downloads/Client%20Brief%20%20FPSOs%20[A4%206pp]%20July%20 2012.pdf (22-02-2015).

Hoepfl, M. C. (1997). "*Choosing Qualitative Research: A Primer for Technology Education Researchers*". Journal of Technology Education. Volume 1. Appalachian State University. NC. Available from: http://scholar.lib.vt.edu/ejournals/JTE/v9n1/hoepfl.html (02-02-2015).

Høivik, D. (2009). "*Health Safety and Environment Culture in the Petroleum Industry in Norway*". PhD Dissertation. University of Bergen. Norway. Available from: https://bora.uib.no/bitstream /handle/1956/3590/Dr.thesis_Dordi%20H%C3%B8ivik.pdf?sequence=1 (05-05-2015).

Hox, K. (2013). "*Successful FPSO start-up*". Teekay Petprojarl. The 14th annual FPSO Congress. Available from: http://www.fpsonetwork.com/downloadContent.cfm?ID=2416 (18-02-2015).

Institute of Lifelong Learning, (2009), *"Introduction of Research"*, Version 1.0, University of Leicester, November 12, UK, Available from: http://www2.le.ac.uk/projects/oer/oers/lill/ oers/fdmvco/module9/module9cg.pdf (30-01-2015).

International Energy Agency (IEA). "*World Energy Outlook 2013*". November 12. London.

IQPC (2013). "*Groundbreaking FPSOs, on the Verge of Something Big*". FPSO Congress 2013. September 16-19th. Singapore. Available from: http://www.oilandgasiq.com/fpso-flng/white-papers/fpso-groundbreaking-fpsos-on-the-verge-of-somethin/ (04-02-2015).

Jacobsen, J. (2011). "*Sustainable business and industry: Designing and operating for social and environmental responsibility*". Milwaukee. Wis.: ASQ Quality Press.

Joynson, J. Director of Proposals & technology Development at SBM Offshore. (2015). "FPSO Deepwater Projects". Presentation at the FPSO Euro Congress. 10-12 February. UK

Klare, M. (2008). "*Rising Powers, Shrinking Planet: The New Geopolitics of Energy*". Metropolitan Books. New York.

Kvale, S. (1996).*"Interviews: An Introduction to Quantitative Research Interviewing"*. SAGE Publications. Thousand Oaks California. United States of America.

Kvale, S. and Brinkman, S. (2009). "*Interviews: Learning the Craft of Quantitative Research Interviewing*". SAGE Publications. Second Edition. United Kingdom.

Lacatena, J. (2010). Engineering Consulting. "*Engineering Coordination During Front- End Engineering Design*". Carmagen Engineering Inc. USA. Available from: http://www.carmagen.com/news/newsletters/Carmagen_6_10.pdf (11-05-2015).

Lindberg, F. (2014). *"Interpretive methodology: From Philosophy of science to practical research"*. Research Methods. March. University of Nordland.

Longman, A. (2004). *"Project Management: key tool for implementing strategy"*. Journal of Business Strategy. Vol 25, No 5, pp54-60, Emerald Group Publishing Limited. Available from: http://www.kepner-tregoe.com/pdfs/articles/jofbusinessstrategypm.pdf (21-02-2014).

Malterud, K. (2012). "*Systematic Text Condensation: A strategy for qualitative analysis*". Scandinavian Journal of Public Health. Vol.40, 8, p.795. Academic Journal.

Maroulis, V. (2004). "*Decision making processes in shipping acquisitions and shipbuilding*". Massachusetts Institute of Technology. Massachusetts Institute of Technology. Availabe from: http://dspace.mit.edu/bitstream/handle/1721.1/33420/62862536-MIT.pdf?sequence=2 (05-05-2015).

Maxwell J. (2008), "*Qualitative Research Design - An Interactive Approach*", Chapter 7: Designing a Qualitative Study, SAGE Publications, United States of America.

Mierendorff, R. (2011). *"Critical success factors for the efficient conversion of oil tankers to floating production storage offloading facilities FPSOs*". Southern Cross University. Available from: ePublications@SCU (20-02-2015).

MindTools. "*Critical Success Factors, Identifying the Things that Really Matter for Success*". Available from: http://www.mindtools.com/pages/article/newLDR_80.htm (17-02-2015).

Minn, H. S. (2014) "*Petroleum Basins in Offshore*". Presentation.FPSO Leasing Forum, SunOpec ENERGY Systems, Burma, Indonesia

MODEC, *"About FPSO"*, Available from: http://www.modec.com/fps/fpso_fso/about/ (04-02-2015).

Morse, M. J. Barrett, M. Mayan, M. Olson, K. and Spiers, J. (2002). "*Verification Strategies for Establishing Realibility and Valitidy in Quantitative Research*". International Journal of Qualitative Methods. IIQM. University of Alberta. Available from: http://www.ualberta.ca/~iiqm/backissues/1_2Final/pdf/morseetal.pdf (02-02-2015).

Newman, I. and Benz, C. R. (1998). "*Qualitative - Qualitative Research Methodology, Exploring the Interactive Continuum*". United States of America, Southern Illinois University. Available from: https://www.google.ru/books?id=xumf1ABFz8cC&printsec=frontcover#v=onepage&q&f=false (01.27.2015). p.2.

Odufuwa, D. (2014). "*An overview of the FPS leasing market: Growth and Changes*". Offshore Engineer. Texas. Available from: http://www.oedigital.com/regions/item/4760-an-overview-of-the-fps-leasing-market-growth-and-changes (10-05-2015).

OGP (2006). International Association of Oil and Gas Producers. *"Guideline for managing marine risks associated with FPSOs"*. UK. Available from: http://www.ogp.org.uk/pubs/377.pdf (04-02-2015).

