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Risk based Follow up of Technical Documentation

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"Not everything that can be counted counts, and not everything that counts can be counted"

- Albert Einstein, Physicist (1879 - 1955)

Abstract

For Statoil to achieve their goal of continuous production and delivery of oil and gas from the Norwegian Continental Shelf, they are dependent on realising projects on smaller to medium sized fields that until now have been unprofitable. To achieve this goal, Statoil initialized a fast track portfolio which strategy is to make use of synergies from earlier projects, and to standardize deliverables from frame agreements with contractors, and by doing so reduce execution time, and realize cost savings in project development.

One of the key elements in standardizing deliverables is that Statoil can reduce time spent on reviewing documents from contractors. In securing that the fast track portfolio has the desired effect on resources spent on contractor follow up, document control performed an analysis of the amount of documents reviewed in fast track projects versus other project portfolios. Findings from these analysis revealed that the percentages of documents reviewed in fast track projects where higher than in any other project portfolio, and that there are great deviations in the amount of documents in for review in quite similar projects, and within the same frame agreements. Results from this analysis were in large part the basis for this master thesis. Statoil wants to further investigate why these deviations occur, and if there will be advantageous to implement some guidelines to improve the review process, and make it more streamlined and consistent.

This thesis asks *why* these deviations occur, and focuses on identifying areas where improvement measures can be implemented. Focus has been given to three fast track projects currently in the execution phase, and by conducting quantitative data analyses in combination with qualitative interviews of key personnel in the fast track portfolio, this study has highlighted several areas where improvements could be implemented.

Key findings in this thesis:

- Alignment of Statoil and contractor's philosophy behind the risk based follow up strategy.
- Better communication between document management and engineering disciplines.
- Better communication between projects and disciplines.
- Better overview over documents in for review.
- Implementing criticality levels for documents in for review.
- Improved experience transfer between projects and employees.
- Implementing a system for storing documents and comments from earlier projects.

Selecting documents to review is a highly qualitative process that mainly depends on the human factor and each engineer's experience and risk averseness. One of the main findings in this study is that lack of experience transfer and misconceptions of the risk based follow up strategy generates a high amount of documents for review. Communication between projects, contractor and disciplines should be systemised to better take advantage of synergies and earlier experiences. Aspects regarding the system used to administrate the review process are also highlighted in this thesis. Especially how the interface facilitates a risk based evaluation of documents in for review.

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Abbreviations

TPD	Technology, Projects and Drilling
FHN	Fram H Nord
GSO	Gullfaks Sør Olje
TYX	Tyrihans Xmas-tree
SDT	Subsea Delivery Team
eRoom	Database software for storing and handling project documents
QRM	Quality and Risk Management
DM	Document Management
CMDR	Company Master Document Register
MDR	Master Document Register
ENS	Engineering Numbering System
VS	Visund Sør
DG X	Decision Gate X
ARIS	Statoil`s management system

Preface

This report completes my education for a M.Sc. degree in industrial economics at the University of Stavanger with risk management and project management as specialisation.

I was first introduced to Statoil's quality and risk management (QRM) department during a summer internship in the Aasta Hansteen field development project summer 2012. During the internship I gained insight in to QRM`S responsibilities and field of work, and learned how Statoil works as a project organisation. After completing the internship I was offered to write my master thesis in cooperation with QRM.

This thesis has been a great opportunity to combine my diverse background within quality and risk management and technical disciplines such as statistical analysis and excel modelling. During the work with this thesis I have gained great knowledge about how a big organisation works and been able to use my education in a practical environment.

I will use this opportunity to thank all the people that has helped me and mentored me during this thesis. Especially I would like to thank Kjersti Rødland Aase and Roger Reksten Stølsnes from the QRM department in Statoil for being good mentors and for providing me with office facilities and housing. In addition I would like to thank all Statoil personnel that have helped me with gathering data and set of time to attend interviews. Also a special thanks to my supervisor at the University of Stavanger Petter Osmundsen for responding constructive feedback during this study.

By working with this thesis I have developed a better understanding of quality and risk management in projects, and the importance of having good systems to ensure that projects deliver according to specifications. During this study I have been located at Statoil`s office at Fornebu, and have been part of the QRM team. By attending QRM seminars and workshops, and by being part of the QRM department I have become more ready for the transition from being a student to becoming an employee.

This semester have been both challenging and rewarding and I hope to sometime in the future develop a career within academic research.

Fornebu, 12.06.2013.

Øystein Schanke

Chapter 1 – Introduction

This thesis is a study focusing on Statoil's fast track portfolio, and how to improve the contractor follow up process during execution phase. This chapter constitutes the background, purpose and scope of work in this study. In addition this chapter will provide an overview of the structure and content of each chapter.

1 Introduction

Statoil is a Norwegian oil and gas company with operations in 36 countries and approximately 21,000 employees worldwide. Statoil has more than 40 years of experience from oil and gas production on the Norwegian continental shelf, and is today the world's largest offshore operator, and the second largest supplier of gas to Europe. Statoil are located with headquarters in Stavanger, Norway, and are listed on the New York and Oslo stock exchange (Statoil ASA, 2009b).

As an operator on the Norwegian continental shelf (NCS) Statoil has an extended responsibility to ensure that all deliverables from contractors and sub-contractors is in conformance with requirements set by the Norwegian petroleum directorate.

As part of securing that all equipment holds the required standard, Statoil works with a risk based approach in all projects. A significant part of this risk based approach is what Statoil refers to as "risk based follow up of technical documents". This strategy is developed to ensure that technical documents from suppliers are in conformance with Statoil`s requirements. In the follow up process of these technical documents, discipline engineers choose which documents to review based on their own assessment of the criticality and level of risk related to each document. This evaluation is a qualitative selection based on each engineers experience and knowledge.

For Statoil to achieve their goal of continues production and delivery of oil and gas from the Norwegian continental shelf, a fast track development strategy was established. By shortening the time period for project execution Statoil can realize small to medium sized fields that until now have been unprofitable, and help maximizing the potential of the Norwegian continental shelf (NCS). Three out of four potential new oil and gas fields on the NCS is classified as small discoveries, and conventional project development cannot make these fields profitable. Fast track is therefore key in realizing these prospects with an estimated cost saving of 30% compared to conventional project execution. The fast track portfolio was established to collate and streamline delivery of subsea production systems from Statoil's subsea frame agreement contractors. The goal of this portfolio strategy is to shorten the time period from discovery to production of new oil and gas fields to half of what it is today (Statoil ASA, 2012).

The strategy behind Statoil's fast track portfolio is to make use of synergies from earlier projects and to standardize deliverables from frame agreements with contractors and by doing so reduce time spent on contractor follow up and clarification of deliverables. An important part of this standardization is to achieve a more streamlined and consistent process for reviewing technical documentation from contractors. Today there is no defined standard method for how this review evaluation shall be performed, except from that it should be risk based, which implies that documents should be selected for review based on the inherent criticality and level of risk each document constitutes for the project. Under the same frame agreements in fast track projects Statoil has observed deviations in the amount of documents sent to review both between disciplines and between reasonably comparable projects. Statoil wants to look in to why these deviations occur, and if it will be advantageous to implement some guidelines to improve the quality and consistency of this process.

1.1 Purpose

The purpose of this thesis is to look into why deviations in the risk based follow up strategy occur in fast track projects and further try to identify areas of improvement to achieve a more streamlined and consistent procedure for risk based follow up of technical documents.

1.2 Scope of work

The thesis will be limited to the subsea delivery team portfolio (SDT), and focus on three fast track projects under the same frame agreement. The projects that are analysed have all passed decision Gate 3 (DG3) and are now in the execution phase. This means that the design is frozen and that a contract has been set to a contractor/supplier, and Statoil`s role is to follow up that the construction is performed according to contract requirements.

To answer the research question in this thesis both interviews of key personnel and several data analyses has been conducted. Data analyses have been conducted to compare the as-is situation in each project, and to formulate interview questions. These analyses have been conducted using Microsoft Excel as a tool to sort and compare data from Statoil`s internal document system, eRoom. Qualitative Interviews have been conducted to map the human factor behind each projects method for selecting documents to review, and to identify how the review process is managed. The subject of this study is quite narrow in the sense that there is not much available literature on the specific topic. Nevertheless some literature has been used to derive fundamental definitions and frameworks for the study to be undertaken.

This thesis will be written for the quality and risk management department in Statoil, and will also be in cooperation with document control and engineering management.

The research question to be answered in this thesis will be:

"Why is there deviations in the amount of documents sent on review in comparable projects under the same frame agreement? "

And the main goal is:

To find out how Statoil can achieve a more streamlined and consistent process for risk based follow up of technical documents.

1.3 The structure of this thesis

This thesis includes 4 main chapters.

Chapter 2 – Theory

Chapter 2 explains principles for risk and quality management in project, and defines what risk and quality means in a project view. Further it emphasises performance management and how to measure quality in projects.

Chapter 3 – Methodology

Chapter 3 describes different methods for conducting study research, and concludes on the method best suited for this study. This chapter constitutes the framework for chapter 4 and 5.

Chapter 4 – Analysis

Chapter 4 presents analysis and interviews performed during this study. Both methods and results are presented.

Chapter 5 – Discussion

Chapter 5 combines results from analysis and relevant theory, and discuss findings and areas of improvement based on analysis in chapter 4.

Remark:

Throughout this thesis the reader will find that some technical terms used by Statoil are included early in the text. This is done on purpose to try and lead both the reader and the thesis in to identifying key elements of the research question to be answered. It is my perception that this will help the reader to get a better understanding of the link between academic theories and key elements of this research paper.

Chapter 2 - Theory

This chapter identify and discusses relevant academic theory related to this study. This chapter will provide a basis for understanding key elements of, and the purpose of risk and quality management, including influencing factors for how a management system should be designed. Further this chapter presents the International standard for risk management.

2 Risk Management

In performing an extensive literature search it was found that there is not much available scientific research on the specific topic of "how to perform risk based follow up of technical documents". In search of relevant theory it was still found that some literature on quality management and measuring of project quality, in combination with risk management literature can be used as a basis for deriving such a process. In addition, internal documents and findings from Statoil will be used to evaluate the process.

This section constitutes the basis for how risk will be defined in this thesis. Risk is a subject that covers a wide range of industries, and risk can be present in many ways. Depending on the field of study risk management can be qualitative, quantitative, or both, and how to perform risk assessments and analysis will vary widely depending on the industry standard, the nature of the risks present etc. This section will present general academic literature on the topic, and further try to adapt this theory to the characteristics of this study.

Key literature (external)

- Goff, S. Measuring and Managing Project Quality.
- PMBOK – Project Management Body Of Knowledge.
- Aven, T. Quantitative Risk assessment.
- Aven, T. Risk Analysis – Assessing Uncertainties beyond Expected Values and Probabilities.
- Davidson, F. Managing risk in organizations.
- ISO 31000 - Risk Management – Principals and guidelines.

Key literature (Statoil Internal)

- ARIS Risk management process.
- GL0356 - Appendix E – Document Control – Technical Documentation.
- GL0356 – Appendix P Review of Technical Documents and Drawings in eRoom.

Aven (2011, p. 1) defines risk management as *"all coordinated activities to direct and control an organization with regards to risk*".

The overall purpose of the risk management process can be separated in to two main objectives. The Risk management process shall ensure that adequate measures are taken to protect people the environment and assets from undesirable consequences of the activities being undertaken, and to balance different concerns regarding for example cost and schedule risk, allowing an organisation to explore the potential upside consequence of uncertainty, and at the same time mitigate treats and undesirable consequences. Risk management in the oil & gas industry was traditionally based on a rigid regulation regime where detailed requirements for both design and operation of the plant were specified. Over time this regime has gradually been replaced by regimes that emphasises a goal-oriented philosophy, putting emphasis on what to achieve rather than on the means of doing so (Aven 2011).

2.1 What is risk?

If you ask some random person on the street "what does the word risk mean to you?" you would most likely get an answer like this "The chance of getting hurt or injured".

In other words risk is a word often used in combination with a negative event that may occur in the future. Hence, risk is often used to describe the downside consequences that may occur when performing an activity. Let us say that you are talking about doing a bungee jump. You will probably encounter some people who will describe this as a risky activity with a potential negative outcome, due to the dangerous consequences of performing such a jump (e.g. the line may break, and you fall to the ground and injure yourself). This perception is also reflected in many dictionaries.

The Oxford dictionary defines the word risk as:

"Risk: (noun) The possibility of something bad happening at some time in the future; a situation that could be dangerous or have a bad result" (Hornby, 2010).

This perception of the word risk is mainly used in day to day life to describe concerns or dangers that may affect you. In a business or project point of view the word risk will have a different meaning.

In Aven (2012) `s book Misconceptions of risk, an entire chapter is dedicated to the perception that risk relates only to negative consequences. Aven argues that risk also can be related to opportunities in situations where the outcome could be either negative or positive. Based on this argument one could define different risk perspectives based on the field of study. In those fields where there is presence of both desirable and undesirable outcomes the dictionaries definition is not applicable. Such as in a development project there will be presence of both outcomes. For example for a project where an offshore installation is to be installed in the North Sea, weather conditions could have an impact on the time of installation. If weather conditions are harsh, installation of the platform could be delayed due to high waves etc. On the other hand, if spring comes early the platform could be installed at an earlier point in time, which could have a positive impact on the NPV of the project due to earlier start up and first oil. This example express that a different definition of the word risk has to be established. Aven`s definition of risk is reflected in the book Quantitative Risk assessment, and focuses on a more ambiguous meaning. The definition is as following:

"Risk is the two dimensional combination of an event A, the consequence C, and the associated uncertainty U". (Aven, 2011, Page 27)

By analysing this definition one can see that the word risk not only relates to the downside, but also take in to account the possible upside that may occur. As a response to his definition, Aven asks, will the event A occur? If so, what will the consequence C be? Because of the uncertainty U, we cannot, with 100% certainty answer this question correctly. This is also referred to as the (A,C,U) perspective.

This perception of the word risk is also reflected in both the Project Management Institutes definition, and in the ISO definition.

PMI definition:

> *"Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives."* (PMI, 2004).

ISO definition:

> "Effect of uncertainty on objectives" (ISO, 2009a, P. 1).

By using these definitions one can conclude that the word risk refers to both negative and positive consequences. In a project view, this will be a more suitable use of the word risk. Hence, in this thesis the word risk will refer to both **the downside and upside consequence of uncertain activities.**

2.2 Risk culture

For an organisation to manage risk, having a good system for identifying, communicating and treating risks are an important aspect. But having good systems is not sufficient in itself. Having a healthy risk culture is a key element for an organisations risk management strategy to be efficient. Individuals working in the organisation can be seen as the first line of defence against risks, and having a well implemented and healthy risk culture can be seen as the frontline of an organisations risk management strategy. An organisations risk culture will define how the day-to-day decisions are made, and even small decisions can have a large impact on the organisations results. Having a strong risk culture in an organisation do not necessarily mean taking less risk or focusing only on the threat aspect, but rather that they identify opportunities and upside risks working together as an organisation, and dares to go new ways by exploring new opportunities (Krivkovich & Levy, 2013). The human factor plays a key role in achieving a strong risk culture, and in organisations where risk assessment is performed by many individuals and in several disciplines, aligning the overall goal and philosophy is critical to achieve rigid and effective risk management, allowing the organisation to explore new opportunities and markets in addition to effective management of threats and downside risks.

The consulting firm KPMG has a definition of risk culture that emphasises the behavioural aspect of risk culture, and also incorporates the behaviours of those who may not treat risks directly on a daily basis. The definition is as following.

> "The system of values and behaviours present throughout an organization that shape risk decisions. Risk culture influences the decisions of management and employees, even if they are not consciously weighing risks and benefits." (KPMG, 2009).

This definition is broad, but so is the extent to how risk culture affects an organisations day-to-day decisions and strategies. The risk culture is an important aspect in risk management, and is a relevant topic for the qualitative perspective of the study to be undertaken in this thesis.

2.3 Risk assessment methods

Qualitative and quantitative risk assessment

Risk assessment can be separated in to two fundamental types of risk analysis. Those are qualitative and quantitative risk assessment. Both methods are widely used, and can be applied when managing project risk. Which method best suited for a risk analysis depends on the detail needed and the nature of the risk to be analysed. In the Merriam-Webster online dictionary (2013) the words quantitative and qualitative are defined as following:

Quantitative: "*Of, relating to, or involving the measurement of quantity or amount*"

.

Qualitative: "*Of, relating to, or involving quality or kind*".

Quantitative risk assessment uses fixed numerical values to express both probability and impact (for example impact on cost or schedule) to describe risk. A quantitative risk assessment systemises the present state of knowledge, including uncertainties related to processes, activities and systems being analysed. Quantitative risk assessment identifies possible hazards (such as a tunnel fire or terrorist attack) using quantitative tools like Fault tree or event tree analysis, and evaluates the combination of cause and consequence to describes risk. A quantitative risk assessment provides a basis for describing the likely impacts of the activity studied, and for evaluating whether risk is tolerable or acceptable. In addition, it provides a basis for choosing the most efficient risk reducing measures. Quantitative risk assessment allows for quantifying risks in to expected values so that different risks can be directly compared (Aven, 2011).

Qualitative risk assessment does not operate with exact numerical values. Instead probability and impact is categorized as e.g. low, medium, high where all three categories are defined with an interval of outcomes (Lowder, 2008). This type of analysis can be illustrated in a risk matrix as seen in Figure 1.

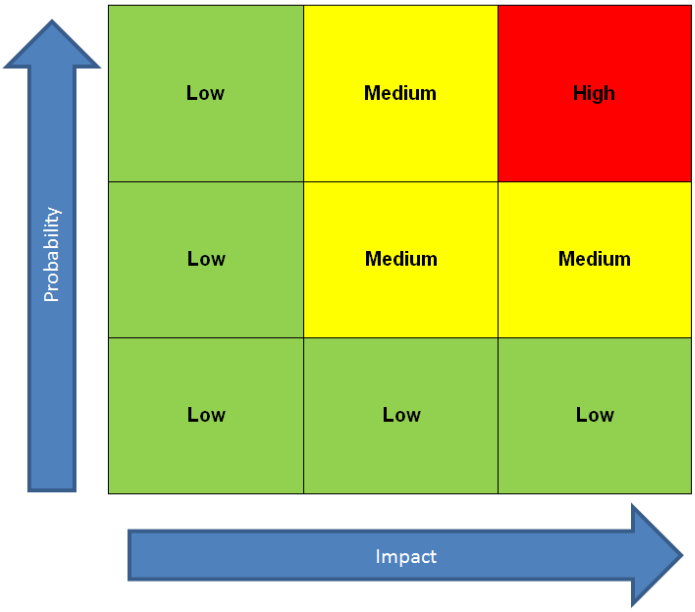


Figure 1: Risk matrix for qualitative risk assessment

In an investment project there will be presence of both qualitative and quantitative risk assessments. The monitoring of cost and schedule risk is often performed using quantitative analysing software, which allows the analysing team to use probabilities as input to a stochastic model. The model will then return an expected value of cost, or time depending on what to be analysed. The input used in these models is often based on experience transfer, historical data and common sense, and the reliability of the output in the model will be as good as the validity of the input data.

As an example, imagine an oil company that is about to make an investment decision for a new oil field. They would naturally perform a net present value (NPV) analysis to calculate the profitability before deciding whether or not to invest. The NPV of the oil field would be calculated on the basis of the expected oil price, first oil, expected costs of construction and operations etc. These numbers will be derived from using historical data, raw material prices and future expectations. And the analysis will result in a number telling you the NPV of the investment. Calculating the NPV using these data will be a quantitative process. It is important to mention that input data can be collected using qualitative methods.

Other risks are more likely to be analysed using qualitative methods. When considering a set of possible risk reducing measures, a qualitative method can be sufficient. For example when building a platform, weight is a critical factor. If the weight of the topside reaches a critical limit, the topside will be too heavy for transportation and installation. In such situations, workshops and discussions can be a good way of analysing different solutions to the problem. Also, during these engineering activities the project team will be able to eliminate solutions that will not have a sufficient effect.

Among risk management specialists there is a strong consensus that quantitative data should be implemented in risk assessments to the extent possible (Davidson, 2003). William Thomson, Lord Kelvin expresses the rationale behind this bias in a famous quotation:

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science". (Bartlett, 1965, P. 723)

- William Thomson, Lord Kelvin (1824 – 1907)

The point of Lord Kelvins quotation is that when one can say that it is a 50 % possibility that an event will occur, you are making a more meaningful statement than when you say that *it is likely that an event will occu*r. Expressing risk with numbers and probabilities makes a more exact statement with less room for interpretation and fuzziness.

2.4 Risk assessment tools

Some common tools used to analyse risk are: risk matrixes, Fault tree analysis and event tree analysis.

2.4.1 Fault tree analysis

Fault tree analysis was developed by Bell telephone laboratories in 1962 when they performed a safety evaluation of the Minuteman Launch Control system. The method was further developed by Boing Company who made use of computer software for both qualitative and quantitative fault tree analysis. Fault tree analysis is today one of the most used methods for performing risk analysis, and the method is applied in most industries. (Aven, 2011)

A fault tree is a logical diagram that shows the relationship between system failure and failure of system components. The top of the fault tree constitutes the undesirable event and the different component failures constitute the basic events. For example the top event can be brake failure on a car, and the basic events can be failure of the cars ABS. It may also constitute human errors or failures due to external events such as weather conditions. The fault tree is built up by symbols that show basic events and logical gates that shows the relationship between components. An example of functional elements in a fault tree can be seen in Figure 2.

