Organizational aspect of three accidents

How common organizational factors contributed to the occurrence of the accidents

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Preface

This master thesis has given me great insight into the offshore drilling industry, especially concerning the three cases studied and how organizational factors and different regulation regimes are contributors to how accidents can happen. The analytical framework has given me a new perspective on how to see the different parts in relation to eacother.

First of all a need to thank my thesis advisor, Ole Andreas Engen, who contributed with useful knowledge on the field as well as for constructive guidance and feedback throughout this process.

There is also a need to thank all the researchers and investigators who have put a lot of their time and effort in the reports that have been studied in this thesis. These have provided great insight that the analysis in this thesis has been completely dependent on.

Last but not least, it is in place to thank my fellow students who have both been an inspiration, motivation and source of knowledge through this process.

Abstract

In this thesis, two serious accidents and one major incident in the offshore drilling industry have been studied and compared. The main objective of this study was to seek out common organizational factors that contributed to these accidents. The findings clearly demonstrated that commonalities exist. Essentially, five factors represent recurring elements in these accidents: management, communication, competence, procedures, and compliance. How the regulatory regimes were organized also contributed to the accidents. These commonalities are important to examine so as to learn from mistakes that have already been made.

The importance of learning after an accident is not related to learning everything there is to know about the accident, but to organizations' willingness to accept that they actually have something to learn and that a need exists to act more safely in the future (Turner & Pidgeon, 1997).

A shift in how we think about safety in the offshore industry is needed—where safety is not just something kept in mind, but rather the top priority. This shift should be facilitated by both the authorities and the industry as a whole. One cannot separate safety from other issues in the organization; however, safety is essential and applies to management, communication, compliance, procedures, competence, and regulatory regimes.

In this thesis, an analytical framework has been used to structure and compare the different accidents/incident. The main finding reflects the fact that to achieve an output that ensures both production and safety, there is a need to increase awareness of the process an organization goes through within its lifetime. This means that every organization goes through a drifting process where the kind of logic of action taken depends on the context of the organization, the tightness of the couplings, and the complexity of the situation. To what degree do the different subunits, which evolve in every organization, have their own logic of action (i.e., their own way of doing things)? The drifting process both affects and is affected by the management structure, the way in which communication systems function, the kinds of competence possessed, and whether it is possible to comply with organizational procedures and whether these procedures are in accordance with regulatory requirements.

Finally, how the regulatory regimes in the different regions are organized varies, and no system is perfect. What is essential is the relationship between the regulator and the regulated organization. All parties are served by a good relationship because such a relationship contributes to achieving the common goal of being a financially sustainable organization and maintaining a high level of safety.

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1.0 Introduction

The three accidents that have been analyzed and compared include the blowout in the Macondo well on the Deepwater Horizon rig in the Gulf of Mexico, the oil leak of Montara VHP in Australia, and an incident with loss of well control on the Gullfaks C platform well 34/10 – C – 06A in Norway.

The in-common characteristics of these accidents are that both technical and organizational explanations were used to describe why they happened. Even though these explanations varied from accident to accident, some key organizational factors constituted the constant variable. In addition, organizational factors that led to the accidents are likely to have played a part in other accidents in this industry. This thesis will focus on these organizational factors.

Unfortunately, the accidents under study were not unique, which means that similar accidents happened both before and after these accidents. The claim in this thesis is that in-common organizational factors need to be addressed. The relevant commonalities are management, communication, competence, procedures, and compliance. An industry with great faith in technology will normally consider technological solutions to be lessons from past accidents and incidents. Given the great technological developments over the last decades, this might be with good reason. The problem is that the focus on leadership, communication, procedures, competence, and compliance has suffered as a result. Thus, in addition to analyzing and identifying organizational commonalities, the thesis aims to provide deeper insight into them.

An important contextual factor to in these cases is that three different regulatory regimes were involved due to the accidents' different global locations. Thus, it is of interest to determine whether and how different regulatory regimes affected the organizations involved. How might different regulatory regimes have had a positive or negative effect on the development of these accidents? How did the organizations implement regulatory safety

requirements? How well suited were the requirements, how transferable were they, and how was the relationship between the regulatory regimes and the organizations involved? Were there any similarities despite the different locations and can we learn something from such similarities?

The main objective of this study was to seek an answer to why accidents occur and to determine how we can learn from accidents so that that the chance of recurrence decreases. Since specific organizational factors were key elements in all the accidents, studying these factors is essential. We need to keep in mind the relationships among technical, organizational, and human factors, as well as how these relationships play a key role and affect the ways in which the organization thinks about and addresses risk and safety issues.

This study involved a document analysis of the three cases based on extensive inquiry reports or research studies after the accidents/incident. This will be explained more thoroughly in Chapter 3, Methods.

On the basis of these reports, the following research questions will be analyzed:

1) How did different underlying organizational factors affect the occurrence of these accidents?
2) In what way did the organizational factors affect the accidents, and how did interaction among them increase the chances for such accidents to occur?
3) How did the different regulatory regimes influence the organizations' handling of safety and risk?

Understanding organizations' interaction, both internal and external, is important in understanding the whole picture. Organizations are complex units that operate in a world of other organizations, regulatory regimes, and similar structures. In answering the research questions of this thesis, five organizational factors will be discussed; all played a key role in the occurrence of the studied accidents. The research questions are upward and downward, which means that both searching for answers in the hierarchy with the regulatory regimes on top and seeking answers within the organization might yield a better understanding of

the interaction among the factors. This process also addresses how the different organizational factors interact and amplify the chances for accidents to occur.

While analyzing and answering these questions, an analytical framework (see Figure 1) was used as the main analysis tool. This analytical framework was developed by the International Research Institute of Stavanger (IRIS); it generally provides for a more thorough comparison of different cases and provides a better understanding of how different organizational aspects and regulatory regimes interact. This analysis model will be presented in Chapter 4, Theory, and the strengths and weaknesses of this type of analysis will be presented in Chapter 3, Methodology.

1.1 The three accidents

There were multiple reasons for choosing these accidents as cases for this thesis. The accidents occurred in a high-risk industry where the potential for major accidents is present at all times. This in itself is interesting because one primary industry objective is to avoid accidents. Also of interest is looking at three accidents that occurred for different reasons and carried different extents of damage specifically to find organizational similarities. The fact that the accidents occurred in different parts of the world and under different regulatory regimes makes this task particularly contributory. We can now examine how the context within different types of regulatory regimes might affect the industry, and vice versa. Though the accidents differed in their severity, they were similar on some level and the chances for a full-scale disaster were present in all three. The purpose of selecting these three cases was to show that despite their differences, many similarities concerning the underlying organizational factors existed. These factors and their similarities have been analyzed and discussed in this paper.

In the next sections, the accidents are described briefly. Chapter 5 contains a more thorough discussion of the accidents and relevant organizational theory.

1.1.1 Macondo

The blowout in the Gulf of Mexico on the Deepwater Horizon drilling rig took place on April 20, 2010, and was a human, economic, and environmental disaster. Eleven men were killed and others were seriously injured, more than four million barrels of oil leaked into the Gulf, and the economic losses were in the tens of billions of dollars.

About 126 people were onboard the platform when the accident occurred. Multiple organizations had personnel involved on the rig and with this drilling operation. Among the organizations involved were BP, operator of the rig, Transocean, and Halliburton. "The Macondo blowout was the product of several individual missteps and oversights by BP, Halliburton, and Transocean, which government regulators lacked the authority, the necessary resources, and the technical expertise to prevent" (National Commission, 2011:115).

The immediate cause of the blowout was a failure to contain hydrocarbon pressure in the well. The blowout preventer (BOP) also failed to seal the well after the hydrocarbons flowed uncontrolled into the well. In addition, some have claimed that the cementing was not proper. Cement has the barrier function of isolating the hydrocarbon zones (BP, 2010: 33). "Halliburton was hired to perform the cementing work in different parts of the drilling process. Cementation, however, required extensive calculations along the way. These were taken onshore by experts in Halliburton" (Ryggvik, 2012:86).

As the BP inquiry report stated, the cause of the accident was complex and involved "mechanical failures, human judgments, engineered design, operational implementation and team interaction came together to allow the initiation and escalation of the Deep Water Horizon accident" (BP, 2010:31).