OGP (2010). "*HSE Management - guidelines for working together in a contract environment*". ReportNo.423, June. International Association of Oil and Gas Producers. Available from: http://www.ogp.org.uk/pubs/423.pdf (25-02-2015).

Parker, G. (1999). "*Newbuild FPSOs: What Can Go Wrong*". Oil & Gas Journal. Vol. 59, no. 2.

Patel, A. (2008). Conceptual Design and FEED Applicaitons. *"Best Practises in Front End Design"*. A Bentley White Paper, Bentley Systems Incorporated. USA. Available from: http://ftp2.bentley.com/dist/collateral/whitepaper/FEED_screen_whitepaper_plant.pdf (5-11-2015).

PMI - Project Management Institute (2008), "*A Guide To The Project Management - Body of Knowledge*", PMBOK Guide, 4th edn, Project Management Institute Inc, Pennsylvania, Available from: http://www2.fiit.stuba.sk/~bielik/courses/msi-slov/reporty/pmbok.pdf (26-02-2015).

Salmons, J. (2012). *"Cases in Online Interview Research"*. Vision2Lead. Capella University School of Business and Technology. SAGE Publications. United States of America.

Sheng, M. L. (2014). "*Valuable Insights on FPSO Financing*". IFC Global Oil and Gas.13th Annual FPSO Congress. London.

Shenton K. A., (2003), *"Strategies for Ensuring Trustworthiness in Qualitative Research Projects"*, Northumbria University, Newcastle upon Tyne, UK, Available from: http://www.crec.co.uk/docs/Trustworthypaper.pdf (02-02-2015).

Shirley, R.R. (1986). *"An expert system to Aid Process Control: A Study in the Design and Manufacturing Interface*". Harvard Business Review. USA. 425-430.

Shirley, R.R. Stevens, J. H. and Strachan, A.D. (2006). "*Complex Projects Need Coordination*". Offshore Construction. Texas. USA. Available from: http://www.woodgroup.com/SiteCollectionDocuments/news-tech-articles/2006-10_ComplexProjectsEP_Mustang.pdf (02-20-2015).

Small, S. (1995). *"Action-Oriented Research Models and Methods",* Journal of Marriage and Family, no. 57, p. 941-955.

Stebbins, A. (2001). "*Exploratory Research in the Social Science".* Qualitative research Methods Series 48. SAGE Publications. California. United States of America.

Taylor -Powell, E. and Renner, M. (2003). Program Development and Evaluation. "*Analyzing Qualitative Data*". Cooperative Extension Publications. University of Wisconsin.

Vinnem, J.E. (2003). *"Operational safety of FPSO shuttle tanker collision risk summary report*". Norwegian University of Science and Technology. Norway. Available from: http://www.hse.gov.uk/research/rrpdf/rr113.pdf (25-02-2015).

Yee, J. O. S. (2013). "*Critical Success Factors of the FPSO Projects*". Masters of Science in Project Management. Malaysia. Available from: http://eprints.utar.edu.my/1073/1/Project_Report_-_CSFs_of_the_FPSO_Projects.pdf (28-02-2015).

Yin, R.K. (1994). "*Case study research: design and methods.".* Thousand Oaks. CA: Sage. 2. Available from: https://designstudiesdiscourses.files.wordpress.com/2013/09/yincasestudy.pdf (08-02-2015).

Appendix

Appendix 1: Interview Quide

This is the main interview guide. It was formulated according to the experience of the informant.

Introducing Questions

1. Can you please tell me if you have been involved in FPSO projects and how?

Strategy and Project Management

2. What long term strategies does your company have when approaching a current/future FPSO project?
3. How does the company introduce a new offshore project in its strategy?
4. What are the frameworks followed by a contractor in order to successfully deliver a new FPSO project within the frameworks of schedule (in time, with budget, quality assurance) and in compliance with regulatory regimes?
5. What are the main drivers in the decision for a project to move forward?
6. What are the barriers for implementing FPSOs?
7. Are there any external factors that can influence FPSO development?
8. In your point of view, what are the main reasons for a project to fail?
9. What are the Critical Success Factors in order for the project schedule to affect and control the rate of success for FPSO projects?

Influential Elements

Human Resources

10. How the organization is aware of how many responsibilities each employee is being assigned and keep in track who is accountable for a particular task and how different departments communicate with each other for efficient flow of information?
11. How are the project employees being trained in order to understand the critical success factors and deliver value to the project?

Coordination with the suppliers and clients

12. How do contractors ensure that their suppliers will deliver projects on time within budget and with consistent quality? What kind of strategies is being followed?

13. According to the responsibility matrix there are different roles for a contractor and client. How does Rosneft achieve the right flow of information with the contractor company?
14. How do FPSO Contractors communicate on the subject of change management which could affect the project cost and schedule?

Stakeholder

15. What kind of stakeholder analysis is being developed in order to mitigate the risks?
16. Which are the main stakeholders involved in the project and how can they affect the company?
17. How is in charge to communicate with all these stakeholders during the project execution?

Cost and Finance

18. Does the company consider leasing FPSO instead of owning? Why?
19. How can the oil operators and contractors get financing?
20. What is the cost structure of a vessel contractor operating FPSOs?
21. What are the factors that lead to increased capex costs?
22. How vessel contractor for FPSO projects can reduce costs and enhance project profitability?
23. Do you believe that these costs are difficult to be control in that kind of projects?

Future Potentials

24. Is the company going to continue with FPSO project in the nearby future or are is it focusing on other offshore promising projects?
25. Do you feel that FPSOs are the right solution for the marginal fields in the Arctic? Why?
26. How is it possible to achieve successful project delivery and profitability in the current oil price?