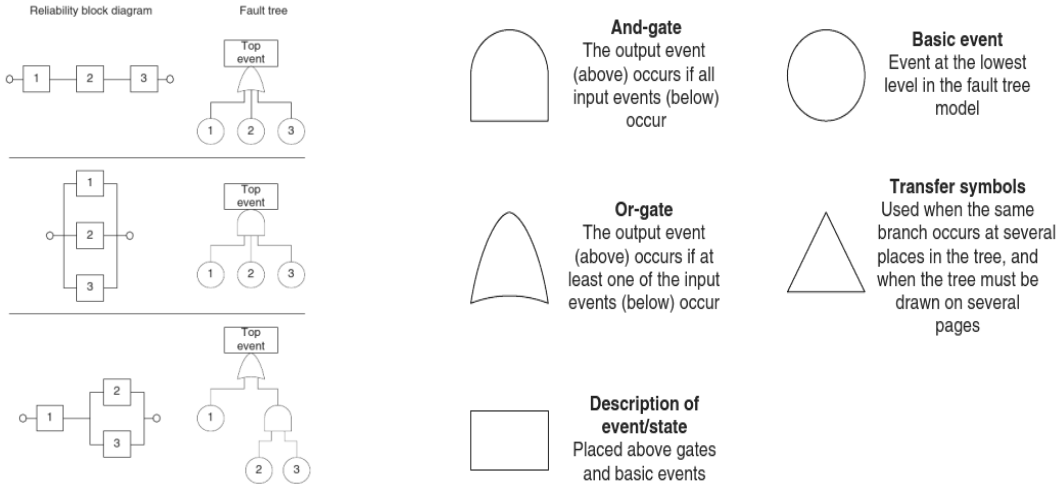


Figure 2: Example of a Reliability block diagram, and symbol description (Aven 2011).

2.4.2 Event tree analysis

Event tree analysis is used to analyse the outcome of for example an investment. The first node in an event tree constitutes an initial event. The event tree then shows the consequences of different scenarios regarding the event. The output of an event tree is the outcome of different scenarios.
For example for an investment in an oil field the first node will be the initial investment, and the tree then calculates outcomes of each scenario. Scenarios can be a fall in oil prices, or variation in the amount of oil recovered from the field. The output in this example will be the net present value of the initial investment. In Figure 3 one can see an example of the structure of an event tree.

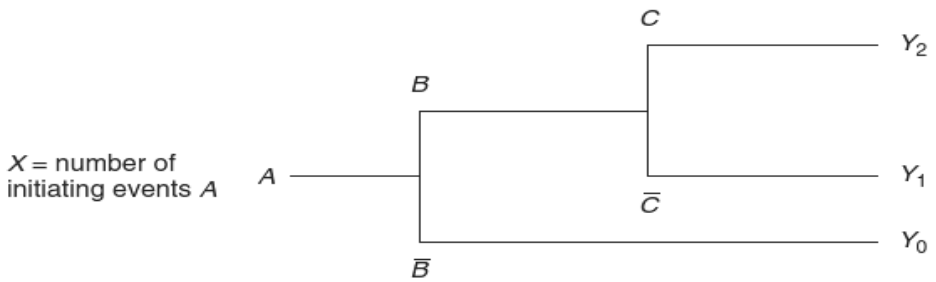


Figure 3: Structure of an event tree (Aven, 2011)

2.5 ISO 31000 - Risk management

This section provides an overview of the general processes for risk management derived from ISO 31000 and Statoil`s risk management process which is compliant with ISO 31000. Figure 4 shows the general risk management process from ISO 31000. And Figure 5 shows Statoil's process for risk management. This section is based on *ISO 31000 Risk Management – Principals and guidelines.*

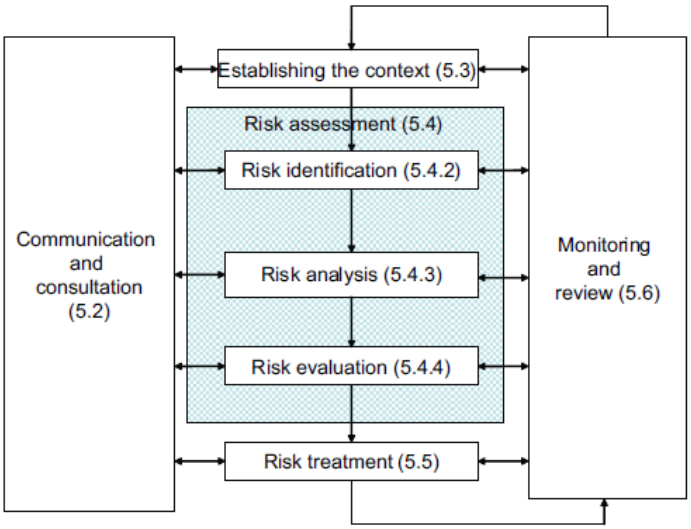


Figure 4: ISO 31000 Risk management process (ISO, 2009a)

Risk management consists of several stages which are defined in the figure above. As you can see from the above illustration risk management consist of a set of stages that should be performed in a defined sequence, with support functions that communicates in all stages. In the following section the content in each of these stages will be presented. In Figure 5 one can see Statoil`s risk management process which is designed on the basis of ISO 3100.

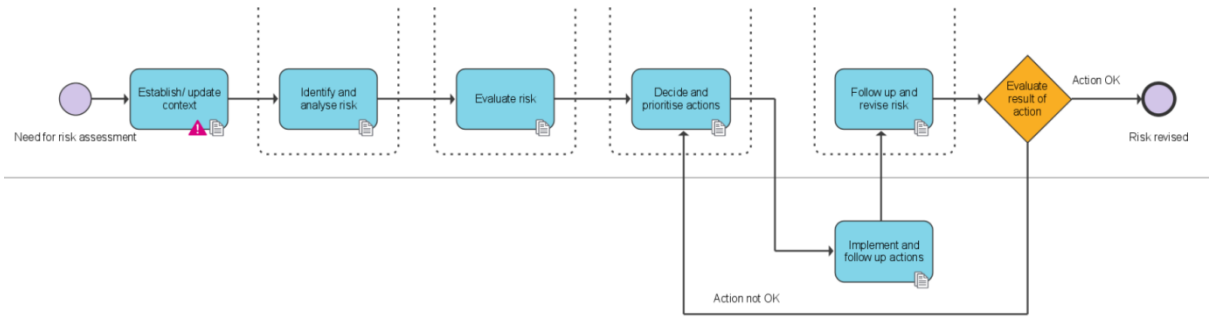


Figure 5: Statoil's risk management process (Statoil ASA, c)

2.5.1 Establishing the context of the risk management process

The objectives, strategies, scope and parameters of the activities in a project should be established. The risk management system should reflect the complexity and the inherent uncertainty with regards to the project, and should reflect a cost effective use of resources to manage risk. All

required resources, responsibilities and authorities, and the records that shall be kept should also be specified. The context of the risk management process will vary within different projects or organisations, and ISO (2009a, P. 16) highlights certain areas that could be defined or identified.

- *Defining the goals and objectives of the risk management activities.*
- *Defining responsibilities for and within the risk management process.*
- *Defining the scope, as well as the depth and breadth of the risk management activities to be carried out, including specific inclusions and exclusions.*
- *Defining the activity, process, function, project, product, service or asset in terms of time and location.*
- *Defining the relationships between a particular project, process or activity and other projects, processes or activities of the organization.*
- *Defining the risk assessment methodologies.*
- *Defining the way performance and effectiveness is evaluated in the management of risk.*
- *Identifying and specifying the decisions that have to be made.*
- *Identifying, scoping or framing studies needed, their extent and objectives, and the resources required for such studies.*

2.5.2 Defining risk criteria

The project or organization should define risk criteria to be used when evaluating the significance of different risks. These criteria's should reflect both internal risk management policies and external requirements such as criteria set by the Norwegian petroleum directorate, or other laws that the organization is obliged to follow. These criteria should be defined at the beginning of the risk management process, and be continually reviewed during the project. (ISO, 2009a)

2.5.3 Risk assessment

The risk assessment process consists of risk identification, risk analysis and risk evaluation. This definition of risk assessment is also reflected in Aven (2008, P. 9).

2.5.3.1 Risk identification

The project should try to identify as many risks as possible in this stage, including events and areas of impact. Have in mind that the definition of risk in this thesis considers both upside and downside risks. The aim of this stage is to produce a list of risks that may occur during the project, and that will have an effect on the project objective, with regard to time, schedule, cost, HSE and quality. In this stage it is important to identify as many sources of risk as possible. Risks that are not identified in this stage will not be included in the following stages, and will therefore not be part of the risk management process. It is important to also take in to account those risks that the project organization not directly can control, and to analyse what the consequence of different scenarios might be (ISO, 2009a) (Aven, 2011). Also those consequences that do not have an evident risk source should be evaluated. Doing so, one would have the opportunity to discover risk sources that is hidden an almost impossible to find when thinking in the direction of Cause →consequence. In this stage one should keep in mind the 80:20 rule stating that 80 % of the risks in a project takes 20% of total time to identify, and the last 20% of risks takes 80% of the total time to identify (Aven, 2008).

This section can be summarised with one sentence. **All significant causes and consequences shall be considered.**

There are several tools that can be used to identify risks in a project, both quantitative and qualitative. For example Workshops, experience transfer, market analysis, historical data etc. Which tool that will be the most appropriate for the identification of risk sources will vary between different projects and organizations.

2.5.3.2 Risk analysis

The analysing part of risk management consists of developing and understanding risks. This stage will provide a basis for evaluating if the respective risk needs to be treated further, and will also give a guide to which risk treatment strategies and methods to use in the next step. The risk analysing process consists of analysing the cause and effect of risk, and the positive and negative consequences. In this stage the likelihood that the respective consequences may occur shall also be identified (ISO, 2009a). In this stage, risk is evaluated by the relationship between consequence and likelihood, and where quantifiable turned in to expected net present value (npv).

Risk analysis can be performed with a varying level of detail. The level of detail will be a result of how much data and information that is available, the purpose of the analysis, and the resources available. These analysis can be both qualitative, quantitative or a combination of both.

2.5.3.3 Risk evaluation

Risk evaluation is a way of evaluating which risks that needs to be mitigated or followed up based on findings in earlier stages. Risks that require further treatment should also be prioritized after the level of treatment implementation. Risk evaluation consists of comparing the level of risk found during analysis with the risk criteria defined in earlier stages. This will set a basis for evaluating if the respective risk needs treatment. (ISO, 2009a)

2.5.4 Risk treatment

Risk treatment consists of choosing a treatment method for those risks that required a follow up strategy. The risk treatment process should work as a cycle, where the first step is to assess risk treatment, then deciding whether residual risk levels are tolerable, if not tolerable one must generate a new risk treatment strategy, and assess the effectiveness of that treatment plan. (ISO, 2009a)

2.6 Quality management

Statoil has an obligation to ensure safe and secure operations in their oil and gas related activities, which implies that the quality of all equipment has to be in compliance with requirements set by any given governmental institution (these requirements will vary depending on the geographical location, which country to operate in etc.). Therefore, quality is an important factor to consider when evaluating how one can achieve a more streamlined and consistent process for risk based follow up of technical documentation. To better understand how implemented improvement measures will affect the quality of deliverables, it is necessary to understand what quality means in a project. Further, it is important to establish a context for monitoring and measuring the effect on quality as new systems and guidelines are implemented. This chapter will establish a definition of quality in a project context, and further emphasise how a framework for measuring and monitoring quality can be designed. Monitoring and measuring quality is not particularly relevant for the research to be conducted during this study, but rather a theoretical framework that becomes relevant in the follow up process of implemented quality improving measures. This section is therefore included to help understand how the effect of implemented improvement measures can be monitored and measured in an organisation.

2.6.1 What is Quality?

Juran`s Quality handbook, written by Joseph M. Juran begins with asking the question "What is Quality?". He then responds to the question by saying that, "*of all the meanings of the word quality, there are two that is of critical importance to quality management in projects*" (Juran, 1999, P. 2.1).

1. ***"****Quality means those features of products which meet customer needs and thereby provide customer satisfaction".*

This definition focuses on income, and generating sale. The purpose of this strategy is to provide customer satisfaction, which again provides increased income. However, raising the quality of your product usually means that you also have to increase production costs. Therefore, higher quality in this sense usually *cost more*.

2. *"Quality means freedom from deficiencies".*

The focus of this definition is to avoid re-work and customer dissatisfaction. In this sense, the meaning of quality is related to cost, and higher quality usually *cost less*.

Juran's second definition can be compared to what Demings refers to as the 1:10:100 rule (Goff, 2008). The 1:10:100 rule emphasise the relationship between preventing defect deliverables and fixing defect deliverables. The relationship between these costs is reflected as 1:10:100, which implies that what costs 1$ to prevent costs 10$ to redo during construction and 100$ to fix after delivery. As an example let's say that a subsea template is to be installed. When transporting the template to site, a safety cover had to be installed to ensure that the template didn't get damaged during lifting operations. This cover has to be removed before submerging the template. Now imagine two scenarios. In the first scenario a quality control is performed prior to installation, and

the cover plate is identified and removed. The cost of this operation is negligible relative to the total project cost. In the second scenario no quality control is performed, and the cover plate is not removed before submerging the template. During system start-up, an operator notices that the cover plate is still on, and has to be removed with the help of a ROV. Now, imagine the costs of this operation. Both hiring a vessel with a ROV team, and delayed start-up of the project will give an unpleasant extra cost to the project. This of course is an extreme case, but it illustrates the relationship in a good way.

2.6.1.1 Quality in the right context

There are probably as many definitions on quality as there are books on the subject, and the definition also depends on the position of each stakeholder. For example in a customer-supplier relationship there will be different views on the meaning of quality. If you are the customer you would probably not be that concerned about the amount of defects produced by the supplier as long as your order comes on time and fulfils your requirements. The supplier on the other hand would probably, in addition to customer satisfaction, be concerned about the defect count, and would be interested in minimizing defects produced to raise the quality of their production line. Thus, the way a customer and a supplier measures quality will differ. In other words, quality is a subjective term that is defined different from person to person, and within different sectors. This is also reflected in the general definition of the American society for quality.

"A subjective term for which each person or sector has its own definition." (ASQ, 2012).

Crosby (2001) defines quality through his principle of *Doing It Right the First Time (DIRFT)* where he divides quality management in to 4 major principles.

1. The definition of quality is conformance to requirements (requirements meaning both the product and the customer's requirements).
2. The system of quality is prevention.
3. The performance standard is zero defects (relative to requirements).
4. The measurement of quality is the price of nonconformance.

In this thesis Statoil can be defined as a customer with an extended responsibility for the project deliverables, and as a customer Statoil evaluate deliverables trough out the project to ensure that the products delivered holds the right quality. Even though Statoil outsources all construction to contractors, Statoil has an internal project organization whose job is to follow up the contractors, and ensure that all deliverables are in conformance to the requirements set by the contract. As one can observe in Figure 6, Statoil takes a great part in following up contractors. In this thesis Crosby`s definition (DIRFT) will be used to define quality, "Conformance to requirements". The choice of this definition is made on the basis of Statoil`s guidelines and approach towards project risk. DIRFT says that one should work towards identifying risks and uncertainties and perform mitigating actions at an early stage of the project to avoid big changes later on. (Have in mind the 1:10:100 rule). This is in conformance with Statoil`s ideology of working risk based trough out the project. Ref: Statoil`s guidelines for risk based follow up of technical documents illustrated in Figure 6.

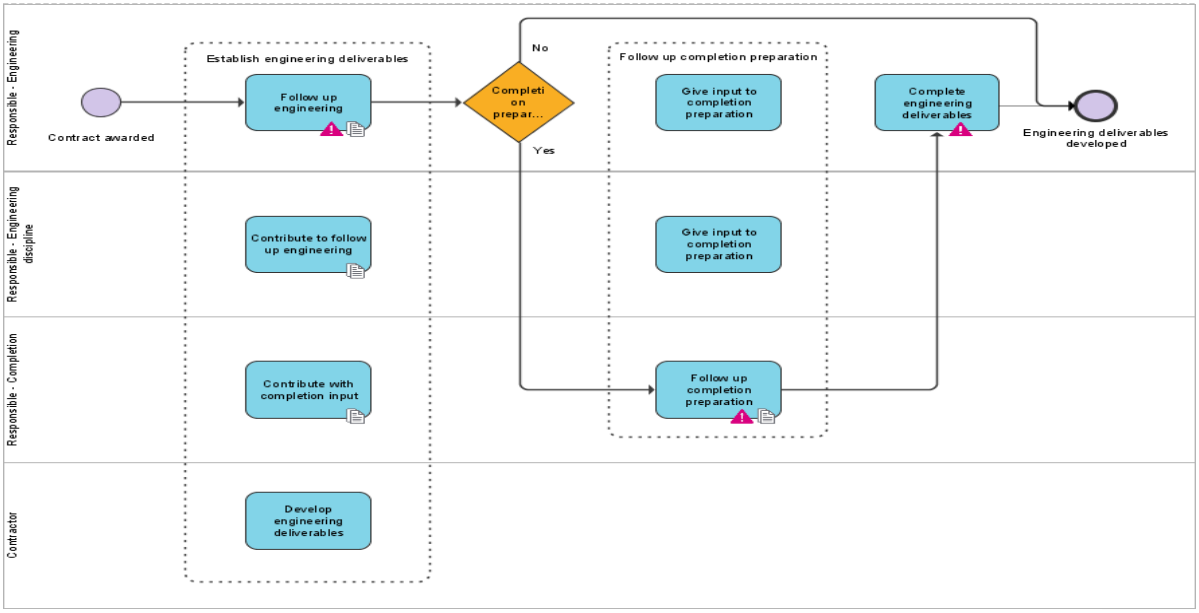


Figure 6: Statoil`s guidelines for follow up and developing engineering deliverables (Statoil ASA, b)

Now that a definition of the word quality is established, a discussion on how quality can be measured in projects will be presented. There is a wide range of literature available on how one can measure quality in an organisation, and several methods can be applied. An extensive literature search has been performed to identify a method that complies with Statoil's role in the follow up process. This study has concluded that this section will focus on a paper written by Stacey Goff where the focus is on monitoring deliverables and to see beyond the "defect count" method to detect poor quality deliverables at an early stage in the project, to minimize the cost of re-work.

2.6.2 How to measure quality in projects

In some projects it can be hard to measure quality of deliverables during the project, but far easier to measure when it is too late to do something about it without taking on large financial losses. One of the most common measures of quality is defect count. However, projects that do not produce any defects can still be perceived by customers, stakeholders and management for lack of quality. This implies that the "unit count of defects" method isn't always a satisfying approach. In some projects you also need another dimension of measurement. Goff (2008) claims that, at least two aspects need to be considered.

- Technical quality – As measured by e.g. Defect counts and positive counts or indicators.
- Perception of quality – A subjective factor that can be measured by such indicators as customer involvement and stakeholder satisfaction.

As a tool for measuring quality in projects, the input -> process -> output model can be used (Goff, 2008). The Input -> Process -> Output method, or the more general term for the method "*The system approach"* (Gardiner, 2005), which has its out spring in system theory from the 1950`s and 60`s can be illustrated as in Figure 7.

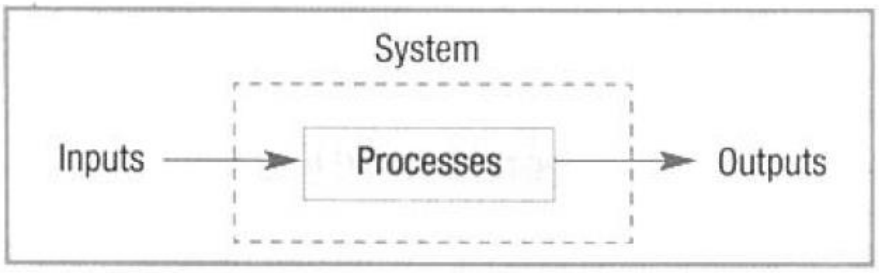


Figure 7: Illustartion of the input, process, output modell (system theory) (Gardiner, 2005)

- Inputs: Defined as the energy in any form brought in to the project,
- Process: Defined as a series of actions, changes or functions that bring about a particular result.
- Output: Defined as the products or consequences that result from the processes performed.

According to Goff (2008) some factors are important when setting up this tool.

- Assure proper inputs; when manning the different assignments, have strong focus on assigning the right talent for the right job, then using effective delegation with information about how the results will be evaluated.
- Specify quality processes, then monitor the results, and correct the processes that produce defects.
- Review the outputs or results, using appropriate review levels and participants. Monitor review outcomes and correct the inputs and processes, as needed.

Goff claims that this model can help as a tool to measure quality, but that it doesn't actually measure it. Thus, we need something more. What we need is some indicators of quality.

2.6.2.1 Indicators of quality

Indicators of quality are a tool that helps identifying good and bad quality early in the project where defect count may not be available. Quality indicators works like evidence that certain aspects of project quality is in place. The indicators can be either global, across projects or incremental, for individual assignments. These indicators provide the project manager with an opportunity to monitor quality as he or she adjusts different processes in the project. Goff (2008) recommends three categories of quality indicators.

- Engagement measures: Internal customer involvement in key project activities.
- Planned vs. actual cumulative review count.
- Assessment measures: Customer satisfaction surveys.

Engagement measures are early indicators of customer satisfaction and probable benefits realization. Engagement of customers can be done by involving them in requirements definition and design decisions.

Planned versus actual cumulative review count. To use this method one has to plan in advance the amount of reviews to be performed. It is also important to perform reviews on an incremental basis and not just at the end of phases and before decision gates. With this method one will have the opportunity to measure the relationship between actual reviews performed and planed reviews. In the table below one can see an example of the use of this quality indicator.

Table 1: Example of a table used to measuer planned versus cumulative review count (Goff, 2008)

Week	Planned reviews	Actual reviews	Status
2	1	1	100 %
4	4	3	75 %
6	6	4	66 %
8	7	4	66%
10	10	7	70 %
12	12	11	92 %

The advantage of using this quality indicator is that by performing incremental reviews one has the opportunity of detecting poor quality in an early phase. The review process in itself doesn't actually improve quality, but it helps you to identify which measures to perform to secure improved quality in your project at an early phase. Have in mind the 1:10:100 rule which implies that "Correcting sooner cost less".