1.1.2 Montara WHP

The blowout on Montara Wellhead Platform (WHP) occurred on August 21, 2009. In this accident, no one was killed but the oil spill was major. For more than 10 weeks, oil and gas

flowed into the Timor Sea just a couple of kilometers from the northwest Australian coastline.

Several organizations were also involved with this West Atlas-owned platform and this specific well: the operator PTT Exploration and Production Australia (PTTEPA), West Atlas – the rig owner, and Halliburton (Montara Commission, 2010).

The immediate cause of this accident was that hydrocarbons entered the well in the 9-⅝" casing where the primary barrier in the well – a 9-⅝" cemented casing shoe – failed (Montara Commission, 2010). High pressure inside the well and a hole in the 13-⅜" casing, which was part of the common barrier element, also contributed. The leakage indicated that the losses to the formation had gone through this hole, down through the cement in the B-annulus, and out into the formation at the 20" shoe where the formation had fractured due to the high pressure. The casing as a common barrier element for the primary and secondary well barrier thereby failed (Montara Commission, 2010).

1.1.3 Gullfaks C

The incident on the Gullfaks C platform happened in Well 34/10 – C – 06A on May 19, 2010, in the Norwegian North Sea. A disaster like the Macondo blowout was only avoided by chance. Because of its lesser severity, Gullfaks C is called an incident instead of accident. No lives were lost and no damage to the environment occurred: "The difference between accidents and incidents is a question of severity or seriousness of the outcome…what determines the difference is thus to some degree subjective" (Hollnagel, 2004:20). "The importance of making the distinction is that an incident generally is understood as an event that might have progressed to become an accident, but which for one reason or another did not do so" (Hollnagel, 2004:21). About 86 people were onboard the platform during the incident, and both Statoil, the operator, and Seawell were organizations involved on the platform and in the drilling operation of this well.

According to the Norwegian Petroleum Safety Authority, the immediate cause of this incident was a total loss of well control: "Planning of well C-06A on the Gullfaks A began in 2008. The original well bore was plugged back in the late fall of 2009 and drilling activity in

the sidetrack was initiated in December 2009. Based on the measured strength of the formation Statoil decided to drill the last part of the well by means of pressure-balanced drilling technology (or managed pressure drilling, MPD). Statoil experienced more incidents of instability during drilling of the well, and eventually got an event with the total loss of well control on 19.5.2010" (PSA, 2010:1).

1.2 Commonalities

Despite differences among the accidents, the aim from here on out is to present their commonalities, commonalities that contributed to these accidents. These commonalities include the following underlying organizational factors: management, communication, competence, procedure, and compliance.

The research was intended to answer the following questions: How did these common underlying organizational factors affect the occurrence of these accidents? How did they interact and amplify the development of these accidents? How did the regulatory regimes ultimately affect the organizations involved?

To answer these questions, document analysis was employed and multiple reports written on the accidents were thoroughly studied. The analysis tool was the analytical framework developed by IRIS. A detailed account of the method is provided in Chapter 3, Methodology.

1.3 Different regulatory regimes

Different regulatory regimes affect the formation of accidents. This fact makes it interesting to discuss how the different regimes studied in this thesis affected the organizations involved. Therefore, there exists the need to clarify what characterizes each of the regimes and their way of interacting with the industry. All of the regulatory regimes have, of course,

evolved over time and been influenced by their own culture and history. “The level of qualification and accuracy of the regulator and their willingness to intervene may be affected by historical and more subjective factors” (Ryggvik, 2012:148).

1.3.1 Norwegian regulation

The Norwegian regulation system is generally recognized for its three-party cooperation. It is unique in that the government, the employer(s), and the employees cooperate. The operator and suppliers involved play the employer role and all employees have both a right and a duty to contribute. Employers and employees are also represented in different unions. The government is represented by the Norwegian Petroleum Safety Authority (PSA). PSA is a regulatory body under the ministry of labor and has regulatory responsibility for safety, emergency response, and the working environment in the petroleum industry. The Norwegian petroleum sector is governed by a framework directive that has four underlying regulations with functional requirements. This means that organizations are free to choose between alternative solutions, rather than following detailed requirements. The intention was to make the regulations functional, not filled with burdensome requirements. The industry itself has a duty to undertake risk assessments, contingency plans, and similar measures to ensure that industry organizations operate safely and within the regulatory framework. Exactly how to implement the various framework requirements is more or less up to the individual organizations, but they must implement internal controls to ensure that they meet the requirements established by the authorities and the organizations themselves. In other words, the industry itself has a responsibility to ensure compliance with regulations. PSA is just a supplement to, not a substitute for, the organizations’ own work concerning risk assessment and the planning/implementing of safe operations.

1.3.2 US regulation

The Macondo accident led to several changes in the US regulation system for the offshore drilling industry. Until the Macondo accident, the Mineral Management Service (MMS) was the regulatory institution: “MMS was the federal agency primarily responsible for leasing, safety, environmental compliance, and royalty collection from offshore drilling. In carrying out its duties, MMS subjected oil and gas activities to an array of prescriptive safety regulations: hundreds of pages…” (National Commission, 2011:68). After the accident, MMS

was split into three institutions: Bureau of Ocean Energy Management, Bureau of Safety and Environmental Enforcement, and Office of Natural Resources Revenue (National Commission, 2011). The institution responsible for industry safety issues is now the Bureau of Safety and Environmental Enforcement (BSEE), which has responsibility for ensuring regulatory compliance within the industry. Its key functions are divided into divisions— Offshore Regulatory Program, Oil Spill Response, Environmental Compliance— and it operates the National Training Center, among other units. BSEE is responsible for safety offshore in both drilling and production. It is headquartered in Washington, DC, from which national programs, policy, and budget are managed, and has several regional offices. The regional offices are responsible for reviewing applications for permits to drill to ensure that all the recently implemented enhanced safety requirements are met, conducting inspections of drilling rigs and production platforms, and investigating accidents and incidents. The American regulation system concerning the petroleum industry differs from the Norwegian system in both philosophy and practice. In contrast to the Norwegian system, the US system is based on a behavior-based philosophy, where individuals are focused when finding solutions and when casting blame (Ryggvik, 2012). Also, a significant difference between the systems is the prescriptive, detailed rules and regulations that characterize the US system. Another contrast to the Norwegian system is that there is no involvement of employees at key decision levels and no demand that the industry itself be responsible for conducting internal control. BSEE is authorized to suspend operations, cancel leases, and impose other remedies and penalties. After investigations of accidents/incidents, BSEE is responsible for taking appropriate action to prevent recurrence and to enhance safety and environmental protection.

1.3.3 Australian regulation

The Australian authority for the petroleum industry is the National Offshore Petroleum Safety Authority (NOPSA). NOPSA's responsibilities include the regulation of occupational health and safety, wells, and well operations and the structural integrity of facilities and environmental management within commonwealth waters. NOPSA has developed complicated yet functional regulations, and most responsibility is assigned to operators and employers; they are required to take all reasonable practicable steps to protect the health and safety of the facility workforce (Montara Commission, 2010). The operator and drilling

contractor are responsible for having a so-called safety case, which must be approved by NOPSA and renewed every fifth year. Unlike the Norwegian and US systems, NOPSA has no operational authority, but provides recommendations to the Ministry. According to law, NOPSA is obligated to inspect every installation once a year based on its safety case.

Several regulators are involved at different stages in the offshore petroleum fields in Australia. In addition to NOPSA, the Northern Territory Department of Resources (NT DoR) "was responsible for oversighting the requirements bearing on the integrity of the H1 Well, including the general requirement that good oilfield practice be followed" (Montara Commission, 2010:12).

To take part in offshore drilling, companies must address systems and procedures in a Well Operation Management Plan (WOMP) and a Drilling Program, both of which must be approved by the regulator. Detailed reports to the regulator about well operation are also required (Montara Commission, 2010).

1.4 Limitations

It has been necessary to refine this thesis to concentrate on the research questions. Even though the thesis revolves around an industry of technology, the focus will not be on the technical elements of the accidents/incident besides definitions and explanations that might facilitate understanding of the discussion.

Priorities have been established so as to answer the research questions in the best possible way. In other words, additional organizational factors could have been drawn upon, but those chosen stood out as significant commonalities. Also, the extent to which the regulatory regimes are discussed also has been limited to keep the focus on the selected organizational factors. However, the regulatory regimes are a significant element in the analysis model and, as a contextual frame, provide the thesis with fertile ground for discussion.

2.0 Theory

This chapter presents theory relevant to this research. First is a presentation of the analytical framework, developed by IRIS, used as the main analytical tool. The reason for presenting this model at the starting point of the chapter is to show how the theory is applied to the framework and how it strengthens the understanding of how this framework was used.

The framework combines the regulatory regime, the organizational factors (management, communication, compliance, procedures, and competence), and Snook's Practical Drift (PD) theory. The four different stages presented in PD ('Designed,'. 'Engineered', Applied', and 'Failed') are essential to the study of how different organizational factors interact and affect the organization and how they move the organization in the direction of higher risk potential and greater possibilities for accidents (see Figure 1). Different logics of action are used in the different stages, which ultimately affect whether procedures are followed or whether different subunits in the organization develop their own way of doing things. A more thorough explanation of practical drift can be found in section 2.1, Understanding accidents.

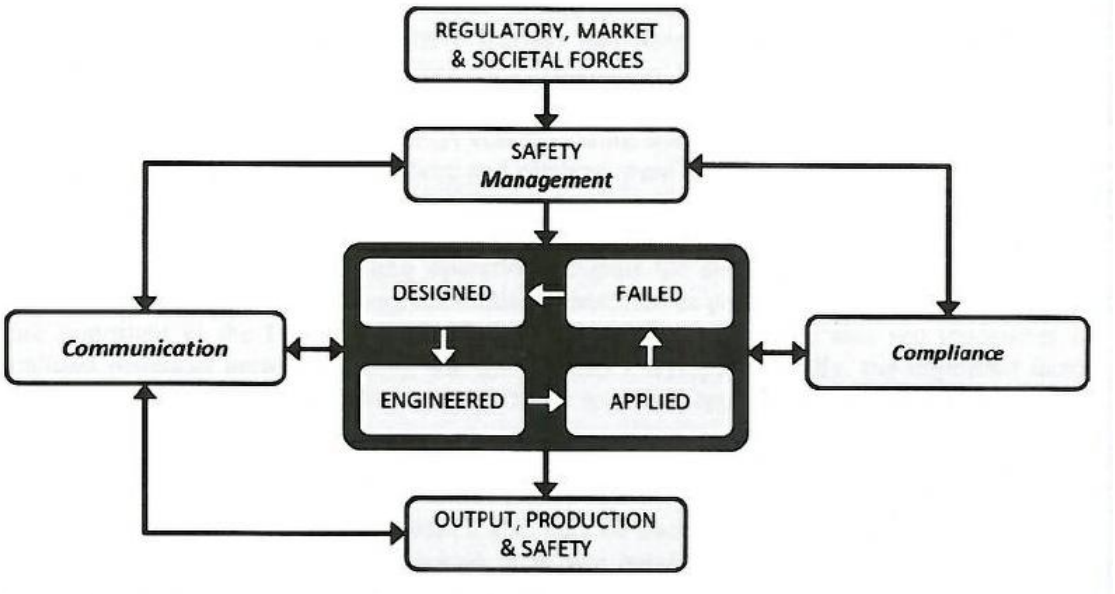

Figure 1. Governance Structure and PD model (IRIS, 2011:16).

PD theory is based on the Normal Accident Theory (NAT) proposed by Perrow (1985) and the High Reliability Theory (HRO), which will be accounted for a bit later, but first a short introduction to the model is needed. Practical drift's main objective is to capture both contextual and temporal factors when explaining why incidents and accidents occur. To capture these factors, Snook introduced three dimensions in the model: situational couplings, logics of action, and time. Situational couplings include tight and loose couplings and the way in which an organization shifts between the two. Logics of action refer to how organizational subunits do their work based on their own logic of action. Time in this context refers to the lifespan of the organization, where the organization shifts between loose and tight couplings and different logics of action.

2.1 Understanding accidents

This main objective of the thesis was to understand how organizational factors contribute to accidents like these and to seek answers that could decrease the possibility for offshore drilling incidents/accidents to end in disaster. NAT and HRO are central in discussions of whether accidents could have been avoided; as mentioned above, Snook combined these theories in his Practical Drift theory. Both HRO and NAT acknowledge that the world is complex, unstable, unknowable, and unpredictable, but they offer different perspectives on how to handle this world. NAT focuses on the level of complexity and the tightness of coupling in an organization. NAT sees accidents as inevitable if complexity is high and couplings are tight, such as in the nuclear industry. If you have these sorts of industries, accidents will happen. To prevent accidents, organizations must decrease the complexity and loosen up tight couplings. They cannot build in more risk barriers because such barriers would only increase complexity (Perrow, 1985). HRO, on the other hand, claims that organizations can act to prevent accidents, even in high-risk industries. HRO theorists describe a number of different strategies for developing highly reliable organizations, where collective mindfulness is the key. Weick described five steps involved in developing a collective mindfulness: 1) preoccupation with failure, 2) reluctance to simplify

interpretations, 3) sensitivity to operations, 4) commitment to resilience, and 5) under specification of structures (Weick et al., 1999:91).

Based on these theoretical perspectives and the analytical framework, how organizations shift from being highly reliable, complex, and tightly coupled is an essential aspect to this discussion. In addition, understanding how these shifts affect the organizational factors studied (i.e., how competence is used to execute one's job, how one communicates vertically and horizontally, how management handles different situations, how well compliance procedures are followed) is critical

Snook's (2000) PD theory (see Figure 2) emphasizes how different degrees of mindfulness depend on different situations and contexts and how organizational systems develop between tight and loose couplings over their lifetime. Organizations are not static but rather dynamic and are always in development, even if not making a radical change. Acquiring new equipment, a new leader, new colleagues, or new procedures, and making similar small and large changes, have some effect on each organization. Even type of operation, situation, and context can increase and decrease complexity and/or tighten or loosen couplings. In other words, each organization is both tightly and loosely coupled and has both high and low complexity. This is important to keep in mind when studying these three accidents and the organizations involved.

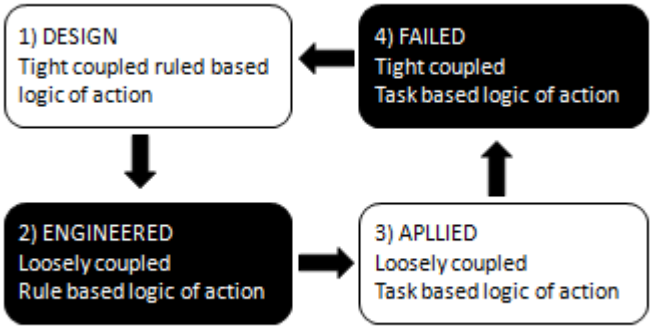

Figure 2. Practical Drift Model.

The first box shown in Figure 2 (Design) refers to when the organization is characterized by top-down management with a focus on procedures and routines to prevent incidents from

occurring. Tight couplings refer to Perrow's (1985) characteristics of high risk and show the need for a ruled-based logic of action.

The second box (Engineered) reflects a shift to an operational situation, a more loosely coupled situation. Problems occur if organizations continue to practice a rule-based logic of action and top-down management, which may not be necessary in this period of time for specific operations or degrees of complexity. In an operational situation, workers with the appropriate competence can be allowed a more mindful approach to their work task, where those with task expertise are trusted to do the work and the hierarchy is flattened. This is referred to in the third box (Applied), which Snook called practical, drift. Practical drift occurs when an organization becomes detached from the rationality referred to in the design stage; subunits develop with their own rationality. Based on the units' own competence, they drift away from rule-based logic of action and toward task-based logic of action. Dangerous situations are associated with the fourth box (Failed), when the organization suddenly and within a short time shifts back to a tight coupling. The organization does not manage to shift back to rule-based logic of action, but rather continues with task-based logic of action even though the tight couplings demand rule-based logic of action. This is a situation where the subunits are "confronted" with each other and forced to take action based on the assumption that the behavior of others is consistent with established procedures. Organizational actors are now in a situation where they need to trust their own task-based logic of action, but at the same time have to believe that others are following procedure. This invites the potential for higher risk.

Eventually the organization shifts back to the 'Design' stage where it seeks to restore the organization by implementing better control systems. This is more or less a time for redesigning in which organizations act on lessons learned from previous mistakes and reintroduce a top-down management structure.