2.6.3 Theoretical summary

This chapter has concluded how risk and quality will be defined throughout this study, and discussed different methods and tools to assess risk. As mentioned earlier, there is not much academic theory related to risk based follow up of contractors. Still, an important aspect of working risk based is to understand the underlying definitions of risk, and the influencing factors of risk management. Theory in this thesis is therefore used to build a basis for understanding fundamental aspects of risk management and to further apply these in the research. Statoil`s risk based strategy is not derived from international standards or fundamental principles. It`s rather a way of working that allows for a qualitative approach to asses project deliverables. Hence, this thesis will not focus on comparing Statoil's follow up strategy with some international Standards or such. It will rather go inn to the depth of the qualitative mind set of a project organisation and analyse the human factors of working risk based. Rather than comparing some model to a theoretical process, this thesis will identify the model used to apply a risk based approach, and further try to identify how this process can be improved.

Chapter 3 - Methodology

This chapter discusses general methodologies for research studies. Further it concludes on the best method for writing this thesis. Finally a methodology for writing this paper will be derived based on the above assessments. Underlying theory regarding the chosen research method will also be presented in this chapter.

3 Methodology

In this chapter different research methods are discussed, and further the best suited method for this study is concluded. In performing a literature search some good books on the subject were identified, and will be used as a basis to derive a methodical framework. Those are the following:

- Yin R.K. - Case study research design and methods
- Hancock, D.E. & Algozzine, B. - Doing case study research
- Kvale, S. & Brinkmann, S. - Det kvalitative forskningsinterview
- Malcolm, C. - Qualitative research skills for social science work: Theory and practice
- Berg, B.L. - Qualitative research methods for social science

3.1 Research methods

In Yin (2008) written by Robert K Yin five main research methods are described:

- Experiments
- Surveys
- Archival analysis
- Histories
- Case studies

Before deciding on which research method to use, there are three main conditions that need to be clarified. The three conditions are:

a) The type of research question to be posed.
b) The extent of control an investigator has over actual behavioural events.
c) The degree of focus on contemporary as opposed to historical events.

Table 2 lists how these five research methods are related to these three conditions.

Table 2: Matrix for choosing the right research method (Yin, 2008)

Strategy	Form of research question (a)	Requires control over behavioural events (b)	Focus on contemporary events (c)
Experiment	How, Why	Yes	Yes
Survey	Who, What, Where, How many, How much	No	Yes
Archival analysis	Who, What, Where, How many, How much	No	Yes/ No
History	How, why	No	No
Case study	How, why	No	Yes

Condition (a) covers your research question with regards to which format the question is posed (Who, Why, How, What, Where, How many, How much). In the table above one can see when each of these research methods is suitable.

Further Condition (b) covers to what extent one have control over, and access to actual behavioural events. If there is limited access to behavioural events, a historical research method is to be preferred. That is, when dealing with the past and there are no living people who can report the actual event, and the researcher must rely on primary documents, secondary documents and cultural artefacts as his or hers main source of information.

On the other hand, when examining contemporary events (c) where the researcher has access to direct observations of an event, and has the opportunity of conduct interviews with the people involved. A case study approach is preferred. Basically the case study method and the historical method overlap in many ways, but the main strength of the case study method is the two sources of information, that is historical and contemporary data. The case study method has the capability to deal with a full variety of evidence like documents, artefacts, interviews and observations (Yin, 2008).

3.1.1 Experiments

Experiments can be used when an investigator can manipulate behaviour directly, precisely and systematically. This can just occur in a laboratory environment, where the investigator can focus on one or two variables at a time, and assume that the laboratory environment can control all the remaining variables beyond the scope of interest. Or if the investigator can treat different groups of people in different ways and see how they act (Yin, 2008) e.g. a medical experiment where one group is given a real drug, and another group is given a placebo.

3.1.2 Surveys/Questionnaires

Surveys and questionnaires tend to be constructed using a closed format approach (limited number of possible answers). However the use of surveys is commonly used in research and can be used in combination with other research methods such as interviews or focus groups. Questionnaires are usually completed by the participant alone, but can also be completed in cooperation with a researcher. The benefits with surveys are that they are fairly cheap and can reach out to a large group of people without using considerable amounts of time. Surveys can also collect much useful data. Topics best suited for surveys and questionnaires are for example evaluations of a service, evaluation of a lecture etc. Answers from surveys are also fairly easy to analyse if the survey is designed with a limited option of answers. For gathering statistics, surveys can be a good way of collecting the required data (Malcolm, 2012).

3.1.3 Archival analysis

Archival analysis is best suited in those situations where most of the data needed for investigating a theory or historical event must be gathered from archives. In archival analysis a great amount of time can be spent gathering permissions and access to data. Examples of archives can be motor vehicle registers, tombstones, credit companies, historical archives from Second World War etc. (Berg, 2001). An archival analysis approach is best suited and most likely used in situations where

the researcher has to gain access to e.g. national archives to obtain information or in other situations where data is stored in archives for different reasons.

3.1.4 Case study

In case study research both single and multiple-case studies are used, and can be seen as different variants of the case study approach. Both the single and the multiple-case study approach can be divided in to two different designs. For the single case study approach one can distinguish between the holistic (single-unit of analysis) and the embedded (multiple units of analysis). For the Multiple case study approach one can distinguish between multi-case holistic design and multi-case embedded design (Yin, 2008), see Figure 8.

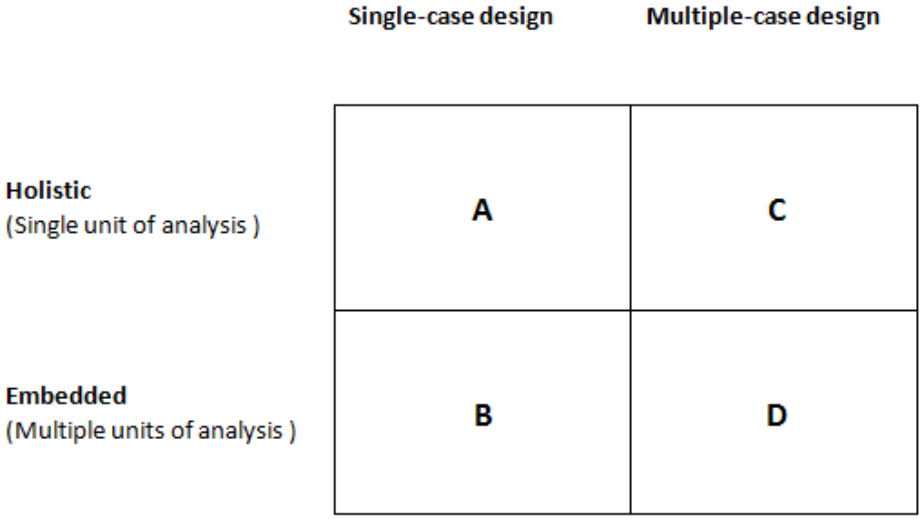


Figure 8: Relationship between holistic and embedded, and single and multiple case designs (Yin, 2008)

3.2 The research question

The main goal of this thesis is to find out how Statoil can achieve a more streamlined and consistent process for risk based follow up of technical documents. This goal will be achieved by seeking answers to why there are deviations in the amount of documents sent to review in different projects. The research question is formulated as following:

"Why are there deviations in the amount of documents sent to review in quite comparable Fast-Track projects under the same frame agreement?"

As discussed in section 3.1, a question formulated on the *why* form is usually best answered with either an historical, experimental or case study method. Further we can observe that in this study we have full access to historical data, reel time observations and full access to conduct interviews with key personnel. As discussed in the above section and in Table 2, this will guide the study in the direction of choosing a case study method. Arguments for not choosing other methods are as following:

- An experimental method would not be appropriate in this study do to the nature of the question to be posed, and the units of analysis.

- An historical approach would be possible, but not favorable since a significant part of the research data is based on interviews with key personnel in the given projects. An historical approach does not allow for the researcher to observe real time data, and therefore, this approach would not include all available data regarding what to be studied.

- As one can see from Table 2, both the surveys and archival analysis would be a misfit in this case, due to the format of the question to be answered.

The conclusion is therefore to choose a case study approach for answering the research question. A case study with multiple units of analysis will allow for both using interviews and data analysis to undertake this study, and it's my belief that this approach will give the best results. The methodological framework will therefore be designed around case study theory based on Yin (2008).

3.3 Methodology design

When designing a case study there are 5 components that are especially important (Yin, 2008).

- The study`s question
- The study`s proposition
- The unit of analysis
- The logic linking the data to the proposition
- The criteria for interpreting the findings

The research question is already defined in section 3.2.

3.3.1 The propositions of this study

In cooperation with Statoil four hypotheses where derived for why deviations in the amount of documents on review occur.

Hypothesis 1 relates to the *human factor* and an individual's risk view concerning the evaluation of documents for review.

- *Are there a correlation between the amount of documents sent to review in different disciplines, and the discipline lead engineers perception of risk?*
- *Does the lead engineer send all documents to review because he or she follows the principle "better safe than sorry"?*
- *Are there a relationship between the engineers experience and the amount of documents sent on review?*
- *And, is there deviating philosophies between projects on which documents to choose for review?*

Hypothesis 2 relates to the contractor, and to what extent the project deliverables are fully defined at project start up.

- *Is the CMDR document immature when lead engineers evaluates documents for review, and to what extent does this affect the review evaluation?*
- *Does contractors and Statoil`s perception of the purpose and meaning of the follow up strategy correlate?*

Hypothesis 3 relates to the employee status and possible cultural differences in Statoil.

- *Is there a correlation between documents sent to review and the lead engineer's employment status? (Consultancies vs. permanent employees)*

Hypothesis 4 relates to routines and systems for risk based follow up of technical documents in Statoil. This hypothesis seeks to find if further guidelines and systems should be implemented to improve the use of synergies and experience transfer in projects.

- *Is there lack of a system for reuse of technical documents that prevent new projects from taking advantage of synergies from earlier projects?*

3.3.2 Units of analysis

Three projects will be analysed during this study. These projects where chosen by SDT management on the background of their fairly comparable scope of delivery under the same frame agreement, and the fact that they all have passed the DG3 milestone, and are now in the execution phase. In addition, these projects will be compared to an earlier project to investigate the use of synergies between project waves in the SDT portfolio. These projects will be further presented in chapter 4, and will until then be referred to as P1, P2 and P3. The units of analysis in this study will be the quantitative data received from document control on the respective projects, and the qualitative and quantitative data gathered from performing interviews with project team members. These projects will be compared to answer the research question posed in this thesis, making it an embedded (Multiple units of analysis) single case design. See Figure 9 for an illustration of how data analysis and interviews will be conducted and analysed in this study. As one can observe, interview questions will be derived on the basis of results gathered from data analysis, and from discussions with SDT management.

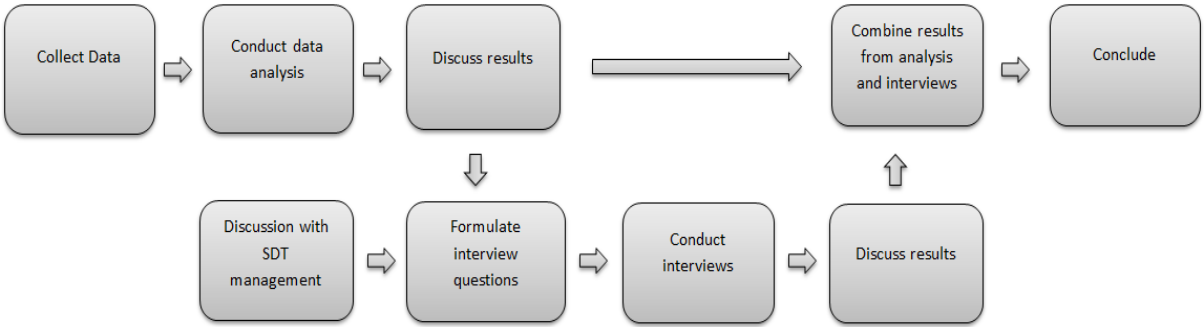


Figure 9: Modell for conducting data analyses and interviews.

3.3.3 The logic linking the data to the proposition, and criteria for interpretation

To best answer the hypothesis in this study, several analyses have to be conducted. The following section explains the logical link between analysis and hypothesis.

1. To test this hypothesis it will be necessary to combine both quantitative and qualitative data gathered from interviews and data analyses. By comparing each interviewee's perception of the risk based follow up strategy with documents in for review in the respective project it is possible to conclude on the correlation between risk view and the amount of documents in for review. This Hypothesis relates to the human factor, and each individuals perception and experience. Qualitative interviews will be a key source to answer this hypothesis.

2. This hypothesis will be tested by interviewing those engineers that follow up the CMDR document. Their opinion will be a good basis for concluding to what degree the CMDR is immature on contract start up. In addition, it would be favorable to get access to data that shows how the CMDR changes during the project, and if contractor and Statoil agrees on which documents who should be reviewed.

3. This is a hypothesis that has to be handled with care. It is important that this study do not reflect a wrong evaluation of individuals employed in Statoil. This proposition will therefore not be evaluated on the basis of quantitative historical data, but rather be evaluated during interviews. It is important to mention that this hypothesis will be presented as a general conclusion of all three projects and will not be project specific due to the anonymity of employees.

4. Using historical data from earlier projects and data received from the research projects will provide an opportunity to investigate to what extent these projects make use of synergies from earlier projects in the SDT portfolio. By comparing historical data from earlier fast track waves with data from each of the three study projects, it can be conclude how each project takes advantage of synergies from earlier projects, and how much re-work is being done. Interviews will be used to identify challenges and areas of improvement to better make use of synergies.

3.4 Data gathering and analysis

As discussed in the above section both qualitative and quantitative data will be necessary assets to undertake this study. Data analysis will be performed using quantitative data gathered from Statoil`s internal document database, and will be analysed using Microsoft Excel. Microsoft Excel is a powerful tool for handling great amounts of data, and by using internal functions in Microsoft Excel it is possible to sort and compare data based on different characteristics. A list of functions used to perform data analysis is presented in appendix 9.1. In Statoil`s database for technical documents it is possible to export a excel file with metadata for document numbers, disciplines and if each document is sent on review or info. This can be done separately for each project. Data analysis will provide quantitative results on how each project perform their risk evaluation and how the evaluation process varies between disciplines and projects. Several analyses have to be conducted to answer the research question in this study, and the procedure and rational for each of them will be described in this section.

Analysis 1 – Correlation between each projects evaluation of documents.

To test the correlation between each projects evaluation of which documents to review, it will be necessary to identify those documents that have been delivered in multiple projects, and see if the review evaluation has been identical. A challenge in finding similar documents between projects is that Statoil`s document numbering system is project specific, this implies that identical documents in two different projects would have different document numbers. This problem is solved by using the contractor's document number in the analysis. In a meeting with contractor it was confirmed that they use the same doc.id between projects for identical documents. This is consistent with what this analysis seeks to find. Is there, or is there not a correlation between the evaluations of identical technical documents between projects?

This analysis will be performed by comparing all document numbers from each of the three projects and analyse if there are deviations in the Review/info evaluation between identical documents. This analysis will be conducted in four steps by first comparing all three projects to find the total number of documents that is included in more than one project. Then separate analysis for each combination of projects will be conducted. Project combinations will be (P1 – P2 – P3, P1 – P2, P1 – P3 and P2 – P3).

Analysis 2 – Correlation between Statoil and contractors risk view

The Company Master Document register (CMDR) is a document containing all deliverables from contractor throughout the execution phase of a project. When contractor distributes this document to Statoil it contains a suggestion on which documents they want Statoil to review. When Statoil receives this document they will assess this suggestion, and make a final decision on what to review. This analysis will investigate to what extent there is a correlation between the contractor`s review suggestion and Statoil`s decision on which documents review. Results from this analysis will show to what extent contractor and Statoil agrees on the risk based follow up strategy. To conducting this analysis it will be necessary to compare the CMDR document received from contractor with documents actually reviewed in eRoom. If results from this analysis reveilles that there is deviating evaluations between contractor and Statoil it will be necessary to conduct a second analysis to observe how it deviates. E.g. if Statoil changes the status from info to review they are more risk averse than the contractor, and vice versa less averse when they change it from review to info.

Analysis 3 – Synergy effects between first wave and third wave projects

As stated in the introduction to this thesis, this research will be limited to and focus on three fast track projects in the SDT portfolio. Even so, I want to expand the analysis to compare these projects with earlier projects in the SDT portfolio. The rationale behind this analysis is to explore the use of synergies and experience transfer between projects. Conducting an analysis of documents for review in first wave VS third wave projects will provide data to conclude on the relationship between theory and practice. This analysis will be conducted using a project from first wave as a reference, and compare it to the main research projects in this study. Results from this analysis will show to what extent documents reviewed in earlier waves are passed on as info documents in later projects or if the projects in third wave are doing re-work reviewing already approved documents.

Analysis 4 - Resources spent on reviewing documents.

An interesting aspect of this study is to analyse the potential economic savings Statoil can achieve by reducing the amount of documents for review. An estimate on the total cost related to reviewing technical documents will therefore be derived. Input to this estimate will be based on an average of man hours spent on review and hourly costs for employees. The methodology is explained below, and will consist of three input variables, Time, Cost and the amount of reviewers per document.

T - Time spent on reviewing one document

An estimate on the time spent on reviewing one document will be based on interviews with discipline engineers from each project.

A challenge with this estimate is the variation in the content of each document. Some documents are several pages, and contain much information, and some documents are drawings that may be easy to review. If answers from interviews reveal a deviation between time spent on drawings and text documents, separate estimates will be given for each of them.

A second challenge with finding the average time spent on reviewing one document or drawing is that the importance and criticality of each document will vary. Some documents are highly technical and require a great amount of time discussing technical challenges and solutions, and will therefore require a lot of time reviewing. Those documents that require a lot of resources to evaluate are those documents that should be reviewed when applying a risk based approach. Thus, these documents will not be part of the estimated average time spent on reviewing documents. The rational is that this thesis focuses on reducing the amount of documents sent to review and the bias with this estimate is to find the potential savings Statoil can achieve by doing so. Since highly technical documents always should be sent on review, including these documents in the estimate would result in a higher estimate on time spent (T) than what Statoil actually would save by reducing the amount of more general and standardized documents to review. The formula is as following:

$$\mathbf{T} = \frac{\sum_1^n Time\ spent\ reviewing\ a\ document\ or\ drawing\ for\ interviewee\ n}{N}$$, N = total number of data samples.

A - Average number of engineers used to review one document.

The average number of engineers used to review one document will be based on data received from document control. This average will then be multiplied with the average time spent on reviewing one document. This will result in a reasonable estimate on man hours spent reviewing a document. The formula for the average time spent on reviewing one document is as following:

$$\mathbf{A} = \frac{\sum_1^n Average\ number\ of\ reviwers\ in\ project\ n}{N}$$, N = total number of projects.

C - The average cost of having one engineer working for one hour.

The average cost of having one engineer working for one hour will be based on data received from Statoil`s HR department.

The formula for total review cost is then as following:

$$Rc = A * T * C \qquad \textbf{E.q 1}$$

Where the product of A and T is an estimate of man hours spent on review and C is the total cost of having one engineer working for one hour.

3.5 Interviews

Interviews are not categorized as a research method in (Yin, 2008), but rather as a tool that can be used to gather information when applying some research methods. Especially in case studies interviews are widely used. Interviews are a common way of gathering information for answering a research question. To conduct a successful interview Hancock & Algozzine (2011) recommends five guidelines:

First of all it is important to identify key participants whose knowledge and experience can provide useful input regarding the research question to be posed. Interviews can be conducted individually or in groups. Performing individual interviews can provide significant amount of information from an individual`s perspective but may be quite time consuming. Group interviews on the other hand can provide good input due to sharing and discussion of questions that could be neglected when performing individual interviews. The downside with group interviews is that it may be hard to fully capture every individual's perspective and point of view.

Second, the researcher should develop an interview guide. This guide will identify appropriate open ended questions that the researcher will ask each interviewee. These questions should be designed to allow the researcher to gain insight into the studies fundamental research question. In addition, the interview guide should include some metadata regarding the interviewer and the interviewee, and a brief introduction to the research question to be answered.

Third, the researcher should consider the setting in which he or she conducts the interview. Although interviews in the natural setting may enhance realism, the researcher may seek a private, neutral, and distraction-free interview location to increase the comfort of the interviewee and the likelihood of attaining high-quality information.

Fourth, the researcher should develop a means for recording the interview data. Handwritten notes don't always suffice, and it could be advantageously to have audio recordings of interviews. By doing so the interviewer could go back and listen to each interview, and compare answers from different individuals. It is important to know that all interviewees must give their approval before audio taping the interview.

Fifth, interview questions should be formulated in such a way that the interviewee do not feel that it is a leading question. One should ask question in a form that allows the participant to talk widely around the subject. Such as "What can you tell me about" or "Why is there".

Another factor that may influence the quality of the interview is how the interviewer approaches the interviewee. First of all it could be appropriate to start out with doing a humoristic joke to establish a comfortable environment before conducting the interview. One should also think about how the interviewer is positioned in relations to the candidate. If the interviewer are positioned in such a way that the interviewer and the interviewee faces directly towards each other, the interviewee could feel that the interviewer has too much authority. This could, in some situations make the candidate nervous, and is not a good approach when the goal is to gain insight in to e.g. how some organizations are performing their job. Therefore, it could be a good idea for the interviewer to position him- or herself in such a way that he/she and the interviewee are positioned on the same side of the table, and do not face directly towards each other. This will provide a more comfortable environment for the interviewee (Bjørklund, 2013).

3.5.1 Interview formats

Carey (2012) divides Qualitative interviews in to two different categories:

Unstructured interviews: In an unstructured interview there is no set questions planed. An unstructured interview consists of a set of topics to be discussed, rather than specific questions. The rationale behind this interview format is that the participant should be the one guiding the conversation. This approach is usually prevailing in biographical or life history research. Some drawbacks with this method is that it could take a considerable amount of time to perform an interview, and tends to generate large amounts of data that takes a long time to read, code and analyse.