So, how can we use the analytical framework (see Figure 1), which includes practical drift, organizational factors, and the regulatory regimes, in comparing and analyzing the accidents/incident? By using the framework, we can identify how the management structures shifted from a top-down to a flat and task-based logic of action. As the model

implies, we will see whether communication and compliance deteriorate when shifting to a practical drift mode. How do the subunits in an organization affect the management and regulatory regimes, and vice versa, especially considering compliance with rules and procedures? In what way is the workers' competence affected by the shift and how does their competence affect how well they execute both rule-based and task-based logics of action?

To use this analytical framework most effectively, the regulatory regimes and the different organizational factors must be conceptualized.

2.2 Regulatory regimes

Regulatory regimes are an important contextual frame in this thesis. According to the analytical framework, the regulatory regime is at the very top of the hierarchy and will affect the organization, organizational factors, practical drift, and ultimately the production and safety outcome. A regulatory regime can be defined as the "regulation of risk, defined as governmental interference with market or social process to control potential adverse consequences to health"(Hood et al., 2001:3). Regarding this, Leveson's theory (2004) makes an interesting contribution. Leveson is a structuralist who sees the hierarchy in a sociotechnical system as an opportunity (rather than an obstacle) for organizations to act safely, where the level above sets boundaries for the next level. This notion can also be applied to the analysis model, especially in the design stage, which is characterized by the top-down structure. She also focused on the importance of feedback loops in a system. Whether the boundaries set by the levels above reach their full potential depends on feedback about how the system acts upon these boundaries (how boundaries comply with rules and regulations). In other words, there needs to be equilibrium between those who set boundaries and those who are restricted. This includes communication and indicates the need for a good communication system, which also is included in the analysis model for reasons of compliance and operational safety.

Hood claimed that “there is a substantial variety in the way risks and hazards are handled by the state” (Hood et al., 2001:5); different views on risk and hazards lay the foundation for different regulations. Hood illustrated with the example of the 1996 campsite tragedy in Spain where even neighboring states like France, Germany, and Ireland had different views on hazards and therefore different approaches to how they regulated risk. These different views on risk and hazards and the associated tradition in regulation ultimately affected how the actors in question reacted and behaved, which varied depending on their differing expectations of the regulatory regime involved. For this thesis, it is important to remember that how different states views risk and hazards have an effect on any differences in their regulatory regimes. This theory also shows the contours of how complex the regulation relationship between states and organizations can be.

Furthermore, Hood (2001) described different aspects of regimes, for example, how cost-benefit might affect how we regulate road safety. How many resources are we willing to use with the intent to improve safety? The Norwegian government has a zero vision for Norwegian roads, which means a goal of no fatalities; however, more than 200 lives are lost to road accidents each year. A natural question is, therefore, whether we use the resources we have available to prevent these accidents. Are the regulation strategies in step with the vision or is the vision too expensive for the regime?

The perspective of decision making and conflict of interest (Rosness et al., 2002) provides an interesting view into how cost-benefit analysis may affect how we regulate safety. This perspective takes into consideration the complexity within organizations regarding what should be their priority. For example, it is easier for management to prioritize short-term gains rather than investing in safety, which is more of a long-term gain. However, the workers in the sharp end are often blamed if something goes wrong and are also the ones to get hurt if the safety barriers are not intact. In other words, the sharp end (the workers), want safety prioritized while management prioritizes short-term gains like economic growth and efficiency; this demonstrates a clear conflict of interest. Also, this perspective shows a conflict of interest where there is complex interaction between different boundaries—for example, those set by the state and management concerning safety, financial boundaries, and each worker’s individual boundary when it comes to acceptable workload. This

perspective is demonstrated in a model developed by Rasmussen and can be used to understand how organizations react to different requirements set by the regulatory regime and how organizations themselves set their boundaries (e.g., rules, procedures, practices) on the basis of how the state sets its boundaries (see Figure 3).

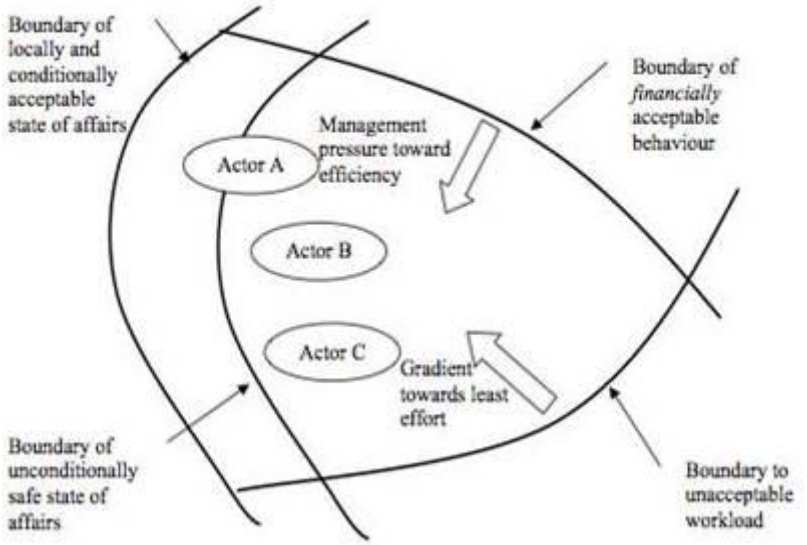

Figure 3. Migration Model (Rosness et al., 2002:46).

When it comes to regimes, Hood described them as "the complex of institutional geography, rules, practice and animating ideas that are associated with the regulation of a particular risk or hazard" (Hood et al., 2001:9). Hood expressed interest in how to analyze different regimes and therefore described three basic features of regulatory regimes:

1. Regulatory regimes as systems, where they are viewed as interacting or related parts and the relationship between the different regulators (e.g., the relationship between the levels in Rasmussen's model) can be analyzed
2. Regulatory regimes as entities
3. Regulatory regimes as bounded systems that specify different levels and breadth

"Regulators are uniquely placed to function as one of the most effective defences against organizational accidents" (Reason, 1997:182).

"The regulatory process – discovery, monitoring, investigation and sanction – is inevitably constrained by the interorganizational relations existing between the regulatory body and the regulated company. These, in turn, lead to relationships based more upon bargaining and compromise than threats and sanctions. The fact that both the regulator and the regulated are autonomous, existing as separate and independent entities, poses special problems for the regulator" (Reason, 1997:173).

2.3 Organizational factors

The organizational factors are essential in the analytical framework (see Figure 1) because one can see the interaction of the different factors, the regulatory regime, and Snook's practical drift. Before the various factors are presented, the meaning of organizational factor must be clarified. There is also a need to clarify the difference between underlying factors and immediate causes of accidents. Accident investigations often find that something technical failed or that someone in the sharp end (worker end) made a mistake that caused the accident, called the *immediate cause*. However, in this thesis, the focus is to look beyond the immediate cause and see if certain characteristics in the organization have developed over time and were triggered by that one technical failure or that one mistake by personnel in the sharp end. As Reason put it, "unsafe acts are merely symptoms of the underlying organizational and managerial pathology" (Reason, 1997:186). Underlying factors form a chain of different components that interact and lead to potentially higher risk. This is what Turner (1997) called the incubation process – a process where accidents develop over time. "This is a development process where chains of discrepant events develop over time and accumulate unnoticed…This is a result of a culture where information and interpretations of hazard signals fail" (Rosness et al., 2002:37).

The terms underlying factors and organizational factors are often used interchangeably, but there is an important difference between them. Technical, organizational, and human factors can be underlying causes of an accident. This study's focus is on the organizational factors that have developed over time and therefore can be considered underlying

organizational factors that caused the accidents/incident. To make it clearer, “organizational factors include organizational structure, management, corporate culture, training and recruitment” (Westrum, 2009:5-1). As one can see, organizational factors are essential elements in constituting an organization. The five organizational factors studied here are, as mentioned, management, communication, competence, procedures, and compliance. Each will be accounted for and theoretically described before being discussed more thoroughly in light of the study’s findings in Chapter 4.

2.3.1 Management

In accordance with the analytical framework, management sets the terms for the organization and will influence how the organization drifts from stage to stage, how the communication, procedures, and competence systems work, and how the organization complies with both regulatory and its own procedures and standards. In addition, management’s relationship with the regulatory regime will also have an effect on whether the organization drifts to a higher risk stage or not.

Management, as an essential part of every organization, will always be responsible for occurrences within the organization. Champoux (2000) used Henri Fayol’s description when defining five functions of management: planning, organizing, command, coordination, and control. Even though he described these functions long ago, they are just as applicable as a definition of what management contains. At least, this is what management should contain (Champoux, 2000). The focus in this thesis is safety management and how the organization’s management structure can give the organization the opportunity to act safely in all operations. Safety management is defined as “all measures taken to achieve, maintain, and develop a level of security/safety in accordance with defined objectives” (Aven et al., 2008:67). Safety management is a continuous activity that occurs in tandem with and is integrated into all planning and work (Aven et al., 2008). One must try to achieve the best possible instruments, solutions, and measures that are adapted to the framework and that consider safety, economy, and other relevant areas.

As the analytical framework shows, management is an important key to all of the other organizational factors, because the management system must ensure compliance with regulatory and internal requirements, adequate communication systems, the right competencies, and a good organizational system for procedures. Management strategies for handling these challenges will depend on which stage in practical drift the organization has entered. Different management strategies might also affect which stage in the PD model the organization is in. The PD model seeks to capture both the contextual and the temporal factors in explaining how accidents and incidents occur. This, of course, will affect management strategies and how they are executed.

2.3.2 Communication

According to the analytical framework, communication is an important link among management, operations, and production and safety outcomes. To study communication properly, it is important to look at the communication both upward and downward, even horizontally, between different organizations and different subunits. How will communication ultimately affect and be affected by the drifting toward an unsafe situation and potential accident?

Communication is one of organizational factors studied in this research. "Organizational communication includes purpose, flow, and direction of messages and the media used for those messages. Such communication happens within the complex, interdependent social systems of organizations" (Champoux, 2000:242). Communication is included in the analysis model as a link between management and outcome, which includes most processes in between. To include the PD part of the model, how and whether to communicate may vary depending on which stage the organization has entered.

"Organizational communication happens over a pathway called a network. The network can be formal as defined by formal organizational positions and relationships among those positions. It can also be informal as defined by informal patterns of social interaction and the informal groups. Communication over the networks goes in any direction: Downward, upward, or horizontally" (Champoux, 2000:243).

“The functions of organizational communication include information sharing, feedback, integration, persuasion, emotion and innovation. The feedback function of organizational communication lets people know about the quality of their job performance. Feedback can reduce uncertainty, give people important cues about levels of performance, and act as a motivational resource” (Champoux, 2000:247).

In 1978, Turner introduced a new way of thinking about how disasters occur in his publication “Man-made Disasters.” To understand how a disaster occurs, one must understand that somewhere in the chain of events leading to the accident there will be absence of knowledge and communication (Turner & Pidgeon, 1997).

Problems related to communication and information are common in all organizations, Turner claimed. Therefore, it would be wrong to say that all such cases lead to disasters (Turner & Pidgeon, 1997:50). However, as Turner found in his research, difficulties with communication has always been a part of the problem.

Turner also pointed out difficulties with involving multiple organizations in a complex work task. When dealing with a potential hazard, procedures are being carried out by individuals and there is a need to know that these individuals can cope with potential hazards. “This should be relatively easy when dealing with a small, clearly defined group, and especially when they are employees of one organization, the problem of giving them adequate information is relatively simple” (Turner & Pidgeon, 1997:55).

Even though Turner studied different accidents than those studied here, many of the aspects that he drew upon apply to this thesis.

2.3.3 Competence

Within the framework used in this thesis, competence is an important aspect of the practical drift part of the model. How and why people perform their work task in a certain way is the essence of this model, specifically, the tendency to cut more or less loose from the decided way of doing things, thereby moving toward high-risk stages where the probability for accidents to occur increases.

Nordhaug defined competence as “applied and applicable knowledge, abilities, and skills” (Nordhaug, 2007:36). Nordhaug continued by addressing the importance of competence; having the right competence might be a determinant of who survives and who does not in market competition. A continued focus on developing staff competence is therefore essential. Within the concept of competence also lies the tacit knowledge of the different subunits. When shifting from a rule-based to a task-based logic of action, the requirements of competence might also shift, affecting at least how one uses organizational competence, including both tacit and explicit knowledge. As Turner stated, “[m]uch scientific and engineered knowledge is of this tacit, craft nature, being absorbed and transmitted in the course of procedures of craft training” (Turner & Pidgeon, 1997:18). This will affect how one shifts from one stage to the next in the PD model, and how well one shifts from rule-based to task-based logic of action – and then back again. In transmission of competence and knowledge, personal contact and interaction is the way to go, according to Turner (1997). How does the organization ensure that new personnel receive this transmission of knowledge?

What’s important for this thesis though is how management structure, procedures, communication, and similar aspects ensure the right competence in the right place. How does the system handle competence and ensure the right competence at all times?

2.3.4 Compliance

The analytical model also contains a compliance factor, namely, how the organization and its subunits comply with procedures, standards, and regulations. The compliance part depends on how management designs and communicates current regulations. In addition, it depends on what kind of competence the organization has and how the different subunits are established.

Compliance is here understood as the involved parties’ ability to act in accordance with applicable procedures, standards, and/or regulations. How the organization complies with regulatory requirements and its own procedures and plans, decided by management, is

essential in the analytical framework. Whether or not the organization is in compliance with legislation and procedures necessarily affect the drifting from one stage to the next in the movement toward unsafe acts. A core element of the practical drift theory is that during the drift away from the planned way of doing things, a failure to comply with procedures will eventually lead to failure.

This could also be expressed as the extent to which there is consistency between behavioral patterns in the sharp end (worker end) and intended decision structures in the blunt end (management end) of the organization. Tinmannsvik (2008) introduced the term silent deviation. She made a distinction between deviation and "silent" deviation; silent deviation involves developing a work practice that deviates more or less from the planned way to do a job (i.e., as described in the procedure). According to Tinmannsvik (2008), silent deviation may result in a lower safety level than intended or designed into the system. Behavior is influenced by the structure, that is, the way work is planned and intended to operate (normative). Structure is the formal framework, including plans, procedures, defined responsibilities, reporting, formal channels of communication, risk assessment, and deviation.

2.3.5 Procedures

The procedures in the analytical framework are incorporated in practical drift, where when employees are behaving according to a rule-based logic of action, they are following procedures set by management or others. In the ISO 9000 standard, a procedure is defined as a "specified way to carry out an activity or a process" (ISO 9000, 2008:3.4.5). Procedures are tools to be used to get to a desired point within a certain framework. Procedures are intended to help the organization, its subunits, and members stay on the organizational pathway. Procedures are also intended to ensure compliance with legislation and requirements imposed by regulators or the government. An interesting aspect of this is that the relationships in the hierarchic system affect both how procedures are set and/or how they are met within the organization.

To what degree employees should and actually are behaving in accordance with procedures and how the procedures themselves affect the organizations or different subunit's drift will be an interesting contribution to the analysis.

2.4 From theory to analysis

The analytical framework combines the various theoretical contributions so that the research questions can be analyzed in a more interesting way. The goal is to see how the various organizational factors influenced the formation of two specific accidents and one incident and how the various factors interacted. Particularly important is the examination of how organizational factors affect the organization's movement from one stage to another in practical drift through the use of different logics of action in different stages and how different parts of the organization tend to break away on the pathway to higher risk and possibility of accident.

In addition, the framework also addresses how the regulatory regimes constitute an important contextual frame for organizations handling safety and risk, which ultimately affects their safety and production outcome.

Finally, it is important to remember that context and degree of complexity and couplings shift during the lifespan of an organization, both in the analysis in this thesis and in real life.

3.0 Methodology

The goal of this chapter is to highlight the steps that were taken to answer the research questions and why these steps constitute a suitable process in this thesis.

The aim of the thesis is to analyze and compare two accidents and one incident, based on already collected data and written reports, to bring additional knowledge to this research area.

3.1 Choosing the cases

In this study, the three cases were selected on the following basis: They had recently taken place, they were in the same industry, and there was extensive information available about them. Even though the cases might be considered to be of the same type— offshore drilling accidents—they differed from each other in their severity and in their global placement in three different regions. Still, what made them interesting to study, despite their differences, is the hypothesis that strong organizational commonalities exist among them that might be transferable to other accidents and other regions.