Semi structured interviews: This approach includes a combination of pre-planned and spontaneous questions, giving the interviewer an opportunity to ask new questions in response to a participant's answers or body language. This approach tends to work well within studies related to social work research and is a popular method in all types of qualitative research. It is ideal for a sensitive or extremely focused topic, and will tend to take less time to conduct than the unstructured method.

3.5.2 Question formats

Malcolm (2012) distinguishes between two categories of interview questions. Closed-form and open ended format.

Closed-format questions: This format is much more common in quantitative research and questionnaires. With this approach a limited choice of answers is provided, and the interviewee has to choose between the alternatives on the basis of what he or she finds most suited. This approach is best suited to collect data like age, past work experience or broad opinions and will not be suitable to answer questions regarding the review process in this study.

Open-ended questions: This is the most common approach in qualitative research. With this approach interviewees are free to answer and explore queries in their own word and style. Interview questions in this study will be based on such a design.

3.6 Method for conducting interviews in this study

Semi-structured Interviews and discussions with key personnel will be conducted to map the qualitative side of the risk based follow up process. This will include philosophies and methods used for choosing documents to review, and how experience transfer is achieved in projects. In addition these interviews will provide important data on how each individual sees the review process, and where there is an individual or common need for improvements.

Qualitative interviews are discussed in Kvale et al. (2009). There are several aspects one should have in mind when conducting such interviews, and 7 stages of performing qualitative interviews are discussed:

1. **Specify the context**: To formulate the purpose of the research and to describe the subject of investigation prior to the interviews.

2. **Planning:** One should plan for all 7 stages of the research with respect to what kind of knowledge one seeks to find.

3. **The interview:** Conduct interviews on the basis of the interview protocol. Be aware of what kind of knowledge you seek and to the human relations regarding the interview situation.

4. **Transcribing:** Prepare the interview material for analysis, this usually means to translate the interview from physical words to written material.

5. **Analysis:** On the basis of the purpose of the research and the interview material, decide on the best method of analysis.

6. **Verify:** Decide on the generalizability, reliability and validity. With reliability means the consistency of the results, and with validity means to what extent results from the research answers the questions which constituted the basis for the interview.

7. **Reporting:** Report results from the interview in a format that satisfies the scientific criteria and the ethical aspects of the research. The result should be a legible product.

An important aspect of conducting quantitative data analysis is to identify areas where there are deviating philosophies and methods for evaluating documents. Results from data analysis in addition to defined hypothesis and discussions with SDT management will be the basis for designing interview questions, and several areas of investigation will be highlighted prior to interviews. Questions will be posed in such a way that they will be categorized as open-ended. To better capture the human factor of the risk evaluation, it is important to provide the interviewee with room to elaborate his or here's answer.

To gain a broad understanding of how the whole project organization thinks, it will be necessary to conduct interviews with different disciplines and in several levels of management in all three project organizations. The interview list will be derived from the distribution matrix for each project. The distribution matrix is a document that defines how technical documents for review shall be distributed in the project. It provides an overview of the discipline leads, and to whom it shall be sent for review.

An interview protocol will be prepared for each of the three categories discipline lead, Document management/QRM and Engineering management. This will be done to ensure a consistent interview process where all interviews are conducted equally and in a structured manner. See appendix 9.2 for interview protocols.

The Interviewer will conduct interviews after the following recommendations by Kvale et. al. (2009):

- **Knowledgeable:** To have knowledge about the subjects that is discussed.
- **Be specific:** Ask specific, simple and short questions
- **Structured:** Describe the purpose, the structure of the interview and how it will be conducted, summaries the interview and close the interview by asking if the interviewee has any questions.
- **Friendly:** Do not interrupt the interviewee, and allow for the interviewee to talk in his or her pace.
- **Sensitive:** Interpret the interviewee
- **Open:** Be open to, and follow up new aspects that may arise during the interview
- **Critical:** Evaluate the validity of the answers received from the interviewee
- **Memory:** Have an overview of the interview and identify general trends.
- **Interpretive:** Ask for clarifications, and elaborate interpretations that can be confirmed or disproved.

Chapter 4 - Analysis

Chapter 4 present results from data analyses and interviews performed. This chapter provide insight to the philosophy behind each projects review evaluation, and identifies problem areas and areas of improvement for the overall strategy for risk based follow up of technical documentation.

4 Analysis

This chapter is the main source for answering the research question posed in this study, and to further identify how Statoil can improve the risk based follow up strategy for technical documents. As an introduction to this chapter the main goal and hypothesis will be rendered from chapter 3.

Research question:

Why are there deviations in the amount of documents sent on review in comparable projects under the same frame agreement?

The main goal:

To find out how Statoil can achieve a more streamlined and consistent process for risk based follow up of technical documents.

The hypotheses are rendered bellow as they were defined in chapter 3:

Hypothesis 1

- *Are there a correlation between the amount of documents sent to review in different disciplines, and the discipline lead engineers perception of risk?*
- *Does the lead engineer send all documents to review because he follows the principle "better safe than sorry"?*
- *Are there a relationship between the engineers experience and the amount of documents sent on review?*
- *And is there deviating philosophies between projects for which documents to choose for review?*

Hypothesis 2

- *Are the CMDR document immature when lead engineers evaluating documents for review, and to what extent does this affect the review evaluation?*
- *Does contractors and Statoil`s perception of the purpose and meaning of the follow up strategy correlate?*

Hypothesis 3

- *Is there a correlation between documents sent to review and the lead engineer's employment status? (Consultancies vs. permanent employees)*

Hypothesis 4

- *Is there lack of a system for reuse of technical documents that prevent new projects from taking advantage of synergies from earlier projects?*

4.1 Projects to be studied

- Fram H nord - FHN
- Gullfaks sør olje - GSO
- Tyrihans juletre - TYX

All three projects are so called fast track projects in the same project portfolio (SDT), and under the same frame agreement. In the execution phase this means that the design is frozen and that a contract has been set to a contractor/supplier, and Statoil`s role is to follow up that the construction is performed according to contract requirements. This section presents a short introduction to these projects and their technical deliverables.

Fram H nord (FHN)

The Fram H-Nord field consists of one production well with gas lift and one four slot production template tied back to the Troll C Platform via Fram Vest. Transportation of the well stream from the Fram H-Nord template to the processing facility on Troll C will be through a single l0" ID production flow line via the existing Fram Vest pipeline system. Gas lift will be supplied to the well from Troll C via the Fram Vest pipeline system using a 4" ID gas flow line between the Fram Vest A2 template and the new Fram H-Nord template. Umbilical to Fram H-Nord will be a continuation of the umbilical from Fram Vest. Existing HPU will be used and new SCU and SPCU are to be installed for controlling of Fram H- Nord (Statoil ASA, 2009). Figure 10 illustrates the layout of existing and new infrastructure on FHN.

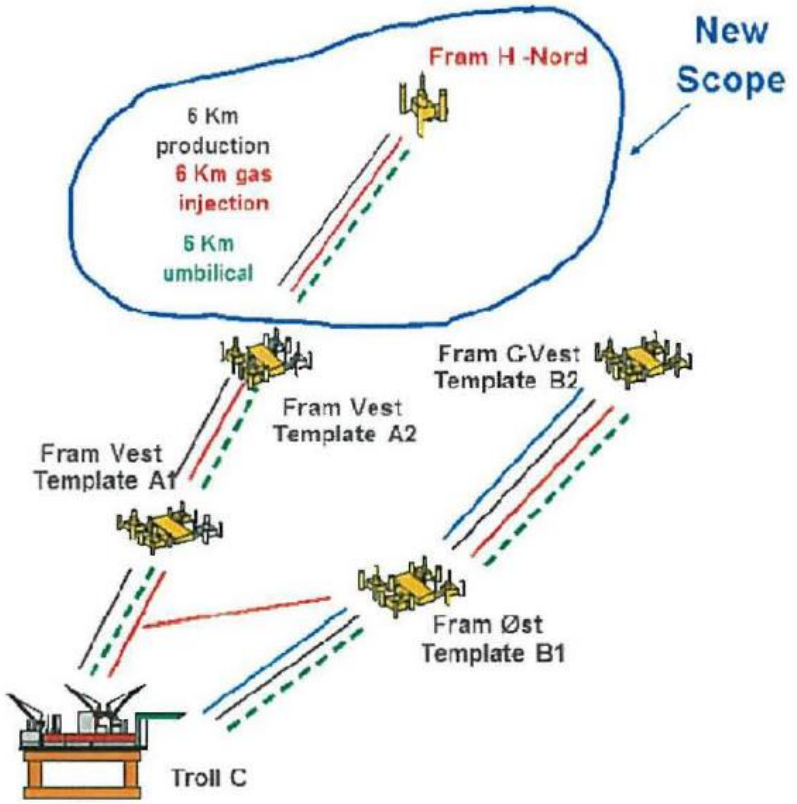


Figure 10: Layout of existing and new infrastructure and templates for Fram H nord (Statoil ASA, 2009a)

Gullfaks sør olje (GSO)

Gullfaks Sør Olje is a further development of the Gullfaks Sør field. This project is performed to increase recovery of oil and gas from the Gullfaks Sør field. The subsea field development consists of two 4-slot templates in the south end of the field. The two slots will be tied back to Gullfaks A via the existing pipeline infrastructure on Gullfaks Sør. The templates will facilitate 4 production wells on template X1 and 2 gas injection wells on template X2. The gas will be routed via a gas injection pipeline from Gullfaks Sør template E to template X2. The field will be controlled via a new power and signal umbilical from Gullfaks A. Chemicals and hydraulics will be supplied from existing infrastructure from template G or F. Start-up of GSO is planned 4rd quarter 2014 (Statoil ASA, 2013). Figure 11 illustrates the layout of the new infrastructure on GSO.

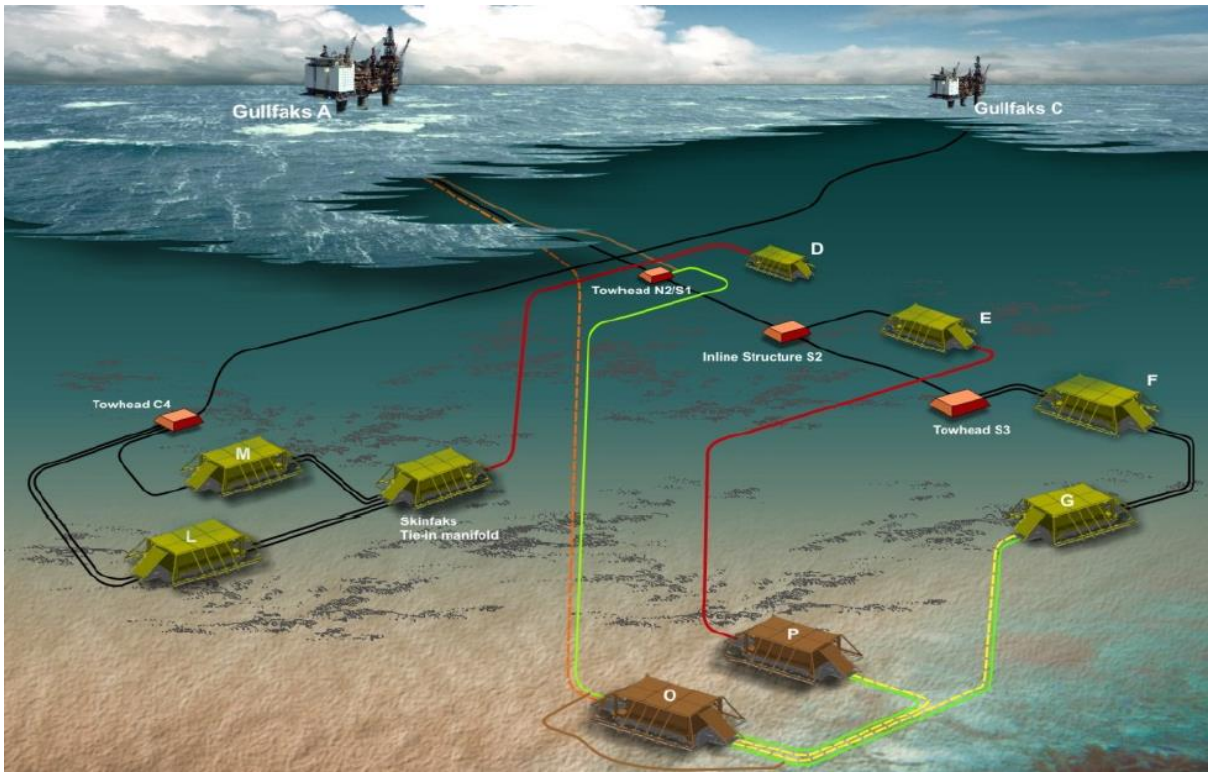


Figure 11: Layout of the new infrastructure on GSO (Statoil ASA, 2013b)

Tyrihans Xmas-tree (TYX)

Statoil started production from the oil and gas field Tyrihans in June 2009. Tyrihans is a subsea development tied back to existing installations and infrastructure on the Kristin and Asgard field in the Norwegian Sea. The field comprises Tyrihans South, an oil field with a gas cap, and Tyrihans North, which is a gas and condensate discovery with a thin oil zone. The recoverable reserves are 186 million barrels of oil and condensate and 41.5 billion standard cubic meters of gas. Proximity to the other fields in the Norwegian Sea makes Tyrihans use existing infrastructure. Tyrihans Add-on is a further development of the already existing Tyrihans field. Tyrihans add-on consists of two new wells. FMC will supply 2pcs XMT, complete with two SCM`s and 2pcs choke modules. In addition, FMC shall deliver 1 additional spare SCM (Subsea Control Module) and 1 spare choke module. There will also be delivered 2 off wellhead systems that include: 30 "conductor housing, 18-3/4" wellhead housing, and 13-3/8 "and 10-3/4" casing hangers (Statoil ASA, 2007). Figure 12 illustrates the layout of new infrastructure on TYX.

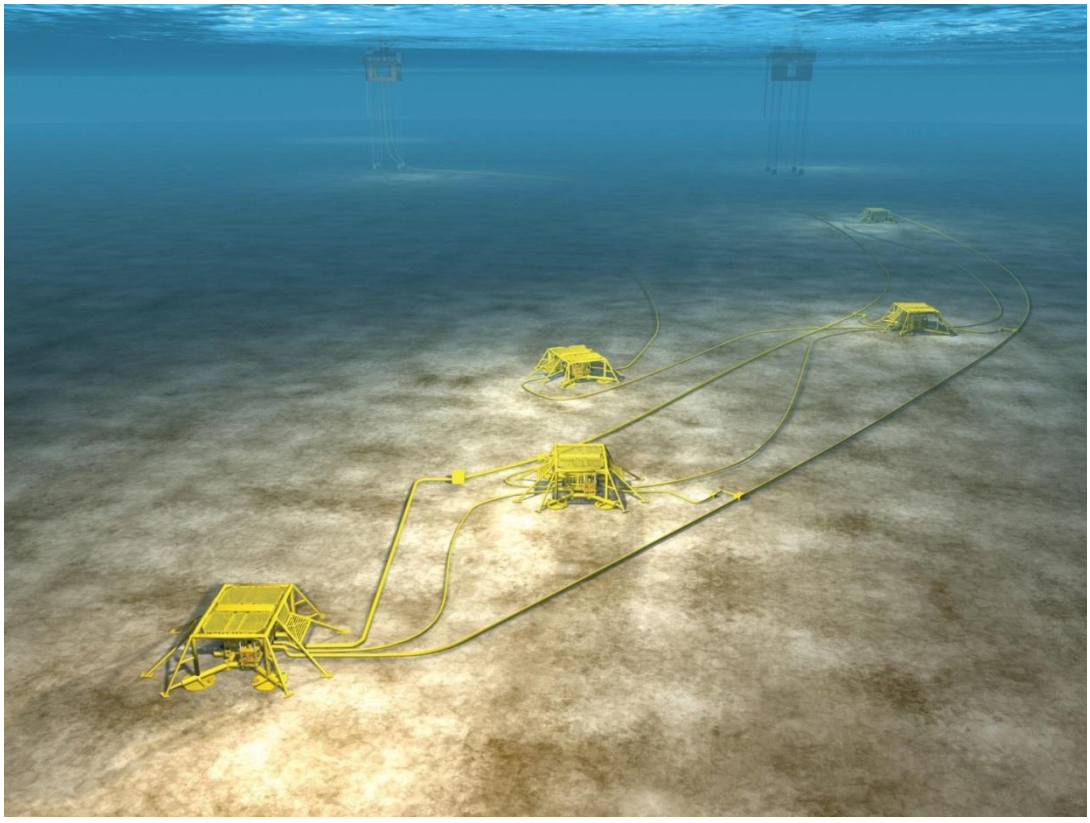


Figure 12: Layout of newifrastructure for Tyrihans (Statoil ASA, 2007)

4.1.1 The review process

When Statoil receive documents from contractor they are stored in Statoil`s document system eRoom, and a process for evaluating if the document is up for review is initiated. The respective discipline leads in the project receives a notification that a new document has been delivered, and has to be evaluated. If the document is marked for review, a process is initiated where the document is distributed to different stakeholders for evaluation. The list of stakeholders for each document is specified in advance in a distribution matrix, and the process for distributing documents is an automatic function in eRoom. If discipline lead chooses not to send a document on review, the document is marked as just for information, and is sent back to supplier with no further remarks. The CMDR is a key document in this process. In the CMDR, all documents are listed and has been evaluated either as a review or info document, Thus, it is the CMDR who communicates if a document is to be reviewed or not. See Figure 13 for an illustration of the review process.

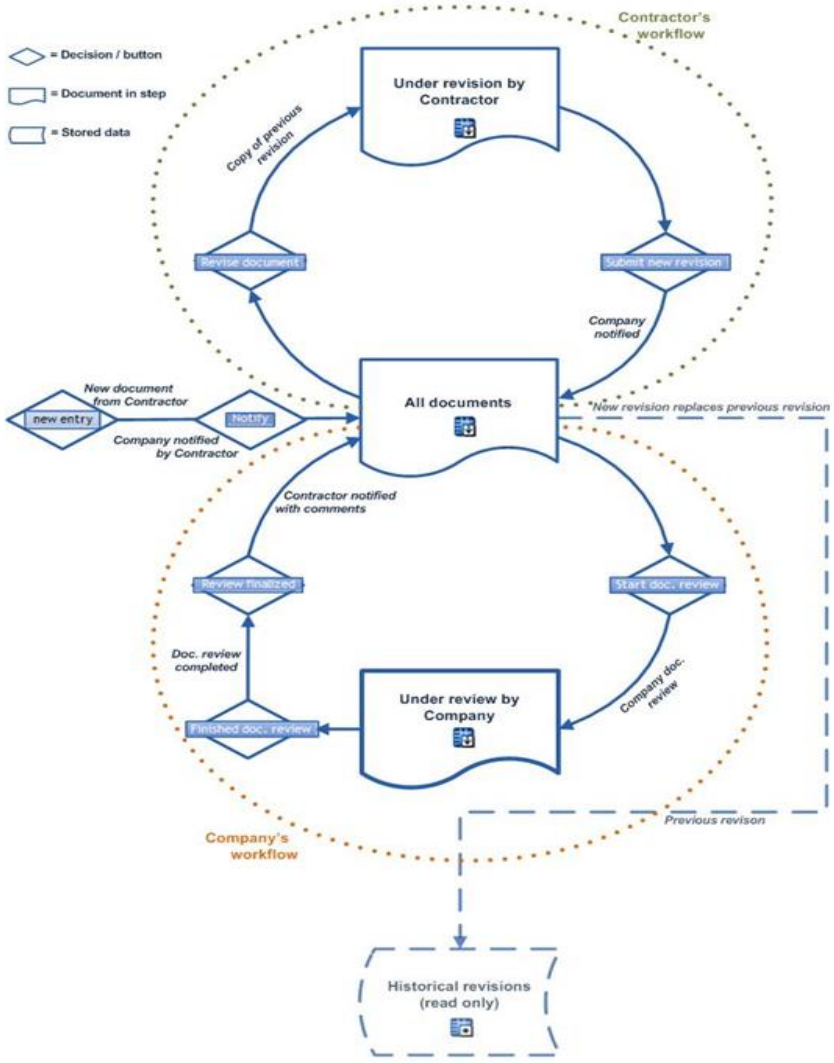


Figure 13: Illustration of the review process (Statoil ASA, 2011a)

4.2 Data analysis

In this section findings from earlier data analysis performed by document control, and findings from data analysis performed during this study are presented and analysed. The method and purpose of conducting these analyses where explained in detail in chapter 3, section 3.3. The survey conducted by document control is included and further analysed in this section to further investigate the basis for which this thesis was derived.

4.2.1 Data analysis conducted by document management

Document management performed a survey in August 2012 where the objective was to investigate the as-is situation in projects. This survey was limited to 12 projects in Statoil's project portfolios with a variation of brownfield, Greenfield, and fast track projects (see Table 3). Mainly projects after DG3 was chosen and the survey was based on the largest contracts in each project. For each project, the CMDR was used to collect data on number of documents in total, number of documents for review and number of documents to info. Results from this analysis can be seen in Table 3, Figure 14, Figure 15 and Figure 16.

Table 3: Projects included in the analysis

Project	**Portfolio**
Vile sør	Fast track
Kristin LPP	Brown field
Skuld	Fast track
TROA 3&4	Brown field
OBDUP	Brown field
Corner	Green field
Gudrun	Green field
GFB WIUP	Brown field
Sheringham	Green field
Valemoen pipeline	Green field
Valemoen topside	Green field
Visund sør	Fast track

Figure 14 illustrates the relationship between documents sent for review and info in each contract, and documents listed in the CMDR. Since the CMDR is used for collecting data, contracts are not fully comparable due to varying maturity and routines of the CMDR between projects. Still, it provides insight to the variation between projects. For example Gudrun and Valemoen which are relatively comparable projects have great deviations in the amount of documents listed in the CMDR compared to documents received for info or review by Statoil. As one can observe in Figure 14 some projects have received more documents for review or info than documents in total listed in the CMDR. This implies that the CMDR is not fully matured on contract start-up.