3.2 Choosing data

The analysis in this thesis was based on data collected by others, specifically, extensive research and investigation by scientists and other investigators in the aftermaths of the accidents/incident. The choice to use the written investigation reports and research as the main data sources was a conscious choice with regard to the extensive information already collected on the three cases.

Qualitative methods are characterized by the fact that you study in depth, but study relatively few units. This study sought commonalities and differences between only three accidents/incident. This is a document analysis, since the data collecting was not done through interviews, but rather through analysis of information collected by others, written

down in different documents. A document analysis can be both quantitative and qualitative. According to Blaikie (2010:207), "textual material can be treated quantitatively by being coded into categories that are assigned numbers, counted and manipulated statistically. Alternatively, they can be treated qualitatively as identifying phenomena among which connections are established." The reason for choosing a qualitative document analysis was the research question and this thesis aim. The statistical gathering of information from inquiry reports would not have given the answers required here. Table 1 is a schematic presentation of the reports used in this thesis.

Main Reports	**Secondary Reports**	**Others**
Deep Water. The Gulf Oil Disaster and the Future of Offshore Drilling – National Commission, 2011.	Deep Water Horizon Accident Investigation Report – BP, 2010.	Causes, Learning Points and Improvements for the Norwegian Shelf – SINTEF, 2011.
Report of the Montara Commission of Inquiry – Montara Commission, 2010.		Macondo Well Deepwater Horizon Blowout: Lessons for Improving Offshore Drilling Safety – National Academy, 2012.
Learning from Incidents in Statoil – IRIS, 2011. (Læring av hendelser I Statoil. En studie av bakenforliggende årsaker til hendelsen på Gullfaks C og Statoils læreevne – IRIS, 2011).	Audit Report: Supervision with Statoil's Planning of Well 34/10-C-06A – PSA, 2010. (Tilsynsaktivitet med Statoils planlegging av brønn 34/10-C-06A. – PTIL, 2010).	Risk Management in the Oil and Gas Industry: Integration of Human, Organizational and Technical Factors – Skogdalen, J. E. , 2011.
		Dypt Vann i Horisonten. Regulering av sikkerhet i Norge og USA i lys av Deepwater Horizon – ulykken. Ryggvik, H., 2012.

Table 1. *Schematic Overview of Relevant Reports*.

The categorization of the reports was based on which reports were used the most in this thesis. The reports listed as main reports and secondary reports received the most analysis. The other reports acted as important supplements to the main and secondary reports. The collection of data in the various main and secondary reports will be briefly accounted for here.

The National Commission (2011) investigating the Macondo blowout intended to focus on aspects that would lead to a practical recommendation, with an even further goal of transforming America into a leader in safe and effective offshore drilling operations. The commission investigated on the orders of President Barack Obama and was composed of seven members appointed by the president. The order was one among others to examine facts and circumstances concerning Macondo's root causes, improvements to laws and regulations, and industry practices. This was to form a public report and the commission was to have full access to information and to hold public hearings.

The inquiry report contained both the orders and the mandate for the investigation. It also included the names of commission members, their meeting frequency, lists of their working papers, and a list of commission staff and consultants. What was missing in this inquiry was a description of the procedures used throughout the investigation. How did the commission investigate? Who was interviewed? What were the pros and cons of the investigation methods?

BP's own investigation report (2010) about the Deepwater Horizon accident was also used to supplement the inquiry report. This internal investigation report had a much more technical focus, but was still relevant to this study since one can clearly see that organizational failures underlay the more technical errors. Also, it is interesting to observe how the different reports were written and designed. Even though BP's report was professional, it was clear that the focus was on its own organization and the organizations involved, such as Halliburton. The accident led to several court cases, where guilt obviously was an important factor. This must also be taken into consideration when reading BP's report. Therefore, the BP report was used as a supplement to the more independent National Commission's report (2011).

The Montara Commission of Inquiry (2010) was to investigate and identify the circumstances and the likely cause(s) of the accident and to review the adequacy, effectiveness, and performance of the regulatory regime. It was also to make recommendations to the Minister for Resources and Energy, other relevant Ministers, regulators, and the industry. This inquiry was conducted mainly by document analyses, which are all public at the commission's Web site. Also, drafts of the report were made available at a public hearing for comments before the report was finalized.

The Gullfaks C incident was studied by IRIS in 2011. "Learning from Incidents in Statoil" is a study of underlying factors and causes of the Gullfaks C accident and of Statoil's learning ability. This study was conducted after Statoil received an order from the PSA following the Gullfaks C incident to implement studies designed to achieve safety improvements. Statoil therefore ordered an independent study of the accident and Statoil's learning ability; the study was conducted by IRIS. Eleven different researchers with broad knowledge and backgrounds were involved in the process, and data collection was mainly performed through interviews of employees at all levels of Statoil and its supply companies. In addition, the PSA's own audit report (2010) was used in this study.

3.3 Data reduction

As mentioned earlier, a lot of information has been written about the accidents/incident, a large part of which has been used in this study. Answering the research questions developed in this thesis required significant data reduction of the large amounts of information. When reducing and categorizing the data, both the analytical framework (see Figure 1) and the chosen theories were necessary tools.

The analytical framework used in this thesis was developed by IRIS and was also used as an analysis tool in the IRIS report (2011). In this thesis, however, the analysis model was intended to structure the thesis so as to better compare the three different cases and to include all the organizational factors and the hierarchic system of which the organization is a part.

While reducing the data from the written documents and deciding what to use in this thesis, some difficulties arose. One was that the different reports were in fact different. They were written by different groups of people that to some degree focused on different aspects of the accidents. This made some of the data collecting and reduction easy and some more challenging. In addition, some issues were not addressed explicitly, and some were. Still, by knowing what data to look for and using the analysis model, the collection and reduction of data were still possible.

Categorization was mainly based on the various organizational factors.

3.4 Analysis

This study was a comparative case study. A case study is defined by the fact that several cases are used to answer the same research question and the cases are selected based on what one wishes to explore (Jacobsen, 2005:85). This research's empirical data were based on a variety of reports created in conjunction with the three accidents studied. The three accidents have been thoroughly analyzed and described in different inquiry reports and one research project.

Like this thesis, the reports were written to learn from each accident so as to increase organizational knowledge with the objective of avoiding accidents in the future. Even though the reports were written with an aim to learn from the accidents, this thesis concentrated on the organizational aspects. Through finding commonalities and analyzing them closely, the goal was to provide a deeper understanding of how underlying organizational factors are important elements in the occurrence of offshore drilling accidents.

When analyzing documents, one must be careful in choosing what kind of reports to include. The reports chosen here were considered to be both serious and thorough, especially in their own collection of data, analysis, and scope.

To help improve the structure of this thesis, the analytical framework was used; this made it easier to categorize the data and improve the analysis. The categorization began in the

reading process with coding the different organizational aspects in the reports. This was done to make comparison easier and to pull out the most important aspects of the organizational factors. Then, the analytical framework was used to examine the bigger picture, how the different factors related to each other, and how the discussion involving the different regulatory regimes fit in.

The steps taken in the analysis were also inspired by the hermeneutic circle, where one goes from analyzing parts of the data, to seeing the different parts in relation to each other, to seeing the big picture with the help of each part. These steps should provide a deeper understanding of how each accident, each organizational aspect, and each regional regime is understood—alone and in relation to each other; this facilitates the ability to draw conclusions about how the industry can learn from these three accidents so that the possibility for recurrence decreases. When writing an academic thesis like this, it is also important to use relevant theory, which can improve the analysis and discussion more than the researcher's own thoughts on the data. The reason for choosing the theories used in this thesis was to provide the capability to analyze the data through a relevant set of academic contributions to the field. The theory, as an important tool in the analysis, is presented in the theory chapter. A conceptual clarification is also needed so that concepts which are important for this thesis can be understood in the same way as intended.

3.5 The quality of evidence

A main challenge with this method is to keep in mind that the data used have been collected by others. Reinterpreting what has already been interpreted by those writing the reports is a challenge. It is important to clarify what kind of institution or people have written the reports, who they were written for, who ordered them, what kind of context they were written in, the time limits in the inquiries/studies, and similar items.

Scott (1990:6) set four criteria for judging the quality of evidence:

(a) Authenticity – Is the evidence genuine and of unquestionable origin?

(b) Credibility – Is the evidence free from error and distortion?