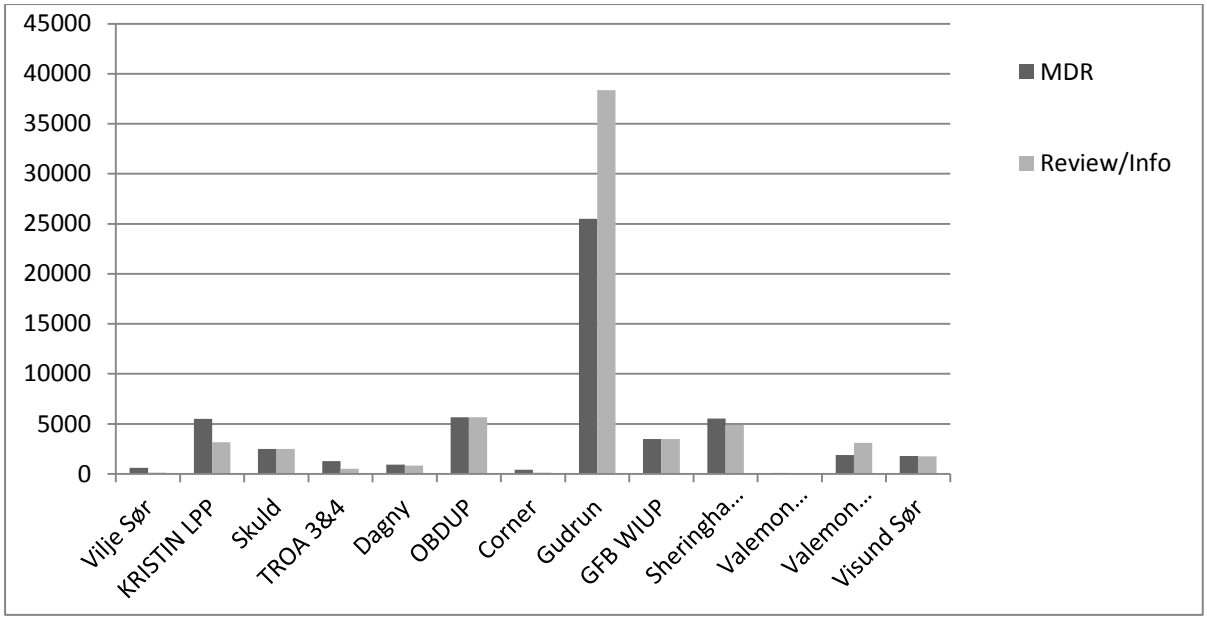


Figure 14: documents listed in the CMDR vs documents sent for review/Info (Statoil ASA, 2013b)

The percentages of documents for review/info in each project can be seen in Figure 15. In this figure the y-axis indicates the percentage of documents sent to review or info compared to the CMDR. The value 100% on the y-axis is equal to the total number of documents listed in the CMDR. By analysing this figure we get further confirmation that the CMDR is not fully matured in some projects. In Valemoen Field development total number of documents for review exceeds the amount of documents listed in the CMDR by over 60%. This implies that the CMDR is highly immature in this project. Another observation in this figure is the variation in documents for review vs. info. The amount of documents sent for review varies between 10% and 100% e.g. Vilje sør and Valemoen field development.

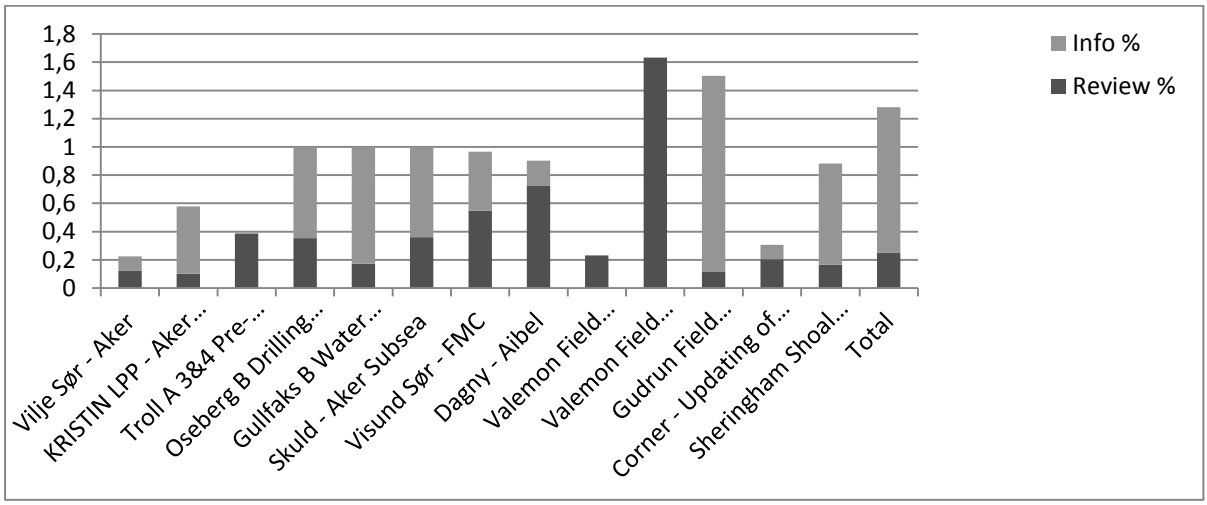


Figure 15: The relationship between documents for info and review in different projects relatively to documents listed in the CMDR (Statoil ASA, 2013b)

Next, this analysis compares documents for review/info in each portfolio. In Figure 16 one can see results from this analysis. In this figure one can observe that the fast track portfolio is the portfolio with the highest average percentage of documents sent to review. This is quite interesting and surprising due to the mandate and purpose of the SDT fast track portfolio, which states that the fast

track portfolio shall make use of synergies from earlier projects, and to standardize deliverables to reduce execution time.

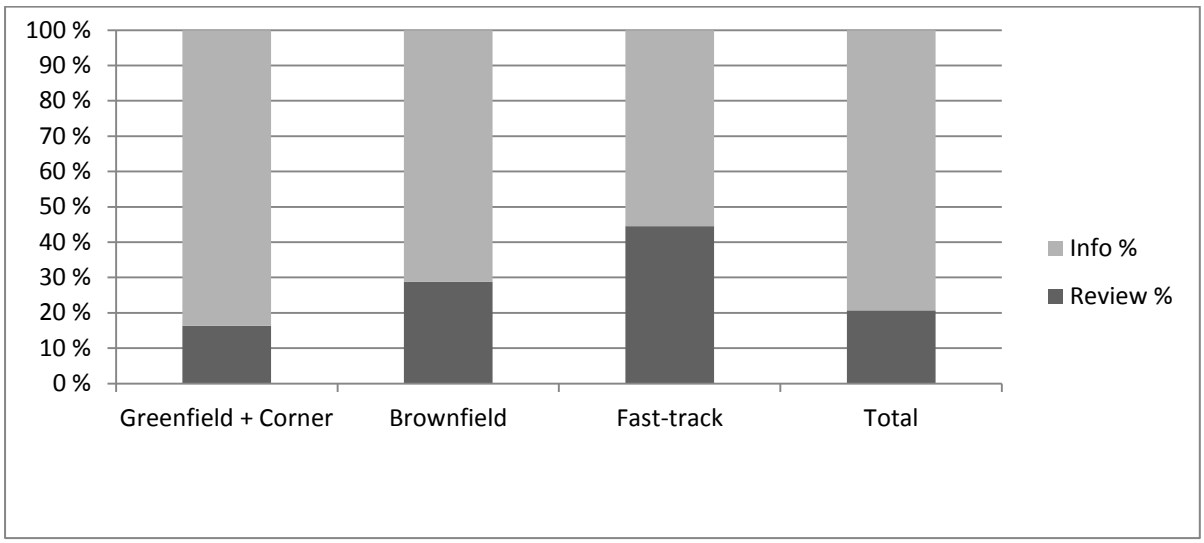


Figure 16: The relationship between documents for info and review in different portfolios. (Statoil ASA, 2013c)

4.2.2 Summary of analysis conducted by document control

Analysis performed by document control confirms that there are deviations in the amount of documents evaluated for review in different projects, and that the CMDR received from contractor is, in some projects immature on execution start up. What these analyses don't show is to what extent each project has similar deliverables and how many documents that is delivered in multiple projects. This has to be further analysed in the projects to be studied in this thesis.

4.3 Data analysis conducted during this study

On request I received data from document control on the amount of documents sent to review, and documents for information for the respective research projects. In Table 4 one can see results from this analysis. This data is gathered from the CMDR, and from eRoom where all documents that have been delivered to Statoil are stored. As one can observe from Table 4, there is an inconsistency between documents in total and documents either sent to review or information. This deviation occurs due to the fact that these projects not yet are completed, and have not received all documents stated in the CMDR.

Mark: Since not all documents defined in the CMDR have been received, this study will focus on those documents that have been delivered to Statoil pt. 13.02.2013. Documents not yet received will therefore not be included in the following data analysis.

Table 4: The relationship between the CMDR, documents received from contractor and docs for review/info

Project	Documents in total CMDR	Documents in eRoom	For review	For information
Fram H – Nord (FHN)	1133	834	614	220
Gullfaks Sør Olje (GSO)	790	591	435	156
Tyrihans X-tree (TYX)	242	109	55	54

By analysing the percentage of documents sent on review in each project one can observe from Figure 17 that both FHN and GSO has about 74 % of total documents on review, while TYX only has about 50 %.

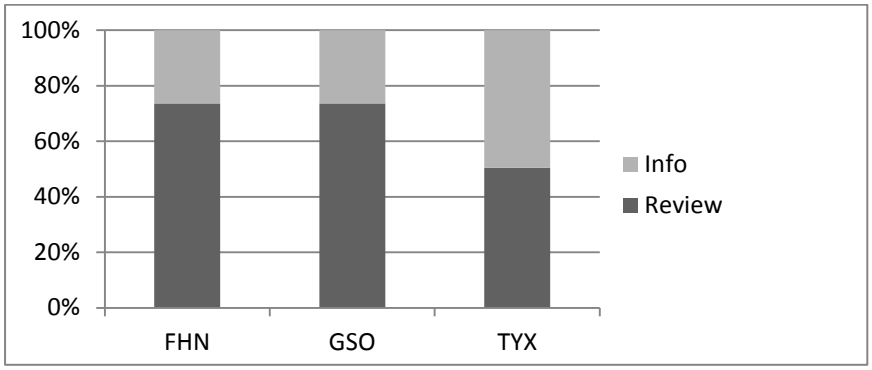


Figure 17: review VS Info in percentage.

Figure 18 shows the relationship between documents sent to review, information and documents that are accessible (documents that not yet has been received from supplier). Due to the fact that all projects to be analysed are operational in the DG3 phase, the CMDR are more mature than those documents actually delivered to the projects. As one can observe in Figure 18, those documents marked accessible are documents that either hasn't been distributed to the project yet. As the project matures, more documents will be distributed to the projects, and will be followed up by discipline engineers.

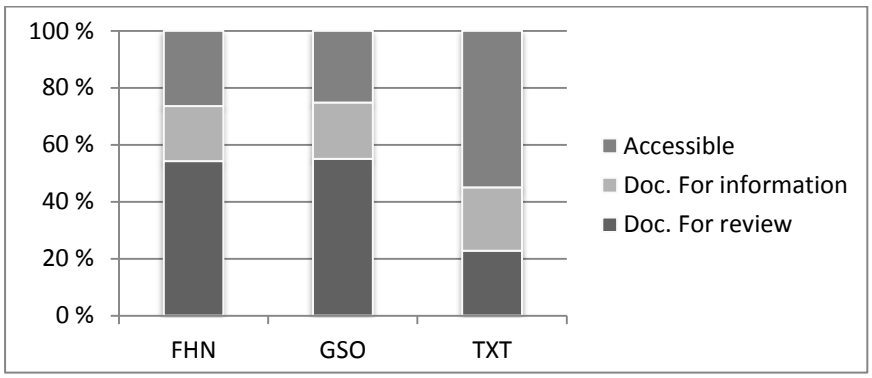


Figure 18: relationship between documents for info, documents for review and documents not yet received from contractor

4.3.1 Analysis 1 – Correlation between each projects evaluation of documents.

By comparing CMDR`s from all three projects, and identify all similar documents, we can further analyse if these documents have been evaluated equally. It is then possible to investigate to what extent there is a correlation between each projects evaluation philosophy.

This analysis is performed by comparing document numbers between projects and analyse if there are deviations in the Review/info evaluation between similar documents. Results from this analysis can be seen in Table 5. Where *Number of similar documents* is the amount of documents included in several projects. *None correlating documents* is the number of documents where the review/info evaluation not correlate between projects, and *documents in total* is the total number of documents included in the analysis.

Table 5: Comparison of document evaluations between the research projects

In total – Between all projects	
Number of similar documents	**159**
Correlated document evaluations	**144**
None correlated document evaluations	**15**
Documents in total included in the analysis	**1534**

GSO - FHN	
Number of similar documents	**105**
Correlated document evaluations	**96**
None correlated document evaluations	**9**
Documents in total included in the analysis	**1425**

GSO - TYX	
Number of similar documents	**28**
Correlated document evaluations	**27**
None correlated document evaluations	**1**
Documents in total included in the analysis	**700**

FHN - TYX	
Number of similar documents	**26**
Correlated document evaluations	**21**
None correlated document evaluations	**5**
Documents in total included in the analysis	**943**

As we can observe in the above table, the amount of deviations between projects is 15. This means that there are 15 documents that have been evaluated differently between projects. GSO – FHN has the highest amount of deviations with 9, and GSO – TYX has the least amount with only one. This must off course be seen relative to the amount of similar documents in the project combination. As TYX is the smallest project measured in document deliverables, this results is not surprising. To gain some perspective on the relative relationship between these projects we will observe the

percentage of documents that correlates and deviates in each project combination. By analysing the percentage of deviating evaluations between projects, we can observe that there is a 9 % deviation in GSO-FHN and 19 % in FHN-TYX (see Figure 19).

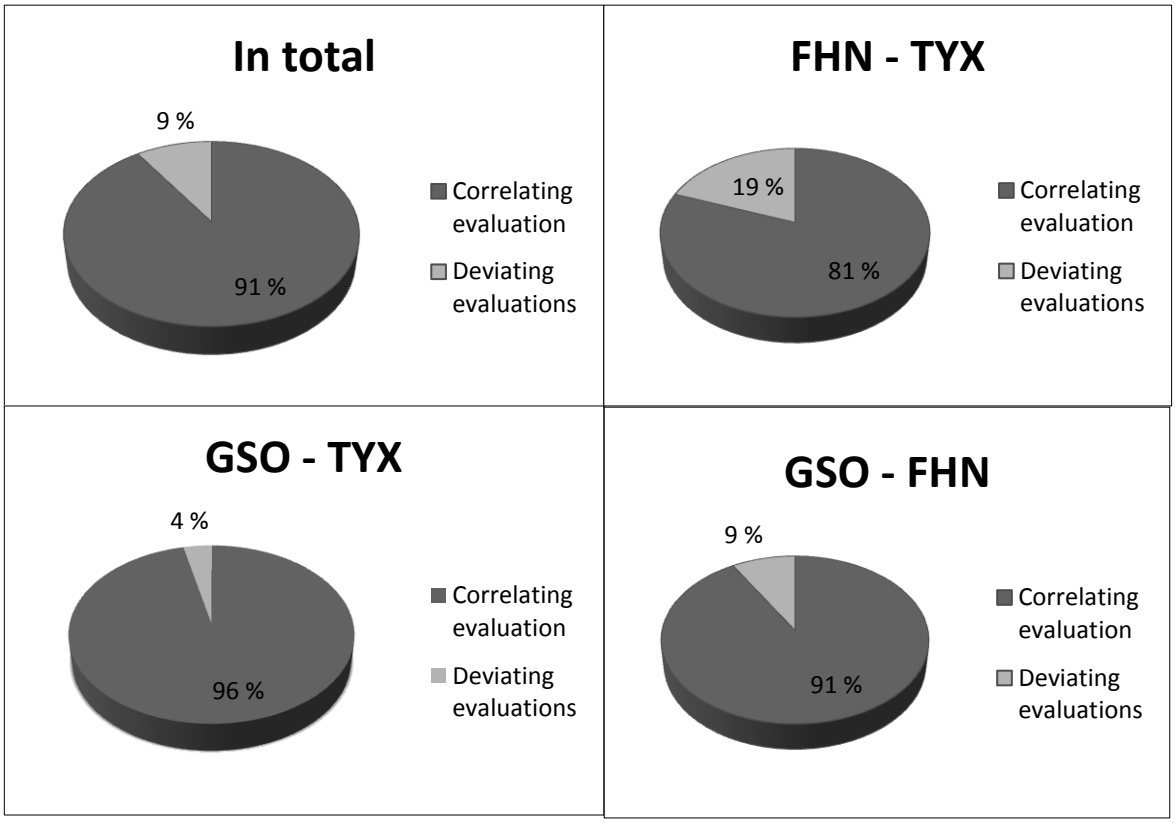


Figure 19: Percentage of deviating evaluations for each project combination

This analysis reveals only the quantitative amount of deviant and correlated evaluations of similar documents between projects, and cannot tell us anything about the philosophy behind each discipline engineer's evaluation technique. Still, it help us to understand if these project has the same risk view, or if some are more avers than others. The amount of similar documents in these projects is not great relative to the project size. Still, results indicate that the evaluation of which documents to review is not quite correlated between these projects.

To gain some perspective, imagine if for example GSO and FHN had exactly the same deliverables, and the amount of documents to be delivered was 1000. Then there would be 1000 similar documents for each project to evaluate. By saying that the risk view deviates by 10 %, 100 documents would be evaluated differently between these two projects. By assuming that these 100 documents are documents that do not contain significant risk sources (which would be a reasonable assumption since one of the projects have considered those as info documents), one can say that these are documents that could have been sent for info if both projects had collaborated in the review process. Based on the estimated costs of reviewing documents (ref section 4.3.4) this could potentially save costs up to 100 000 NOK.

Summary

Above analysis of GSO, TYX and FHN lack of evident proof that great deviations in the review evaluation occur between projects. It would be advantageous for the analysis if documents delivered in eRoom were more consistent with deliverables listed in the CMDR. In other words, if more documents were distributed by contractor there would have been more data to analyse, and therefore a more reliable analysis. Due to the fact that this analysis is not completely satisfying with respect to validity, it would be advantageous to get access to eRoom data from projects /contracts which are closer to DG4 (Closer to completing the execution phase). These projects will be more mature. Hence, the correlation between eRoom and the CMDR would be more equal to 1. In discussions with lead engineers in SDT I was recommended to look into two projects under the same frame agreement as the respective research projects, namely Visund sør and Tyrihans. Unfortunately it was not possible to get access to necessary data from Tyrihans, and therefore not possible to conduct this analysis. Data from Visund sør was available, and will be used to compare first wave projects (Visund sør) with the research projects (third wave) to explore the use of synergies in the SDT portfolio. This analysis can be seen in section 4.3.3.

4.3.2 Analysis 2 – Correlation between Statoil's and contractors risk view

This analysis is conducted to investigate to what extent contractor and Statoil agree on the risk based follow up strategy for technical documents. This analysis is performed by comparing documents that Statoil has reviewed with those documents contractor suggested that Statoil should review. This analysis is performed with data from the GSO project where documents reviewed by Statoil are compared to the review suggestion provided by contractor. Results can be seen in Table 6 and Table 7. Table 6 shows the amount of documents delivered in eRoom, and how the review evaluation correlates with what contractor suggested Statoil to review. The column "deviation" shows the amount of documents that deviates in the evaluation of review or info between contractor and Statoil. As one can observe, 72 out of 596 documents were evaluated different by Statoil and contractor.

Table 6: Deviations between contractors review suggestion and documents reviewed by Statoil.

Conformance	**Total**
None correlated evaluations	72
Correlated evaluations	496
Grand Total	**568**

Further it is interesting to see how these evaluations deviate. In Table 7 one can observe how Statoil changed the status of documents received i.e. from info to review or from review to info. From the results in this analysis one can observe that GSO so far only chose to review two documents that contractor did not recommend, and chose to not review 70 of the recommended documents. This result shows that contractor is more risk averse than Statoil in this project. Reasons for not reviewing recommended documents can be many e.g. similar documents have been reviewed in earlier projects, or Statoil engineers may feel that they are doing the job for the contractor by reviewing these documents. During interviews, reasons for not reviewing documents recommended by contractor will be further investigated.

Table 7: Statoil`s risk view compared to contractors risk view

Risk view	Total
Statoil changed status from info to review	2
Statoil changed status from review to info	70
No change	496
Grand Total	**568**

4.3.3 Analysis 3 – The Synergy effect between first wave and third wave projects

This analysis has been conducted to evaluate to what extent synergies and experience transfer are taken advantageous of between earlier projects and this studies research projects. Table 8 shows the relationship between Visund Sør (VS), (a SDT project from first wave), and the respective research projects GSO, FHN and TYX.

Table 8: Synergie analysis of Visund sør vs FHN,GSO and TYX

VS – FHN	Amount of documents
Similar deliverables between projects	242
Similar deliverables with same evaluation (RR/II)	191
R/R	2
R/I	50
I/R	1
I/I	189
VS - TYX	**Amount of documents**
Similar deliverables between projects	31
Similar deliverables with the same evaluation (RR/II)	28
R/R	0
R/I	2
I/R	1
I/I	28
VS - GSO	**Amount of documents**
Similar deliverables between projects	197
Similar deliverables with same evaluation (RR/II)	142
R/R	10
R/I	48
I/R	7
I/I	132

In figure 21, 22, and 23 one can observe the percentage breakdown of evaluations for each project combination.