(c) Representativeness – Is the evidence typical of its kind?

(d) Meaning – Is the evidence clear and comprehensible?

Based on the reports analyzed in this thesis, there are no reasons to believe that these documents used as evidence cannot be trusted. Their authenticity, credibility, representativeness, and meaning seem to be of high quality. These are objective documents, mostly written by independent institutions and researchers. Multiple people were involved in each of the reports and some were even sent out for public hearing before being finalized. Of course, as Scott stated, "[f]acts are not raw perceptions, but are theoretically constructed observations" (Scott, 1990:54). This means that every piece of knowledge drawn from the different reports is affected by the different authors' theoretical perspectives.

According to Scott, official documents such as these inquiry reports, are shaped by the structure and activities of the state, both directly and indirectly (Scott, 1999:59). This is clearly visible in the various reports, where each country's culture is reflected in its focus and in the way the reports are written. However, the reports still are objective and clearly state wrongs and rights in the context of each accident/incident.

These reports provided extensive information for use in this analysis. There was no need for additional interviews because those who would be interesting to interview already had answered major questions for these and other investigations. In addition, this was not considered necessary to address the research question. The main focus was to compare the three accidents in a search to find common underlying organizational factors and to determine whether the different regulatory regimes could have affected the occurrence of the accidents/incident.

Deciding whether or not the results from this thesis can be generalized is not straightforward. However, the fact that coincidence distinguished the outcome of these three accidents the transferability to other accidents is relevant. In other words, the underlying organizational factors highlighted in this paper may also apply to other

organizations and events. Especially for similar major accidents and the potential for major accidents to develop, common factors highlighted in this thesis might also represent challenges. All organizations have elements of these underlying organizational factors and these factors must be systematically taken into account in all organizations. Although the degree of influence the various factors have in each organization might vary, critical points are emphasized in this thesis and should be taken into account in other organizations.

4.0 Results

This chapter presents the findings of this research and discusses the commonalities across the accidents within each organizational factor. Although each factor is presented separately, the factors overlap in certain fields. This shows the complexity involved in how the underlying organizational factors affect each other.

The analytical framework is illustrated in both the theory and method chapters and in Figure 1.

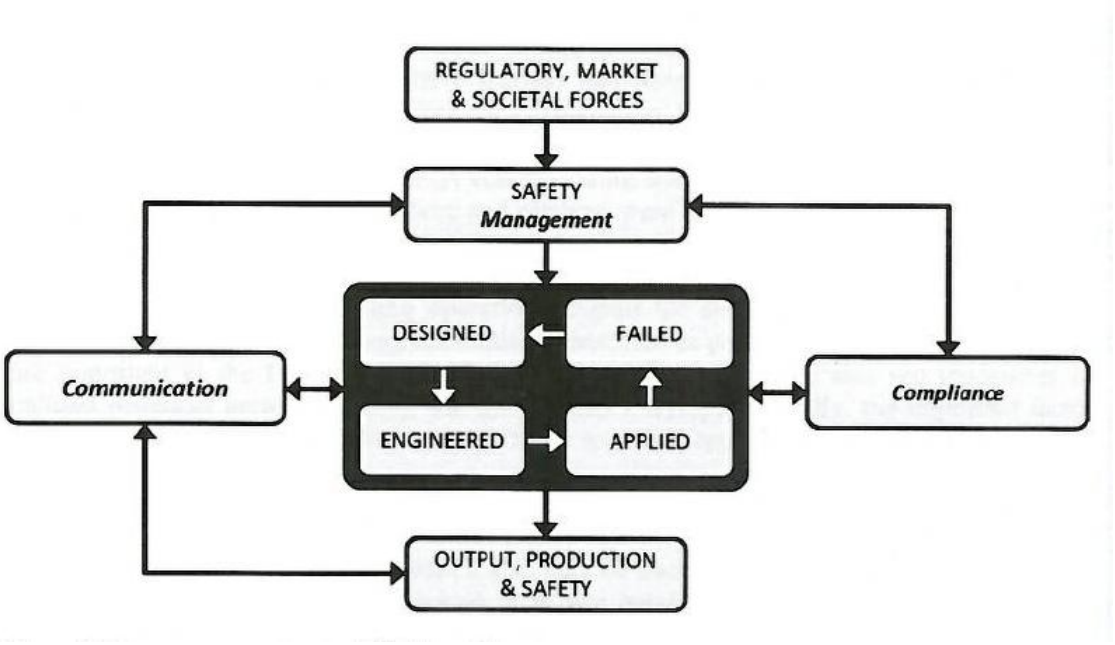

Figure 1. Governance Structure and PD Model (IRIS, 2011:16).

4.1 Management

When analyzing management, the focus was on the management structure, on the way the management and its structure affected the practical drift, and on how management was

affected by the relationship with the organization's regulator. The main discussion in this part will focus on the ways in which management both consciously and unconsciously affected how the organization and its subunits moved into stages in which the subunits were more or less decoupled from what was intended. It is this decoupling that may end up in the failure in which the accidents occurred (Snook, 2000).

The PSA inquiry after the Gullfaks C incident stated that "management at all levels inadequately ensured that the planning of the operation was carried out in accordance with the company's requirements, Health, Safety and Environment (HSE) policy and strategy" (PSA, 2010:3). An MPD operation like that at well C06 demands thorough planning that is reckoned to take at least six months. As the IRIS report stated, for some reason this process was cut to three months, which might have been a critical mistake. This indicated a need to save both time and money, but that safety was compromised. There "was a sense of urgency, and that decisions on technical issues and progress in drilling activities undertaken without the input and concerns of professionals were handled in a satisfactory manner" (IRIS, 2011:33).

The National Commission was quite direct in its statement that "[t]he most significant failure at the Macondo – and the clear root cause of the blowout – was a failure of industry management" (National Commission, 2011:122). The decision-making process at Macondo did not adequately ensure that personnel fully considered the risk created by time- and money-saving decisions. Some of the decisions made clearly saved time and money for the companies' involved. For example, neither Halliburton's nor BP's "management process ensured that cement was adequately tested. Halliburton had insufficient controls in place to make sure laboratory testing was performed in a timely manner or that test results were vetted rigorously in-house or with the clients. It appears that Halliburton did not even have testing results in its possession showing that the Macondo slurry was stable until after the job had been pumped. It is difficult to imagine a clearer failure of management or communication, the commission stated" (National Commission, 2011:123). BP's management process did not adequately identify or address risks created by late changes to well design and procedures. BP did "not ensure that key decisions in the months leading up to the blowout were safe or sound from an engineering perspective."

A PTTEPAA failure in management was also a major issue. “The management structure paid insufficient attention to putting in place mechanisms to asses and manage project risks, the competence of key personnel, the adequacy of Well Operations Management Plan, the WOMP, and the interaction with contractors” (Montara Commission, 2010:10). This in turn resulted in several poor decisions and judgments by both PTTEPAA’s senior personnel on the rig and onshore personnel.

4.1.1 Inadequate planning, a pathway to failure

In all of the three cases, clearly, the top-down management structure was not adequate, not even in the design stage when one would think it important. In the stages of planning, risk assessment, and building strategies for interaction, there is a need for managers to put their effort into developing procedures and routines to build a robust and resilient organization. As the inquiry report after the Montara accident stated, this turned into mistakes made by personnel in the sharp (worker) end. Based on stage 4 in the PD model (failure), this is what can happen when a situation arises that demands adequate procedures for handling all possible scenarios and personnel who comply with these procedures. Accidents occur in this stage when personnel follow their own task-based logic of action instead of the rule-based logic that is required to address complexity or tightness of couplings.

If one goes backward stage by stage, one can see that for personnel to act in accordance with procedures management already in the planning stage must have a clear strategy and spell out clear procedures. Management needs to be consistent for the procedures to reach their full potential. In fact, if procedures are not followed and the organization shifts to a more task-based logic of action with tight couplings in the drifting toward stage 4, then management needs a system to detect what is happening in the organization. If one could recognize when different subunits shift from rule-based to task-based logics of action, one might develop a more proactive strategy for change. A key factor here would be adequate communication systems, which are discussed later.