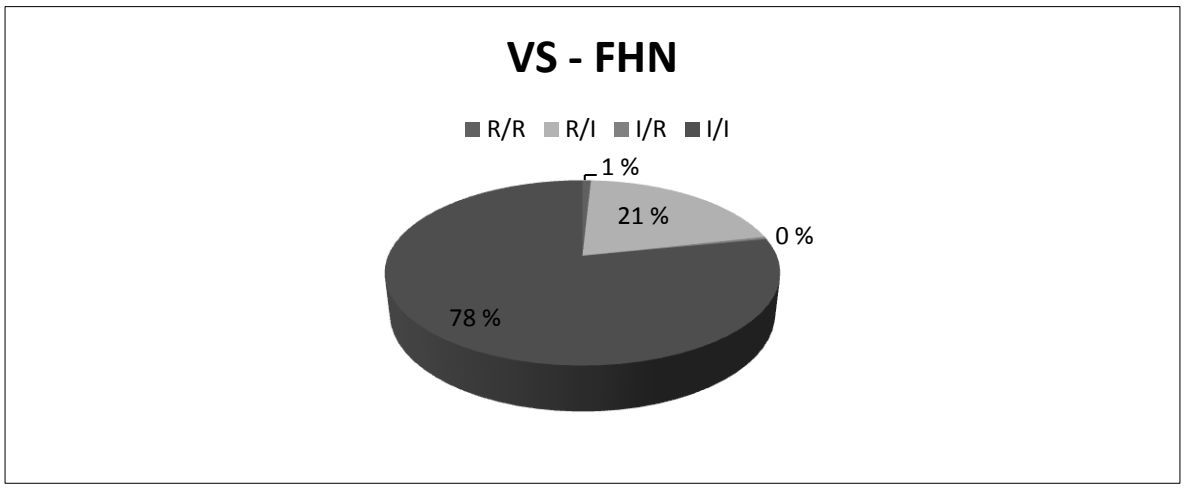


Figure 20: Percentage breakdown of evaluations VS - FHN

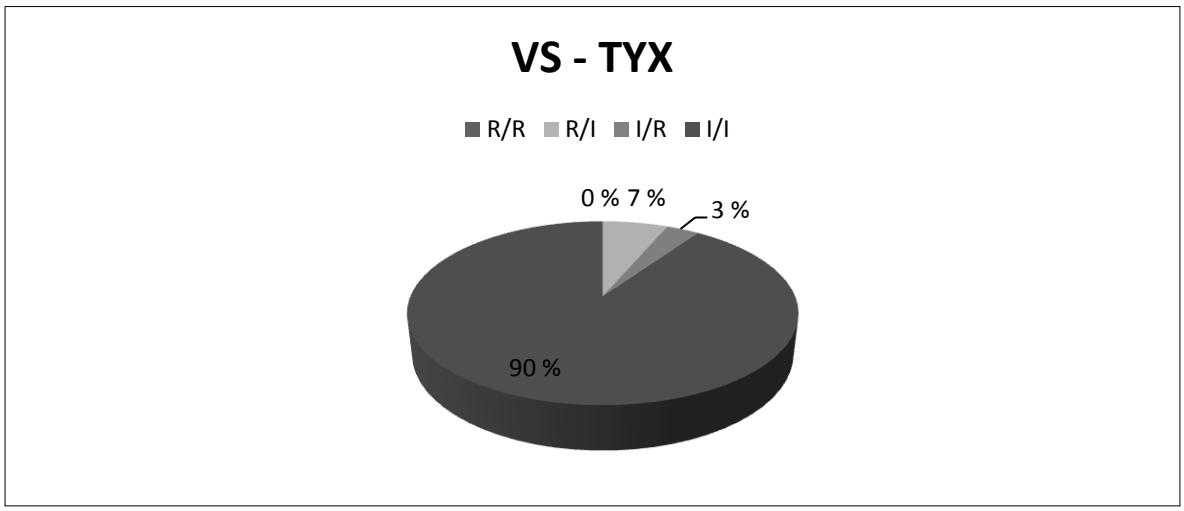


Figure 21: Percentage breakdown of evaluations VS - TYX

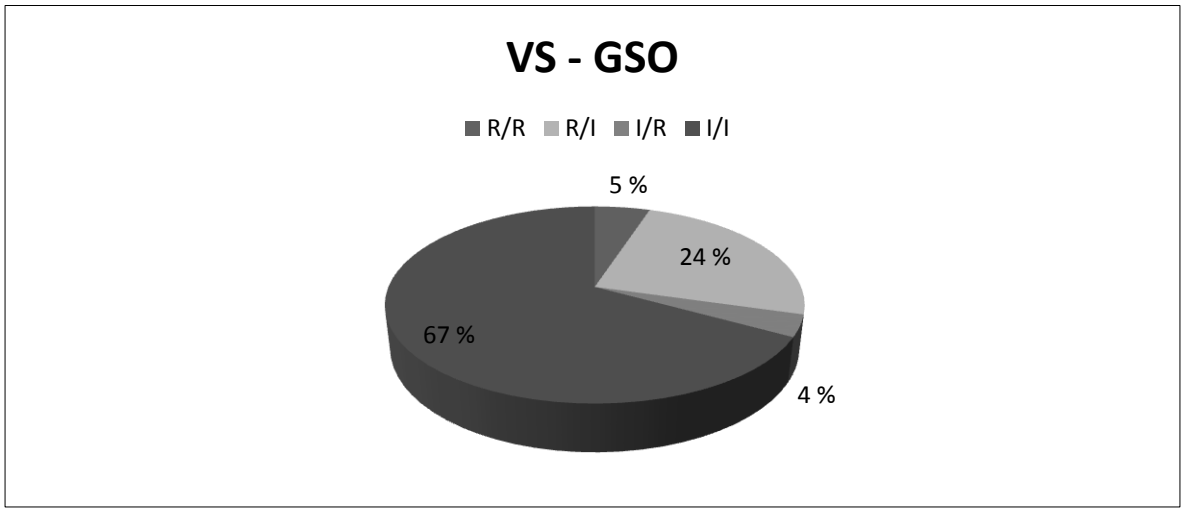


Figure 22: Percentage breakdown of evaluations VS – GSO

Results from this analysis show that a significant part of documents delivered in earlier projects is evaluated as info documents in future projects. It also shows that these documents usually are defined as info documents in earlier projects as well (189 Documents in FHN, 28 in TYX, and 132 in GSO) And those documents that changes status from wave one to wave three do change from review to info in most instances. Based on results from this analysis it seems like the majority of documents that is a deliverable in multiple project waves are of such a characteristic that they do not generate high risk for the project. This conclusion is based on the amount of documents that is defined as info documents both in first wave and third wave. Documents marked as info documents as early as in first wave would most likely be those documents that don't constitute any significant risk for the project, and implicitly these documents would most likely not be project specific.

Further, this analysis indicates that experience transfer and synergies between projects do occur. Results show that the majority of documents marked for review in first wave are marked for info in third wave projects. The amount of documents either reviewed in both first and third wave, or reviewed only in third wave is not significant. We can observe that in VS-FHN, 242 document deliverables are similar. Only two out of these documents was reviewed in both projects, and there is only one document that has been reviewed in FHN and not in VS.

In VS-GSO the amount of documents either reviewed in both projects, or only in GSO is somewhat higher. One can observe that 10 documents have been reviewed in both projects, and 7 documents have been reviewed only in GSO. Still, the amount of documents reviewed in VS and sent for info in GSO is 48. This indicates that GSO also takes advantages of synergy effects.

In the analysis of VS-TYX the amount of similar documents is significantly smaller relatively to GSO and FHN. This is not surprising due to the project size. TYX is the smallest project with only 109 document deliverables. One can observe that out of 31 similar deliverables 28 documents where sent for info in both projects. Two documents were reviewed in VS and sent for info in TYX, and only one document was sent for info in VS and reviewed in TYX.

Based on results from this analysis it seems like discipline engineers are focusing on taking advantageous of experiences and synergies from earlier projects. It is important to take in to account that not all documents from the research projects has been delivered yet and are therefore not part of this analysis. Still, the amount of data should be sufficient to conclude a valid trend that synergies from earlier projects are taken in to consideration when choosing documents to review.

4.3.4 Resources spent on reviewing documents.

Costs related to reviewing a document or drawing will be calculated applying equation 1 derived in chapter 3 section 3.6.

A - Average number of engineers used to reviewing one document.

Table 9: Average amount of reviewers for each project (Statoil ASA, 2013d)

Project n	Reviewers	Project n	*Reviewers*
Hyme project	2	Kristin LPP	*2*
Stjerne	3	Oseberg B Drilling Upgrade Project	*7*
Kvitebjørn Precompression Project	4	Valemon Project	*4*
Svalin EPCI	4	Skuld	*13*
Visund Sør	5	Snorre A Drilling Facilities	*15*
Visund Nord	5	Gullfaks B Drilling upgrade	*5*
Vilje Sør	5	Troll A 3&4 Pre-Compression (TPC34)	*5*
Delayed Coker Revamp (DCR) Project	10	Gullfaks B Water Injection Upgrade	*5*
Kårst Expansion Project (KEP)	15	Heimdal Extended Life Project (HELP)	*2*
Gullfaks Automation and Safety Systems (SAS)	4	Oseberg C Drilling Upgrade	*4*
H-7 and 2/4S removal	4	Gudrun Field Development Project	*8*
Åsgard Subsea Compression project	3	Vigdis Nordøst prosjekt	*4*
Ormen Lange Subsea Compression Pilot	3	In Salah Southern Fields Development Project	*3*
Gullfaks Subsea Compression	5	**Average reviewers**	***5,5***

$\mathbf{A} = \frac{\sum_1^n Average\ number\ of\ reviwers\ in\ project\ n}{N}$, N = total number of projects (see Table 9)

$$\mathbf{A} = \frac{149}{27} = \mathbf{5,5}$$

T - Time spent on reviewing one document

Based on results from interviews, the estimated time spent on reviewing one document can be seen in Table 10, derived from section 4.5.3.9. Time spent on review includes all activities related to reviewing a document.

Table 10: Estimated time in average spent on reviewing documents

	A (min)	B (min)	C (min)	D (min)	E (min)	F (min)	Average
Drawings	1,5	0,5	3	0,2	0,5	2	**1,3 Hour**
Text documents	0,25	0,5	3	0,66	0,5	2	**1,15 Hour**

C - The average cost of having one engineer working for one hour.

I received an estimate from the TPD HR department on the average cost of having one engineer working for one hour. The estimate is **1450 NOK/hour** based on 1700 working hours per annum.

The formula for total review cost is then as following:

Rc – The average cost of reviewing one text document.

$$Rc = A * T * C$$

Rc = 5,5 Person*1,15 Hour*1450 NOK/(Person *hour) = **9171 NOK**

Rd – The average cost of reviewing one drawing.

$$Rc = A * T * C$$

Rd = 5,5 Person*1,3 Hour*1450 NOK/Person *hour = **10367 NOK**

The purpose of these estimates is to give an indication of the cost related to reviewing documents, and these costs will wary between disciplines and projects depending on the amount of reviewers and the related level of technicality and detail. As one can observe in Table 9, there is a wide spread in the average amount of reviewers between projects with 2 in the Hyme project and 15 in the Kårstø expansion project. In addition it would have been advantageous to have access to more data on the average time spent on reviewing documents to get a more valid estimate. Still, this estimate provides an indicator on the costs related to reviewing documents in an average Statoil project. To obtain a project specific estimate these numbers can be adjusted accordingly.

From the distribution matrix from the research projects in this study we can find the average number of personnel used to review documents. Thus, we can derive project specific estimates. These averages can be seen in Table 11. The distribution matrix for TYX is not available and it is therefore not possible to derive an estimate on the average number of reviewers for this project.

Table 11: Average number of reviewers in the research projects

Project	Average number of reviewers	Estimated cost (documents)	Estimated cost (drawings)
FHN	4,5	7500 NOK	8480 NOK
GSO	4,5	7500 NOK	8482 NOK
TYX	Not available	Not available	Not available

4.4 Summing up data analysis

Data analysis has been performed to map each projects philosophy for review evaluation and the correlation between each projects risk view. In addition, data analysis has shown to what extent Statoil and contractor agrees on which documents that should be reviewed. Gathered data has also made it possible to investigate to what extent synergies and experience transfer is taken advantage

of in the SDT portfolio. Results from these analyses has provided a good basis for being able to understand differences and similarities between the research projects, and will be a good basis for designing interview questions and later discuss and identify areas of improvement. Data analysis has provided quantitative results that show how each project evaluates documents, but these results do not tell us much about the human factor in the evaluation process. Interviews are therefore a key input to better understand this process, and will be analysed in the next section

4.5 Interviews – Analysing the human factor

4.5.1 Interview questions

Interview questions have been designed on the basis of results from data analysis, and by discussions with engineering management in SDT. Three sets of interview questions have been prepared.

Discipline leads: A set of questions have been prepared for discipline leads. These questions have been designed to map each discipline leads perception and philosophy behind the risk based follow up strategy, the method for selecting documents for review, His or here's desire of more guidelines and tools for performing such selection, the risk view each lead possesses, and their use of resources for reviewing documents.

QRM/Document managers: Document management and QRM has a better perception and overview of the philosophy behind the risk based follow up strategy than what other disciplines in the project has. Especially The projects QRM manager plays a key role in achieving a risk based approach towards selecting technical documents, and the document managers has an overall responsibility for distributing and coordinate the review process. Hence, The QRM and document manager will get a slightly different set of questions than what other disciplines get, focusing on how the risk based philosophy is integrated in the project.

Engineering managers: The engineering manager has an overall responsibility to ensure that a risk based approach is applied when discipline leads select documents to review. Interview questions for engineering managers is designed to map each managers role and level of engagement in the selection of documents for review, his or here`s role in securing a consistent process for selecting documents, To what degree each engineering manager support discipline engineers in using resources on reviewing documents, and their perception of the importance of conducting such follow up of contractors.

Interviews has been conducted in conformance to the method described in chapter 3, section3.5 3.6. Questions and the underlying rational can be seen in appendix 9.4.

4.5.2 Summary of the interview process

Interviews have been conducted over a time period of three weeks. It was found quite challenging to reach out to all participants on the interview list and to receive a response. Some of the project personnel did not prioritize the request, and some just did not have the time or interest to participate. This of course did not include everyone. Some of the candidates on the interview list

responded quickly and I was able to book an interview within a couple of days. Those that didn't respond to my first invitation received a kind reminder to which I received some response. Others had to be looked up personally to get in touch with. And after conducting interviews with just about 50% of the project personnel on the list this study has covered satisfying spread of personalities, experiences and different disciplines in the projects.

Since not all project personnel is located at Fornebu some of the interviews had to be conducted via video link, and not everyone was comfortable with the interview being recorded on tape. Therefore, some of the interviews had to be written down parallel to the interview.

Results gathered during interviews in combination with results gathered from data analysis will provide a good basis for answering the research question, and conclude on areas of improvement to achieve a more standardized and efficient process for risk based follow up. Answers from interviews will be presented as a discussion based on different areas of the review process. Projects and personnel will not be presented by name in this discussion, due to the anonymity of interviewees.

4.5.3 Findings during the interview process

4.5.3.1 Method for selecting documents to review

Methods used for selecting documents to review are based on a highly qualitative process, and is depending on the experience, knowledge and detail focus each discipline lead possess. The key input to selecting documents for review is the knowledge and experience each engineer possesses, and as experience vary, so does the basis for decision making. Interviews have revealed that to achieve a more streamlined and standardized process for selecting documents to review, enhanced experience transfer and communication between projects is required.

4.5.3.2 Conformance to the risk based follow up strategy

When conducting interviews it was found that not all project personnel have the same philosophy for selecting documents to review. Some engineers have much experience and have been in the industry for several years, taking part in many similar projects. Other personnel are fairly new employees that have been working in the supplier industry or other fields of work prior to taking a position in Statoil. Naturally this constitutes a difference when it comes to experiences and identifying show stoppers for the project. Those engineers that are newly employed make use of the review process in a different way than those who are experienced. They may choose to review a large amount of documents not only to identify critical documents, but also to read up on project deliverables and gain knowledge. Thus, some engineers are using the review process not only as a quality assurance tool, but also as a way of further educate them self on project deliverables. This is not in conformance with the purpose of the quality assurance process. The review process should be a tool to identify deliverables that is not in conformance to the requirements specified in the contract, and to identify risks that may affect the project or the product when in operation. Thus, review of contractor's documents should not include reading up on documents for personal learning

and interest. This argument is not meant to imply that reading up on project documents is a waste of time. I would actually argue that this is a good way to gain both understanding and experience, and should be supported. But it should not be included as part of the risk based follow up strategy. Learning and quality assurance should be two separate processes, and that only those documents with high criticality and high risk should be picked for review. Other documents that lead engineers want to look at should therefore be kept out of this process either by categorizing them as info documents, or in another way mark them as documents of interest. This would contribute to achieve a more systematic process, and allocate more focus to those documents that actually requires a thorough review. This could also contribute to a better understanding of what "risk based follow up" actually means.

Employees with much experience tend to use their experience as a way to think risk based. Their method of choosing documents to review is highly qualitative and tends to be based on their own experience and knowledge. Newly employees have stated that trying to take advantage of experience transfer could be a challenging task, and that the best way to do so is to gain your own experience. Another observation during the interview process is that experience transfer is easier to obtain in disciplines where the number of personnel is limited, and where communication between projects is good. E.g. Material technology is a discipline in the SDT portfolio which has responsibility for many parallel projects. In addition materials don't change over time. St-316 will still be st-316 one year from now, and will have the same physical properties tomorrow as it has today. On the other hand, umbilical's tends to be highly project specific, and standard umbilical's is an unusual deliverable in Statoil. Therefore, it is harder to transfer experience from experienced to new employees in such disciplines.

4.5.3.3 Deviations between disciplines

Deviations between disciplines occur due to several reasons. Some of them are also quite natural. For example for Life cycle information (LCI) the amount of documents received from contractor is quite small and relatively standardized, and the LCI coordinator is fairly familiarized with the content of each document. He or she would know what to look for and the review process would not be very time consuming. On the other hand, mechanical disciplines receive a great amount of documents from suppliers, and a significant part of these documents are project specific. Thus, the review process is much more time consuming and unstandardized relatively to LCI. For mechanical disciplines to review all documents received from contractor would be a tremendous job and would require too many resources to justify such a thorough quality assurance. Thus, the importance of working risk based increases linearly with the amount of documents received and the technicality related to these documents. To achieve an efficient and successful review process in disciplines with high amounts of documents, discipline lead has to choose those documents that constitute the highest criticality for the project, and where he or she thinks he/she can find show stoppers. During interviews it was found that in some periods, the amount of documents in for review in the most technical disciplines exceeds a critical level where discipline engineers loses overview over those documents that has the highest criticality. Several engineers stated that there should be a criticality level related to each document in for review. The as-is situation is that all documents in for review has the same criticality and deadline for completing the review process, and this poses a challenge in allocating resources applying a risk based approach. Too many documents for review will decrease

the quality of each document review, and increase the probability that critical documents do not get the required priority.

Another interesting source to why deviations between disciplines may occur was also identified when conducting interviews. The research projects analysed in this thesis are all using the same frame agreement contractor, but an important aspect is that sub-contractors of equipment to the main contractor does not necessarily have to be the same in all projects. Different specifications, availability and needs can lead to different sub-contractors in each project. Thus, deviating amounts of documents sent on review in similar disciplines can be caused by different sub-contractors in each project. Several discipline leads stated that one criteria for selecting documents to review is their past experiences and familiarity with the contractor. If for example the supplier of equipment is new to Statoil or if past experiences has been of such a characteristic that Statoil has reasons to believe that deliverables could lack of quality, the amount of documents Statoil chose to review will be higher than if the supplier is well known and past experiences has been that deliverables is in conformance to the requirements specified in the contract.

4.5.3.4 Standardization of documents between projects

Standardizing documents between projects would be a way of reducing documents for review. Standardizing and approving documents would basically mean that the respective document would be approved in advance of the project, and no review would be required. The challenge with standard documents is that it requires no change in the deliverable between projects. In other words the document could not be project specific. When questioning lead engineers about the opportunity of standardizing documents the response was both yes and no. Most engineers could see the upside of doing so, but was sceptical to how this would work in practice. The problem would be that the document must be exactly the same in each project. During interviews it was found that some disciplines has a higher potential in doing so than others. E.g. Material technology. As mentioned earlier materials don't change over time and standardizing documents is actually the way they work today. In other disciplines like umbilical, standardizing has been a challenge so far due to varying specifications and requirements between projects.

Some interviewees stated that part of this responsibility should be put on the contractor. As the contractor operates with the same document number for documents between projects, a way of standardizing documents would be to store historical data on documents and give notice to Statoil when they deliver a document that has been delivered in earlier projects. Such historical documentation could be an effective asset for achieving experience transfer and could over time, reduce the amount of re-work generated by reviewing a document several times. If engineers in Statoil received historical data on when and where a document has been delivered earlier, they could look up and read comments from earlier review evaluations, and take advantageous of earlier experiences. Historical data tracking in itself has been a desire from several Statoil engineers during interview rounds.

4.5.3.5 Experience transfer between projects

During interviews it was found that several engineers had a strong desire to get access to a database where one could find document history for those documents that have been delivered in earlier projects. With history they were referring to a database where it is possible to see when or if a document had been delivered in earlier projects, and if delivered how it was evaluated. Documents in the history database did not necessarily have to be 100% similar to the projects deliverable, and the database could be separated in to different categories where similar documents are stored. Such a categorization could be defined on the basis of parts, disciplines, systems etc. By implementing such a database several engineers stated that experience transfer could be achieved on a higher level throughout the SDT portfolio.

4.5.3.6 Compliance to the CMDR

It seems like there is some internal disagreement regarding the CMDR documents meaning, purpose and responsibility. When interviewing the document manager I was told that contractor is responsible for communicating a suggestion on which documents they want Statoil to review and which documents who is just for information. Statoil then receives this suggestion and it is then up to each lead engineer to evaluate and decide which documents they want to review.

When questioning both lead engineers and engineering managers, I found that their perception of the CMDR vary.

The perception between engineering managers is the most surprising. It seems like there are deviating philosophies on how to use the CMDR. Two projects followed the principal stated by document managers. The manager's role in the review evaluation in these projects is to force lead engineers to be selective when choosing documents to review. In this case the supplier has the advantage of communicating to Statoil which documents they want to send for review, before Statoil send their review list back. This is a good opportunity for the contractor to communicate to Statoil which documents they feel that contains uncertainties. On the other hand, this method could make it too easy for contractors to suggest documents for review "just in case" something is deviating from the contract. During interviews it was found that some engineers are concerned that contractors don't bather doing a thorough review if Statoil can do it for them. This is not the purpose of the review process, and should not happen. With reference to the analysis of correlation between the contractors CMDR proposal and Statoil's review decision (ref section 4.3.2), it seems like the contractor is more risk averse than Statoil.

In the third project, communication between Statoil and contractor regarding documents for review occur prior to the CMDR publication. In this project Statoil has communicated in advance what they want for review and contractor sends out the CMDR with Statoil's request. This strategy may be advantageous with regards to findings in the analysis of correlation between contractors CMDR proposal and Statoil's review decision ref Table 6 and Table 7 in section 4.3.2. The advantage with this method is that it provides Statoil with an opportunity to choose which documents to review in an objective way when they do not need to take in to account the contractors review proposal. In my opinion this provides Statoil with a better basis for choosing documents for review using a risk

based approach. Another aspect with this method is that it may be harder for the contractor to ask Statoil to review documents that they do not feel they have full control over. If the supplier has the required resources and skills to review those document by them self it would not constitute a big problem, but on the other hand if the supplier has limited resources and qualifications to perform such review, the result could be unfortunate. Thus, a too strict review strategy could actually mean that the quality of deliverables is reduced.

Between discipline leads the consensus to contractors review proposal varies. The main reason found in this study has to do with the experience each engineer possesses. For those engineers that have a lot of experience the choice of documents to review is based on earlier experience with the contractor, and their experience with the system or part. For those engineers who are quite new in Statoil the perception is that they want to review almost everything.

4.5.3.7 Communication between contractor and Statoil

Interviews with document managers and engineering managers revealed that the CMDR received from contractor on execution start up usually is, to a varying degree immature. This implies that new documents are added to the CMDR during project execution. Engineering managers could see a potential upside in performing updates of this document during execution phase to assess new deliverables and to what extent these deliverables should be reviewed or not. The as-is situation is that the CMDR is evaluated on project start up, and deliverables specified later in the project are excluded from this evaluation. By conducting evaluation updates regularly and assess new documents, there is consensus among engineering managers that this could help to reduce the amount of documents in for review, and increase the quality of the follow up process. The underlying rational is that these new documents are added by contractor, and that these documents are added to the CMDR with contractor's evaluation of the review/info status. If the project performed CMDR updates on a regular basis, these evaluations could be assessed in the same manner as those documents evaluated on project start up.

4.5.3.8 Communication between document management and engineering disciplines

Especially engineering managers were critical to the document controller's responsibility in the review process. As mentioned earlier it is the document manager's responsibility to send out documents to document owners and internal stakeholders when the document is received from contractor. Engineering managers were sceptical to the document manager's knowledge about technical disciplines and the content of each document. If the individual responsible for sending out documents had some interdisciplinary knowledge he or she could evaluate if all engineers on the distribution matrix really needed to review the respective document. If the person responsible for this process possessed such knowledge, the number of reviewers could be reduced for some documents. Hence, the work load and use of resources could be reduced.

4.5.3.9 Time in average spent on reviewing documents

The following results were gathered from interviews with lead engineers.

Table 12: Estimated time in average spent on reviewing documents

	A (hour)	B (hour)	C (hour)	D (hour)	E (hour)	F (hour)	Average
Drawings	1,5	0,5	3	0,2	0,5	2	1,3 Hour
Text documents	0,25	0,5	3	0,66	0,5	2	1,15 Hour

It would have been advantageous if I had a larger data sample to build the estimated average on. As one can observe from the above table there is a wide spread in how much time each engineer uses to review a document or drawing. This spread occurs between disciplines and is depending on the level of detail each engineer has, and the level of technicality related to each disciplines. A larger sample would provide a more valid estimate. Even so, this estimate provides an indication to how much time each engineer spends on reviewing documents and drawings, and will be used as a basis for deriving the average cost of reviewing documents. As one can observe from the above table there will be derived separate estimates for documents and drawings.

4.5.3.10 Resources spent on review and resource availability

From interview results it seems like lead engineers is free of choice when they select documents to review. The engineering manager do not set strict rules on which type of documents to review, and the responsibility of applying a risk based approach when selecting documents lies mainly on the discipline leads.

4.5.3.11 Summing up - Findings from interviews

This section is a short summary of the most important findings from interview rounds. These findings are presented in random order.

- Better communication with contractors regarding the CMDR, and CMDR updates during the project.
- Better communication with contractor regarding the philosophy behind the risk based follow up strategy (Statoil shall not do the job for contractors).
- Better communication between document management and engineering disciplines.
- Better communication between projects and disciplines.
- Better overview of documents for review (Criticality, Sorting, Historical data etc.).
- Improved experience transfer between projects and employees.
- Implementing a system for storing documents and comments from earlier projects.
- Decrease the amount of documents for review.
- Standardizing documents.

4.5.3.12 The three research projects – how comparable are they?

This study consist of three projects that are analysed with an approach that the projects are comparable in what is required of technical documentation and deliverables from contractor. Before ending this chapter a reflection on the different perspectives on the comparability between these projects will be given.

It is important to take in to account the different perspectives of how comparable these projects really are. For those people working outside the project portfolio and analyses all Statoil's projects, these projects would most likely be characterized as reasonably comparable, and what would be required of technical documentation would seem much alike. They are all in the fast track portfolio, and the scope of delivery includes much of the same equipment.

For those people working in the respective projects this perspective will most likely be quite different. For those working in a single project, the world would look quite different as from those who sit higher up in the hierarchy. For those people working in a single project, the scope of which they think will most likely consist of their project, and the level of detail and understanding of what should be delivered is much greater than for those in top management. These three projects shall deliver equipment to different platforms in the North Sea, with different seabed structure, and to different platform managers whose philosophy and demands may deviate strongly. The ownership and closeness to the project will be much stronger for those working directly in it, and there is a possibility that internal stakeholders in the respective projects will disagree to compare these projects directly.

4.6 Discussion with SDT management and contractor

In addition to interviews and data analysis, I was invited to participate in a program currently being undertaken to improve the process for reviewing technical documentation from contractors. This program is initiated in cooperation with FMC which is one of the main suppliers of subsea equipment to Statoil. The overall goal of this program is to decrease the amount of documents sent on review, and to achieve a more efficient and standardized method for selecting documents to review. This program will hopefully provide good input to this study.

In a meeting with representatives from Statoil and contractor, problems and solutions on how to improve the risk based follow up strategy for documentation was discussed. This program focusses on the cooperation and interface between supplier and operator and the focus are on how the process for delivery and handling of documents can be more streamlined and predictable. The goal is to reduce the amount of documents for review in the execution phase. Some problems that where discussed can be seen below.

- Different Engineering numbering system (ENS) for each installation, which makes it hard for each project to approve a "standard" document.
- Today there are no guidelines on how engineers in Statoil ASA shall evaluate documents, and it is therefore hard to predict which documents that are selected for review in different

projects. The process may be based too much on each engineer's personal references and experience, and not on a general risk analysis process.

- Statoil ASA`s technical requirements for engineering deliverables may be too detailed. This document should probably be revised in cooperation with suppliers to make sure that all included documents are relevant and needed.

A proposal on developing a more user friendly database for documents between supplier and operator where discussed. Today Statoil and contractors use different software's for handling documents. In addition Statoil has different software's for different types of documents. This poses a challenge in handling documents between Statoil and contractor. This is a good proposal, but a realistic view of this suggestion is that it is time consuming, ambitious and costly with regard to resources. The business case of such a program would probably be good, but the realistic time horizon is also long.

Follow up meeting with contractor

Continued improvement of the review process was discussed, and the main topic was on how FMC can make a more standardized CMDR. One area of improvement is on which documents FMC shall mark for review. At the moment communication between contractor and Statoil is not as good as it can be with regards to the *risk based* follow up strategy. With reference to analysis performed in Table 6 and Table 7 one can see that there are some disagreements on which documents that should be reviewed. The analysis showed that contractor is more risk averse than Statoil in this evaluation.

Chapter 5 - Discussion

In this chapter results from data analysis and interviews will be combined and discussed to further conclude on which measures Statoil should implement to improve the review process.

5 Discussion

Analysis of data has provided a good basis for understanding how each project selects documents to review. The research question to be answered was formed on the basis of document controls earlier findings, and SDT management's perception of, and desire to improve the review process. The perception was that lack of synergy effects and experience transfer between projects led to much re-work and inefficient use of resources doing the job for contractor. After conducting several analysis and interviews, it is my perception that this assumption was based on analysis that didn't actually say anything about the amount of re-work being done. Document management highlighted only the amount of documents on review in each project, and the analysis did not include any comparison of projects to see how many similar documents their actually were. This thesis has taken these analyses further, and investigated how comparable these projects are, and how synergy effects are taken advantage of in the fast track portfolio. The following chapter is a discussion of findings from these analyses.

5.1 Experience transfer and synergies

I will first of all distinguish between two types of experience transfer related to selecting documents for review. Those two are *Portfolio experience transfer* and *internal experience transfer within projects and disciplines*.

Experience transfer in a portfolio view is based on communication with contractors, historical data and earlier evaluations performed by other projects in the SDT portfolio. This experience is transferred by comparing project deliverables with deliverables from earlier fast track projects, and the focus is on eliminating documents that already has been approved in earlier projects. Documents that has been on review in earlier projects, and **do not** constitute any significant risks in the project can then be categorized as info documents. One can say that by communicating with contractor and by comparing deliverables with earlier projects, the project is taking advantageous of synergies and experiences from earlier projects to reduce the amount of re-work in the SDT portfolio.

Internal experience transfer is of a different nature. This kind of experience is based on each individuals work experience, knowledge and education, and is therefore more time consuming and challenging to transfer. An individual's experience and expertise is kept in that individuals mind and is built up over time by their own assessments and experiences. These experiences are of great value for a project, but will easily disappear with the individual possessing them. Transferring such experience between individuals is a time consuming process that requires good communication and learning from "hands on" experiences.

This study has found that it is the internal experience transfer that is the main challenge, and the belief is that there is a potential in trying to improve this process. When comparing similar documents within GSO, FHN and TYX results showed that there are some deviations in the philosophy behind each projects selection of documents to review (see Table 5 in section 4.3.1). These deviations could possibly be reduced by improving experience transfer between projects.

In addition to findings from data analysis, answers from interviews are a key source to understand how experience transferring occurs in, and between projects. Answers received from discipline leads followed a clear pattern, where those engineers with years of experience knew what to look for and a risk based approach was implicitly applied when evaluating documents for review or info. For those engineers with less experience the evaluation of documents was quite different. Their evaluation of documents was more based on their uncertainty and curiosity regarding each document. Several engineers used the review process to gain experience and knowledge about the content of documents rather than to choose documents applying a risk based approach.

With reference to section 4.5.3.4 there was a strong desire from several engineers to get access to a database where one could find historical information on those documents that have been delivered in earlier projects, in addition to comments given in earlier assessments. Implementing such a database would be a time consuming process, but over time this could provide good results. Portfolio experience transfer is transferred using such methods, and indicates that it is fairly easy to use. If Statoil had initiated a program for storing historical data on documents for review, the same method could be used to transfer knowledge between discipline engineers and projects. Implementing such a system in Statoil would be a long term investment with an initial investment to develop a program suitable for logging this type of data. A new program has to be developed, or an existing program needs to be further developed. In this process the contractor has to be involved in the development. Contractors should be responsible for categorization and numbering of documents and make sure that documents fall in under the right category. Since contractors use the same document numbering systems on all documents, they would probably have an easier job keeping track of deliverables than what Statoil would.

Another way of improving experience transfer between projects could be to establish better communication between parallel projects, and to compare each projects selection of documents to review and info. By identifying deviating evaluations between projects, and by discussing to what extent these documents constitutes a significant source of risk, experience and knowledge could be transferred between projects, and from experienced to less experienced personnel.

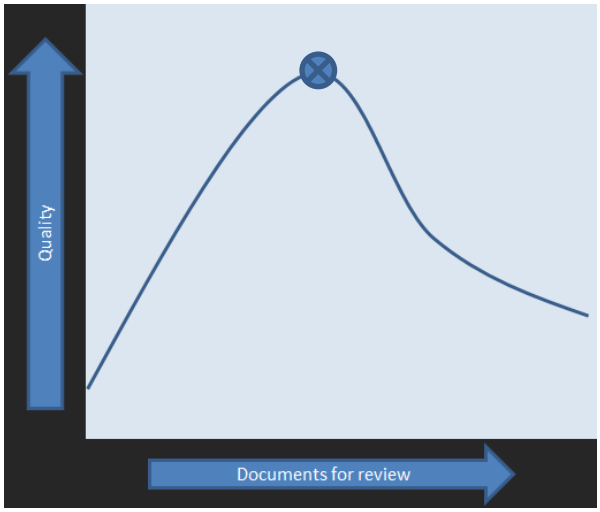
5.2 Communication with contractor

As stated in section 4.5.3.6, there are deviating methods for how different projects communicate with contractors regarding the CMDR. And, as discussed there are pros and cons with both methods. The trade of with giving contractor to much or less freedom in proposing documents for review is an important aspect in trying to optimize the review process. This trade of is two dimensional and the overall objective would be to achieve high quality and decrease the amount of documents for review. The two dimensions are the level of quality and the amount of documents for review (See Figure 23).

Too many documents for review will reduce time spent on reviewing those documents that are of critical importance to the project. Therefore, one should be selective when selecting documents. Also, too few documents for review can lead to unfortunate results if contractor lack experience in a specific field and Statoil chooses to be too selective in the review process. Thus, better communication between Statoil and contractor is necessary to agree on the review philosophy.

Contractor should be aware that Statoil do not have time to “do the job” for them, and only documents who needs clarification should be reviewed. The threshold for sending documents on review in Statoil should be defined in such a way that both Statoil and contractor have the same perception of the purpose of the review process.

It is important to mention that this strategy should have some slack, and be specifically designed to fit each contractor. Different contractors have different resources and skills, and one of the key areas of quality assurance is to be aware of areas where contractors lack experience and competence.



The figure illustrates the trade of between number of documents inn for review and the quality of the review process. The value of the graph in the point where documents for review is equal to zero is depending on the contractor’s skills and expertise.

Figure 23: Trade-off between the amount of documents for review and the quality of the review process

5.3 Standardizing documents

Standardizing document deliverables sound good in theory, but if feasible in practice is uncertain. My perception after conducting interviews and collecting data is that standardizing documents is easier said than done. Standardization means producing documents that fits all projects. To do so, the document has to be the same deliverable in all projects, with the same specifications and interface. In the oil and gas industry specifications vary widely between different fields and a x-mas tree is usually not standardized. Results from analysis in section 4.3.2 shows that those documents that are deliverables in multiple projects often are marked as info documents. In other words, those documents that can be standardized are usually categorized as information documents in the first place. And therefore, producing more standard documents wouldn’t necessary make the amount of documents for review go down. It is my belief that the cost exceeds the savings by implementing a standardizing program. It is also my perception that a standardization program would encounter great resistance in some disciplines where most deliverables are project specific.

Rather than standardizing document deliverables, disciplines could seek possibilities to standardize the review process for some document categories. Identifying show stoppers in advance and make a more check-list based approach could perhaps force disciplines to think more risk based when choosing documents to review. By applying a check-list approach engineers needs to think about

risks related to each document category before choosing what to review. This could make the review process more predictable and streamlined with regards to risk and quality. An example of such a checklist can be seen in appendix 9.5.

5.4 Criticality assessments

Criticality classification of documents sent on review is another way of achieving awareness among engineers with respect to risks related to each document sent on review. Implementing such a system would help engineers to keep track over those documents that is most critical with regards to quality and risk. This method will not, in itself reduce the amount of documents on review, but a side effect could be that engineers become more aware of the risk based philosophy behind the review process, and may choose to send low criticality documents for information. Today, all documents on review have the same criticality. That is, they have no criticality level at all. During interviews, several participants stated that it is hard to keep track of documents in eRoom, and in some phases of the project too many documents comes in for review at the same time. When the amount of documents reaches a critical level, keeping track of what's the most important is a challenge. Therefore, it would be favourable to have a column that communicates the criticality of each document in for review.

5.5 Purpose and goals

The follow up strategy should be clearer on what the main goals are. As mentioned in section 4.5.3.2, many leads uses the review process to read through documents to learn what it contains and how i.e. a system works. The risk based follow up strategy should be clear on the purpose and not allow engineers to classify documents for review if the basis for this evaluation is to read up on own learning an interest. One should support learning in projects, but learning should be a separate process rather than included in the quality assurance process.

5.6 Hypothesis

In this section hypothesis defined in chapter 3 will be answered. As one may recall the hypothesis where formulated as such:

Hypothesis 1

- *Are there a correlation between the amount of documents sent to review in different disciplines, and the discipline lead engineers perception of risk?*
- *Does the lead engineer send all documents to review because he follows the principle "better safe than sorry"?*
- *Are there a relationship between the engineers experience and the amount of documents sent on review?*
- *And is there deviating philosophies between projects for which documents to choose for review?*

Hypothesis 2

- *Are the CMDR document immature when lead engineers evaluating documents for review, and to what extent does this affect the review evaluation?*
- *Does contractors and Statoil`s perception of the purpose and meaning of the follow up strategy correlate?*

Hypothesis 3

- *Is there a correlation between documents sent to review and the lead engineer's employment status? (Consultancies vs. permanent employees)*

Hypothesis 4

- *Is there lack of a system for reuse of technical documents that prevent new projects from taking advantage of synergies from earlier projects?*

Answer to hypothesis 1.

The review evaluation process is as mentioned earlier a process that is highly depending on each engineers experience, risk view, discipline and knowledge. Therefore, it would not be correct to draw a general conclusion that engineers in Statoil follows a "better safe than sorry" philosophy in the evaluation of technical documents. What can be concluded based on this research is that some disciplines follow this principle to a varying degree. There is a trend that engineers working in highly technical disciplines choose to review a greater amount of documents than less technical disciplines. Several reasons have been highlighted during this study. Naturally, highly technical disciplines tend to have a higher exposure to risks than less technical disciplines, and would naturally have more documents on review. Technical disciplines also tend to receive more documents than other

disciplines, which naturally would accumulate more documents on review. A more interesting observation is that some discipline engineers base the review evaluation not only on the nature of the document, but also on the supplier of equipment. If the supplier is known and trusted, the "better safe than sorry" principle doesn't seem to apply, but if the supplier is new to Statoil, or if engineers have a bad experience in past projects they would choose to review more documents. In other words, the "better safe than sorry" principle tends to be more used when the supplier is new to Statoil, or if the supplier has delivered bad quality in earlier projects (ref section 4.5.3.3). This observation is interesting and arise an interesting question. Choosing new or "low" quality suppliers increases the costs, and need for resources in contract follow up?

With regards to the relationship between the experiences each engineer possesses and the selection of documents to review, there is a clear pattern that those with less experience tend to select larger amounts of documents to review. For a thorough explanation on this topic see section 4.5.3.2.

Answer to hypothesis 2.

This hypothesis has been discussed thoroughly earlier in this thesis. And the reader is referred to section 4.5.3.7 for a comprehensive discussion on this topic. It can be conclude that the CMDR tends to be highly immature in some projects, and it is quite common that comprehensive updates of the CMDR do occur during the execution phase. This is one of the key areas where Statoil has an opportunity to improve the follow up process and reduce the amount of documents in for review.

Answer to hypothesis 3.

During this study there are no findings that imply that consultancies generate higher amounts of documents for review than employees. What was found is that personnel with less experience and knowledge usually choose to review more documents than experienced personnel. This observation applies both for consultancies and employees in Statoil. To conclude on deviating evaluation philosophies between consultancies and employees, a more comprehensive research on the topic has to be performed. The reader is referred to section 4.5.3.2 for a more thorough discussion on this topic.

Answer to hypothesis 4.

As discussed earlier many discipline engineers feel that it is difficult to take advantageous of earlier evaluations due to non-existing systems for storing document history. Today there is no system for storing history on which documents that has been delivered in earlier projects. Analysis in chapter 4 shows that the fast track portfolio has been doing a good job keeping track of documents that has been delivered in earlier waves and is taking advantage of synergies. Still, engineers in the research projects have stated that they would prefer a database for storing both historical documents and comments given in earlier reviews to take advantage of earlier experience. For a more detailed discussion on this topic the reader is referred to section 4.5.3.5. It can be concluded that there is lack of a system for historical data, and by implementing such a system Statoil could achieve a more consistent and effective review process.

Chapter 6 - Conclusion

This chapter first answers the research question posed in this thesis, before concluding on which measures Statoil should implement to achieve a more streamlined and consistent process for risk based follow up of technical documents.

6 Conclusion

Several reasons for why deviations occur between these projects have been highlighted during this thesis. The main reason found in this study has to do with the human factor and each individual`s risk averseness and detail focus. Choosing documents to review is a qualitative selection based on experience and knowledge, and it is up to each discipline lead to select documents that he or she wants to review. This freedom to select documents for review results in deviating philosophies between project personnel, and the trend is that those individuals with less experience choose to review a high amount of documents, not only to identify risks, but also to gain learning and knowledge from reading up on technical deliverables. Experienced personnel tend to be more selective when choosing documents to review, and use their knowledge and experience to apply a risk based approach towards choosing documents for review. A second reason for why these deviations occur where highlighted during interviews, and has to do with sub-contractors, and Statoil's earlier experiences with them. A factor that is considered when selecting documents for review is past experiences and the level of trust one has to each sub-contractor. If the contractor is fairly new to Statoil, or if experiences from earlier projects indicate that they lack of competence in some areas, the amount of documents reviewed tends to be higher than if the sub-contractor has delivered high quality products in earlier projects. A third reason for why these deviations occur has to do with how the project communicates with contractor regarding which documents to review. Different projects have different methods for doing so, and this affects the amount of documents sent on review. The reader is referred to section 4.5.3.7 for a more thorough explanation. Based on these findings, some recommended actions to achieve a more streamlined and consistent process for risk based follow up is presented.

Recommended actions

This study concludes that there are several areas where improvement measures could be implemented to enhance the review process. Recommended actions will be to align the risk based philosophy between projects, making engineers more aware of the underlying rational of working *risk based*, and to make engineers think more risk based by implementing criticality assessments as part of the review evaluation. This would also help to separate learning from the review process by making engineers more aware of the inherent criticality of each document. Further, it is believed that Statoil would benefit from communicating to contractors in advance which type of documents they want for review, and implement a stricter regime for contractor reviews. An important aspect of this regime is that it has to be dynamic in the sense that different contractors possess varying degree of competence. Implementation of a stricter regime should be implemented over time and in cooperation with each contractor, aligning the purpose and overall goals of the review process. The overall goal of such a regime should be to enable Statoil from doing the job for contractors, and at the same time ensure that all deliverables from contractor are in conformance to the requirements specified in the contract. A system for storing historical data on document reviews is a more costly improvement measure, but also a desire from many engineers. By implementing such a system, one would achieve better experience transfer between projects, and a more structured process for selecting documents to review. Statoil should therefore further evaluate the business case of such a database.

7 Further work

This study has highlighted areas where inconsistencies in the review process occurs, and causes for why there is deviations in the amount of documents in for review between projects and disciplines. The scope of work in this thesis has been to analyse the as-is situation, and to identify areas where improvement measures could be implemented to achieve a more streamlined and consistent follow up process, and further conclude on recommended actions to achieve such consistency.

Further work based on results from this thesis will be to evaluate to what extent highlighted improvement measures would make a good business case, and to what extent these measures would help Statoil to achieve a more efficient and cost effective tool for contractor follow up and quality assurance. For an organisation such as Statoil, theirs many stakeholders that needs to be included and considered in such evaluations. And the effect of these changes has to be studied in all areas of the SDT portfolio. This thesis provides recommendations based on quantitative and qualitative data, and it is up to Statoil to evaluate to what extent these recommendations should be further implemented in the management system.

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Appendices

9 Appendices

9.1 Appendix 1 - List of Microsoft Excel functions

Table 13: List of functions used in data analyses, gathered from Microsoft Excel

ADDRESS function	Lookup and reference: Returns a reference as text to a single cell in a worksheet
AND function	Logical: Returns TRUE if all of its arguments are TRUE
AREAS function	Lookup and reference: Returns the number of areas in a reference
AVERAGE function	Statistical: Returns the average of its arguments
AVERAGEA function	Statistical: Returns the average of its arguments, including numbers, text, and logical values
AVERAGEIF function	Statistical: Returns the average (arithmetic mean) of all the cells in a range that meet a given criteria
AVERAGEIFS function	Statistical: Returns the average (arithmetic mean) of all cells that meet multiple criteria.
CHAR function	Text: Returns the character specified by the code number
CHOOSE function	Lookup and reference: Chooses a value from a list of values
CLEAN function	Text: Removes all nonprintable characters from text
CORREL function	Statistical: Returns the correlation coefficient between two data sets
COUNT function	Statistical: Counts how many numbers are in the list of arguments
COUNTA function	Statistical: Counts how many values are in the list of arguments
COUNTBLANK function	Statistical: Counts the number of blank cells within a range
COUNTIF function	Statistical: Counts the number of cells within a range that meet the given criteria
COUNTIFS function	Statistical: Counts the number of cells within a range that meet multiple criteria
COVAR function	Compatibility: Returns covariance, the average of the products of paired deviations
COVARIANCE.P function	Statistical: Returns covariance, the average of the products of paired deviations
COVARIANCE.S function	Statistical: Returns the sample covariance, the average of the products deviations for each data point pair in two data sets
DB function	Financial: Returns the depreciation of an asset for a specified period by using the fixed-declining balance method
DCOUNT function	Database: Counts the cells that contain numbers in a database
DCOUNTA function	Database: Counts nonblank cells in a database

DSTDEV function	Database: Estimates the standard deviation based on a sample of selected database entries
EXACT function	Text: Checks to see if two text values are identical
FIND, FINDB functions	Text: Finds one text value within another (case-sensitive)
GETPIVOTDATA function	Add-in and Automation: Returns data stored in a PivotTable report
HLOOKUP function	Lookup and reference: Looks in the top row of an array and returns the value of the indicated cell
IF function	Logical: Specifies a logical test to perform
INDEX function	Lookup and reference: Uses an index to choose a value from a reference or array
MID, MIDB functions	Text: Returns a specific number of characters from a text string starting at the position you specify
MIN function	Statistical: Returns the minimum value in a list of arguments
REPLACE,	Text: Replaces characters within text
ROW function	Lookup and reference: Returns the row number of a reference
ROWS function	Lookup and reference: Returns the number of rows in a reference
STDEV function	Compatibility: Estimates standard deviation based on a sample
STDEV.P function	Statistical: Calculates standard deviation based on the entire population
STDEV.S function	Statistical: Estimates standard deviation based on a sample
STDEVA function	Statistical: Estimates standard deviation based on a sample, including numbers, text, and logical values
STDEVP function	Compatibility: Calculates standard deviation based on the entire population
STDEVPA function	Statistical: Calculates standard deviation based on the entire population, including numbers, text, and logical values
SUM function	Math and trigonometry: Adds its arguments
VLOOKUP function	Lookup and reference: Looks in the first column of an array and moves across the row to return the value of a cell
OR function	Logical: Returns TRUE if any argument is TRUE

9.2 Appendix 2 – Interview protocols

Interview protocol for Discipline leads.
I am currently writing my master thesis for the QRM department in Statoil with the title "risk based follow up of technical documents". The main goal for this thesis is to find out why there are deviations in the amount of documents sent to review in different projects, and try to find solutions on how this process can be more streamlined and consistent. I have been given three projects/contracts (all in the SDT portfolio, and under the same frame agreement) to investigate during this study. These projects are as following:

- GSO
- Fram H Nord
- Tyrihans X-mas tree

A significant part of this study is to conduct interviews with key personnel in each project to map the philosophy behind each disciplines review evaluation process. To gain a good understanding of how the review process is performed in different projects I wish to interview lead engineers in all disciplines, and in all three projects.

Interviewer	
Interviewee (Title and name)	
Project	
How long have you been in your present position	
How long have you been in Statoil ASA	
Employee or external hire	

1. **To what extent do you follow suppliers CMDR proposal for review when evaluating documents?**

2. **What is your method for evaluating which documents to send on review/info?**

3. **How comfortable are you with passing documents just for information?**

4. **To what extent do you feel that you have support from the engineering manager to review all documents that you feel are necessary?**

5. **Do you feel that you have the necessary resources for conducting a satisfying review process**

6. **Would you prefer a more systematic process for conducting a risk based approach for evaluating documents for review?**

7. **Do you think it is possible to standardize some technical documents? What would be the main challenges of doing so?**

8. **How much time is spent on reviewing one document in average?**

Interview protocol for Document control.

I am currently writing my master thesis for the QRM department in Statoil with the title “risk based follow up of technical documents”. The main goal for this thesis is to find out why there are deviations in the amount of documents sent to review in different projects, and try to find solutions on how this process can be more streamlined and consistent. I have been given three projects/contracts (all in the SDT portfolio, and under the same frame agreement) to investigate during this study. These projects are as following:

- GSO
- Fram H Nord
- Tyrihans X-mas tree

A significant part of this study is to conduct interviews with key personnel in each project to map the philosophy behind each disciplines review evaluation process. To gain a good understanding of how the review process is performed in different projects I wish to interview lead engineers in all disciplines, and in all three projects.

Interviewer	
Interviewee (Title and name)	
Project	
How long have you been in your present position	
How long have you been in Statoil ASA	
Employee or external hire	

1. **To what degree do you feel that discipline engineers understand the risk based follow up strategy for technical documents?**

2. **Do you feel that there are deviations in the perception of risk in different disciplines with regards to technical documents? Are some more risk averse than others?**

3. **Would you prefer a more structured way of evaluating documents? More guidelines etc. If yes, please explain.**

4. **Do you observe any deviation in the amount of documents to review with employees and consultants?**

Interview protocol for engineering manager.

I am currently writing my master thesis for the QRM department in Statoil with the title "risk based follow up of technical documents". The main goal for this thesis is to find out why there are deviations in the amount of documents sent to review in different projects, and try to find solutions on how this process can be more streamlined and consistent. I have been given three projects/contracts (all in the SDT portfolio, and under the same frame agreement) to investigate during this study. These projects are as following:

- GSO
- Fram H Nord
- Tyrihans X-mas tree

A significant part of this study is to conduct interviews with key personnel in each project to map the philosophy behind each disciplines review evaluation process. To gain a good understanding of how the review process is performed in different projects I wish to interview lead engineers in all disciplines, and in all three projects

Interviewer	
Interviewee (Title and name)	
Project	
How long have you been in your present position	
How long have you been in Statoil ASA	
Employee or external hire	

1. **How important do you feel that the review process is for achieving high quality?**

2. **To what extent do you support discipline engineers to use resources on reviewing technical documentation?**

3. **To what degree do you ensure that all disciplines follow a risk based approach for selecting documents to review?**

4. **To what degree do you participate in the selection of documents to review in the project**

5. **What is your role in securing that a risk based approach is applied when selecting documents to review?**

9.3 Appendix 3 – Interview list

9.3.1 Interview list (tentative)

Table 14: interview list GSO

Engineering manager
HSE
Quality and risk management
Mechanical completion
Project Control
Life cycle information
System Engineering
Technical safety
Material technology
Control system
WH
XMT/CM/TH
Work over systems
TMI (Template/Manifold Intervention)
Tie-In connections
Umbilical
SIT

Table 15: Interview list FHN

Engineering manager
Central & System Engineering
Template & Manifold System and Structure
Wellheads System & Tools
Subsea Tree System
Production Control System
WOCS Modification
Intervention & Inter. Cont. Sys
Umbilical system
Sea line Tie-In System & Termination equipment
Integration testing
Process
Quality and risk management

Table 16: Interview list TYX

Technical lead
Material technology

9.4 Appendix 4 – Interview questions

Interview questions to Discipline leads

Interview question 1 focuses on each discipline leads perception of the contractor's suggestion on which documents to review. It is designed to identify causes for why there are deviating evaluations by contractor and Statoil on which documents that should be reviewed, based on results from analysis 4.3.3.

9. **To what extent do you follow suppliers CMDR proposal for review when evaluating documents?**

Interview question 2 is designed to map each discipline leads method for evaluating which documents to review.

10. **What is your method for evaluating which documents to send on review/info?**

Interview question 3 is designed to investigate each discipline leads risk view, and to what extent the respective lead is comfortable with passing documents for info.

11. **How comfortable are you with passing documents just for information?**

Interview question 4 is designed to investigate to what extent engineering management in each project focuses on applying a risk based approach for evaluating documents, and to what extent engineering management facilitate a risk based approach towards the review evaluation.

12. **To what extent do you feel that you have support from the engineering manager to review all documents that you feel are necessary?**

Interview question 5 is designed to investigate to what extent each discipline lead feels that he or she has the necessary resources for conducting a satisfying quality assurance of all documents to be reviewed.

13. **Do you feel that you have the necessary resources for conducting a satisfying review process**

Interview question 6 is designed to map the need for a more structured way of performing a risk based evaluation of documents to review.

14. **Would you prefer a more systematic process for conducting a risk based approach for evaluating documents for review?**

Interview question 7 is designed to investigate to what extent there is possible to standardize document deliverables between projects in different disciplines.

15. **Do you think it is possible to standardize some technical documents? What would be the main challenges of doing so?**

Interview question 8 is designed to provide an estimate on the average time spent on reviewing a document or drawing. The estimated average derived from this question will be used to derive an estimate on the total cost of reviewing a document.

16. **How much time is spent on reviewing one document in average?**

QRM and DM

Document management and QRM has a better perception and overview of the philosophy behind the risk based follow up strategy than what other disciplines in the project has. Especially The projects QRM manager plays a key role in achieving a risk based approach towards technical documents, and the document managers has an overall responsibility for distributing and coordinate the review process. Hence, The QRM and document manager will get a slightly different set of questions than other disciplines. These questions are as following:

5. **To what degree do you feel that discipline engineers understand the risk based follow up strategy for technical documents?**

6. **Do you feel that there are deviations in the perception of risk in different disciplines with regards to technical documents? Are some more risk averse than others?**

7. **Would you prefer a more structured way of evaluating documents? More guidelines etc. If yes, please explain.**

8. **Do you observe any deviation in the amount of documents to review with employees and consultants?**

Engineering manager

The engineering manager has an overall responsibility to ensure that a risk based approach is applied when discipline leads select documents to review. Interview question 1 is designed to investigate to what extent the engineering manager facilitates an efficient and standardized method for performing such a selection.

6. **What is your role in securing that a risk based approach is applied when selecting documents to review?**

Interview question 2 and 3 is designed to investigate to what extent the engineering manager participates in the process of selecting documents to review, and what he does to secure a risk based approach towards the review process.

7. **To what degree do you participate in the selection of documents to review in the project?**

8. **To what degree do you ensure that all disciplines follow a risk based approach for selecting documents to review?**

Interview question 4 is designed to investigate to what extent the engineering manager support engineers in using resources on reviewing documents.

9. **To what extent do you support discipline engineers to use resources on reviewing technical documentation?**

Interview question 5 is designed to map the engineering manager's perception of how important the review process is for achieving high quality in projects.

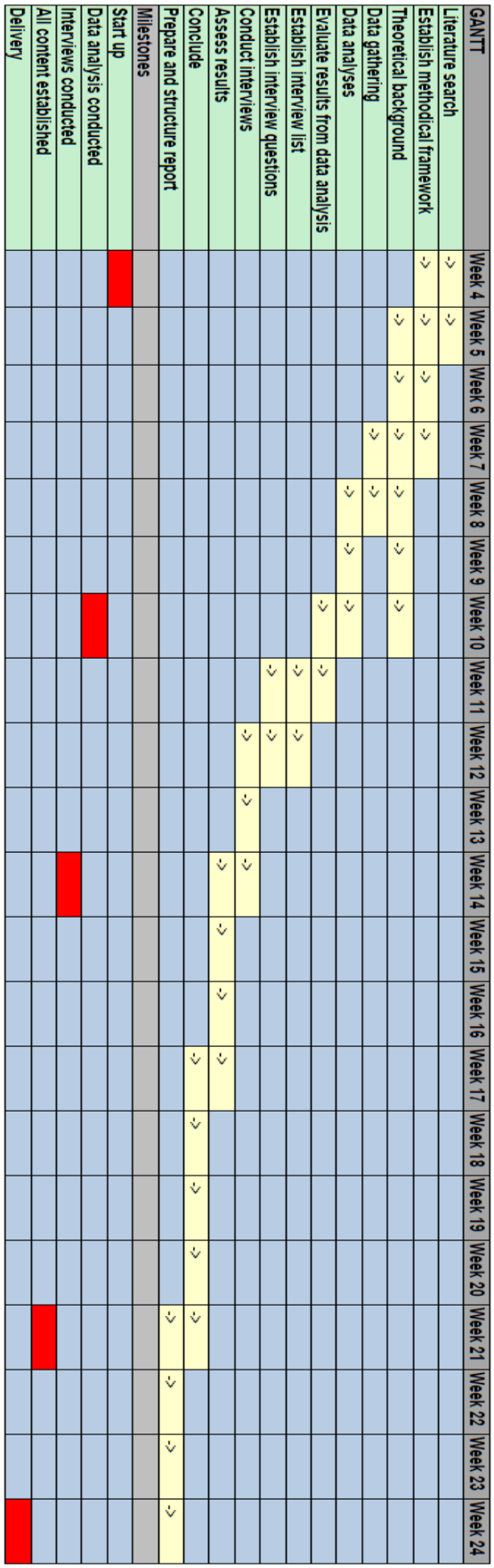
10. **How important do you feel that the review process is for achieving high quality?**

9.5 Appendix 4

Figure 24: Example of a risk worksheet

Risk category	Scope triangle	Doc.number	Describe risk	Prob	Impact	Priority
Central & System Engineering	Cost					
Control system	Time					
Engineering manager	Quality					
HSE						
Integration testing						
Intervention & Inter. Cont. Sys						
Life cycle information						
Material technology						
Mechanical completion						
Process						
Production Control System						
Project Control						
Quality and risk management						
Sea line Tie-In System & Termination equipment						
SIT						
Subsea Tree System						
System Engineering						
Technical safety						
Template & Manifold System and Structure						
Tie-In connections						
TMI (Template/Manifold Intervention)						
Umbilical system						
Wellheads System & Tools						
WH						
WOCS Modification						
Work over systems						
XMT/CM/TH						

9.6 Appendix 4 – Gantt chart



9.7 Appendix 5 – Forberedende studie

Problemstilling

Statoil ASA har som operatør på norsk sokkel et på-se ansvar ovenfor sine leverandører for å sikre at alle leveranser tilfredstiller den kvaliteten og de kravene som er satt av norske myndigheter. Det innebærer at det er Statoil ASA som har det overordnede ansvaret for at alle operasjoner på norsk sokkel blir gjort på en forsvarlig måte, og i henhold til de standarder som er satt.

Som en del av det å sikre at disse kravene blir overholdt jobber Statoil ASA risikobasert i alle sine prosjekter. En stor del av denne risikobaserte oppfølgingen skjer mot leverandørene. Når kontraktene er satt, produsers et såkalt master dokument register. Dette dokumentet inneholder alle dokumenter som skal leveres til prosjektet. Ut ifra dette registeret velger disiplineringeniørene ut hvilke dokumenter som de ønsker å ha på review. Dokumentkontrollavdelingen i Statoil har foretatt undersøkelser hvor de har sammenlignet antall dokumenter som blir sendt på review i forholdsvis like prosjekter, og har observert at det er store avvik i anntall dokumenter som blir sendt på rewiev på tvers av prosjektene. Dette fenomenet oppstår også i prosjekter som er under samme rammekontrakter.

I denne oppgaven vil jeg prøve å avdekke årsaken til at disse avvikene oppstår, og videre se på tiltak som kan implementeres for å oppnå en mer forutsigbar gjennomføring av reviewprosessen. Prosjektene jeg skal analysere er en del av subsea delivery team porteføLgen, og under samme rammekontrakt. Problemstillingen vil være å først se på hvorfor disse avvikene oppstår, og videre se på hvordan den risikobaserte utvelgelsen av dokumenter for review kan gjøres mer konsistent og strømlinjeformet.

Metode

I denne oppgaven ønsker jeg å utføre et studie hvor jeg ser på tre prosjekter. Jeg vil først samle inn relevant data fra alle prosjektene, og analysere denne dataen for å avdekke årsaker til avvik. Deretter vil jeg i sammarbeid med relevante fagdisipliner utarbeide intervjuspørsmål for og prøve å avvdekke hvordan de forskjellige fagdisiplinene og prosjektene utfører denne utvelgelsen. Dermed vil dette studie bestå av både kvantitative og kvalitative analyser. Jeg ser for meg at det vil være hensiktsmessig å foreta intervjuer på flere nivåer i prosjektorganisasjonene, hvor jeg innvolverer alle interessenter. Dvs alt fra prosjektlederen til disiplinlederene og QRM-teamet.

Deretter vil jeg samle sammen all data, og prøve å konkludere med en årsak til at disse avvikene oppstår, samt hvilke tiltak som kan implementeres for å oppnå høyere kvalitet i reviewprosessen. Jeg vil se både på de myke sidene, og hvilke metoder som benyttes for å utføre review-vurderingen. Deretter vil jeg prøve å komme opp med forslag til hvordan denne prosessen kan forbedres.

Jeg vil igjennom oppgaven jobbe opp mot på forhånd definerte hypoteser om hvorfor disse avvikene oppstår, samt være åpen for nye hypoteser og årsaker ettersom analysearbeidet utføres.

Teoretisk del

I den teoretiske delen vil jeg presentere relevant fagteori innen de forskjellige fagområdene denne oppgaven omhandler. Jeg vil også prøve å definere en del subjektive begreper slik som risiko, usikkerhet og kvalitet på en slik måte som det egner seg for oppgaven. Videre vil jeg sammenligen faglitteraturen med Statoil ASA`sine prosesser. Og knytte teori opp mot praksis.

Den teoretiske delen vil inneholde teori basert på:

- Kvalitetsledelse og styring
- Risikostyring i prosjekter
- Dokument kontroll
- Rammeverk for metode
- Metoder for Intervju

Oppbygning av den analytiske delen av oppgaven

Jeg vil innlede den analytiske delen av oppgaven med å presentere de respektive prosjektene. Jeg vil gi en kort innføring i hva disse prosjektene går ut på, samt presentere nøkkeltall og info.
Deretter vil jeg presentere dataen som er samlet inn, og de funnene som er oppdaget.
Videre vil jeg utforme intervjuer for å avdekke årsakene til avvikene.
Ut ifra de ovenfornevnte fasene vil jeg samle all informasjon, og konkludere anbefalte tiltak for å oppnå en mer konsistent og strømlinjeformet prosess for risikobasert utvelgelse av dokumenter.

Arbeidsmetodikk

Arbeidet med denne oppgaven vil bli utført hos Statoil ASA sine lokaler på Fornebu, hvor jeg vil ha faste arbeidsdager sett ut ifra nødvendighet. Samtaler med faglid ansvarlig vil foregå via telefon og videokonferanser.