By communicating proactively, management could change the procedures before an incident/accident happens instead of after – from the failed stage to the design stage. As Snook (2000) stated, a task-based logic of action is sometimes the “right way” to do the job,

depending on both the context and the temporal factors. Also, as Tinmannsvik (2008) would say, the reason we use people instead of machines is that in some situations there is a need to be adaptable and to do something outside the procedure to perform the best and safest job. However, it is important to understand the consequences of actions that are not consistent with procedures. According to Tinmannsvik (2008), the local adjustments in relation to the planned procedures for performing the job (informal deviations) can cause unexpected interactions that have serious consequences. Good management is not always sufficient to achieve a high level of safety in day-to-day life. It does not matter how good the systems look on paper if the people in the organization do not have a culture of thinking and acting in accordance with work practices. One way to improve or develop procedures and job descriptions are to make the silent deviations visible (i.e., encourage and facilitate a discussion about alternative ways to do the job). A prerequisite for this is a working environment that encourages openness and learning. Making sure that the organization has the systems for developing adequate procedures and a culture of reporting, openness, and learning is management's responsibility. That said, even if management itself does not catch the drifting within the organization or operation, the management systems and procedures need to be designed in a way that detects this drifting.

In terms of the management system, managers seem to "hide behind" the system. Statements from the IRIS report indicated that "management documentation is to be followed regardless" and that at higher levels of management leaders seem to think that all employees comply with management systems, procedures, and documentation (IRIS, 2011:91). This just exemplifies the need for members of management to become more aware of how their organization actually works, and that there always will be some deviation from the procedures, depending on the context. Poor management leads to poor judgment and decision making in the sharp (worker) end. In the three accidents/incident, management consistently failed to ensure that adequate procedures, plans, and risk assessments existed for different types of situations.

4.1.2 Time is money – but what about safety?

The dilemma of time versus money and how this affects safety is another commonality in the three cases. By using the terms of the analytical framework, one will hit the failure stage when personnel feel that they must take shortcuts and do things differently and quicker to achieve the company's goals. This is not necessarily a conscious choice by management, but this is the way that subunits perceive it.

This is a competitive and exposed industry, where management must make tough decisions within limited time. In accordance with Rasmussens model (see Figure 3), pressure comes from internal goals, but also from the competition of other organizations, the number of requirements, regulations, and similar outside forces. The analytical framework exemplifies how both the regulatory regime and the market affect safety management and the practical drift within the organization. As mentioned, this might not be a conscious choice to push subunits toward failure, but rather the opposite. The fact that this might be an unconscious consequence of management actions makes this discussion even more important. There is an obvious need to increase awareness of how different contextual frames affect the logic of action in organizations. When subunits feel that they are forced to prioritize job elements to get the job done quickly, rather than safely, they take shortcuts. This is when the subunits are more or less forced to detach themselves from rule-based logic of action.

In the offshore drilling industry, time is money. The quicker one completes planning, risk assessing, and other items, the earlier one can start production and cash flow. As the National Commission (2011) report stated, project profitability depends on how soon production can yield income. Delays in one part cause delays in other parts; one is therefore often put in situations where getting the job done quickly compromises safety. Furthermore, delays in production of just a couple of hours, not to mention days, can result in a significant loss of profit. "The decision-making process at Macondo did not adequately ensure that personnel fully considered the risks created by time- and money-saving decision[s]… many of the decisions that BP, Halliburton and Transocean made that increased the risk of the Macondo blowout clearly saved those companies significant time (and money)" (National Commission, 2011:125). After the Montara accident, the inquiry stated that "[t]he prevailing

philosophy revealed by the PTTEPA's action appears to have been to get the job done without delay" (Montara Commission, 20110:11). The fact that management failed to recognize risk, did not assess risk properly when it was recognized, and pushed forward to get the job done without evaluating the consequences reflected poor decision making.

4.1.3 Planning for the long term

To prevent accidents, one needs a long-term approach to safe operations; this can be achieved by taking the time needed to plan in the most adequate way. The planning stage in the model clearly states the importance of management in this period of time. This is where the foundation of the whole production process is laid and essential safety-critical decisions are taken. This is where one chooses a pathway and what type of systems to use and determines the distribution of responsibility for internal and cooperating organizations. As a highly reliable organization, HRO-theorists emphasize, among other things, the organization's ability to predict errors it might make and failures it might experience. In the design stage, it is management's responsibility to first ensure this ability and then to ensure that the right procedures are established so that potential failure can be managed if and when it arrives. The danger of moving away from a rule-based logic of action to a task-based logic of action involves subunits not acting in accordance with procedures when failure arises, but rather acting in accordance with their own developed task-based logic of action. As hard as it can be, the need for management to be continuously updated on where the organization is in the stages of the PD model is important so that management can step in on short notice if the organization drifts from stage 3 to stage 4. As discussed earlier, one needs a system to detect and implement changes in a safe manner. These two accidents and the one incident demonstrated that when changes occurred, management systems failed to adequately address them.

4.1.4 The possibilities within the hierarchy

The analytical framework contains a hierarchic system, with regulatory regimes on top (macro level), safety management in the middle (meso level), and then the process within the organizations and the outcomes (micro level). It seems that there is strict respect for the hierarchy when it comes to who the "boss" is. At Gullfaks C, the suppliers stated that they did as their told by Statoil, end of discussion. At Montara, the impression of the operators'

authority was the same; “it was clearly PTTEPAA that effectively called the shots” (Montara Commission, 2010:10). As can be seen from the discussion concerning the interface between BP and its suppliers at Macondo, the respect for the operator seems to be as valid here.

However, the IRIS report (2011) still indicated difficulties related to the interface between the operator and suppliers. Statoil is the largest oil company in Norway and many supply companies depend on contracts with Statoil to survive in the market. The report showed that Statoil was very much aware of this and used its size to get its way if there were disagreements about the contract, planning, or operational process. In relation to the analysis model, this involves multiple stages. An aggressive and uncompromising contractor does not provide a sound foundation for cooperation and communication. In addition, the fact that the different organizations used different management documentation systems hampered the sharing of information and knowledge even more. In fact, as one of the differences between the U.S. and Norwegian system is that there were no requirements to have a documented management system in the U.S. (Ryggvik, 2012).

Leveson (2004) emphasized the possibilities that lie within the hierarchic system, where the level above sets the boundaries for the next level so as to operate safely. In accordance with this theory and the examples drawn from the different inquiry reports, the organizations have a great opportunity to make good use of the authoritarian respect the contractors have for the operator. When this hierarchic system is already in place, it is easier for management to perform its leadership role, which could make the design part of the operation more manageable. However, one must not overlook management responsibilities during the other stages, as discussed earlier. The important point still lies in the objective to agree when it comes to the type of logic of action that is needed and used in the specific situation.

4.1.5 The regulatory influence

Regulatory regimes affect how organizations manage risk and safety. The discussion of this impact largely concerns how the relationship between the regulator and the organization strengthens or weakens the way one moves toward the failure stage. Is there a perfect way to regulate an organization’s efforts to prevent accidents?

Since the three accidents studied occurred in different parts of the world (the US, Australia, and Norway), different types of regulatory regimes were involved. The way the different regulatory regimes were organized and structured affected both the degree of influence they had on the different organizations and the relationship between the organizations and the regulators.

While the Norwegian and Australian industries are required to take a proactive attitude toward safety, it seems that the US industry is more or less "sitting on the fence," waiting for authorities to identify failures and implement solutions. One example of this is how risk assessment, which is a proactive instrument, was not a requirement to the industry in the US (Ryggvik, 2012).

While the Norwegian system involves the government, the employers, and the employees, the so-called three-party cooperation, the Australian system expects the operator and employers to take most of the responsibility. However, platform inspections are conducted once a year by the regulator. The US, in contrast, seems to only depend on the government itself to handle these issues.

Still, even though the Australian system requires more proactive action from the owners and operators, such action may not be easy to achieve. "The Inquiry considers that the manner in which PTTEPAA approached the National Offshore Petroleum Authority (NOPSA), the NT DoR and the Inquiry itself provides further evidence of the company's poor governance" (Montara Commission, 2010:12). "The information that it provided to the regulators was consequently incomplete and apt to mislead" (Montara Commission, 2010:12).

Also, in the Norwegian system, which is characterized by the mentioned three-party cooperation, incidents and accidents still occur. Statoil was not error-free before the incident occurred, rather the opposite. The reason why IRIS carried out its study at all was due to Statoil's inability to learn from past events. So, why wasn't the relationship between the PSA and the industry flawless, where incidents and accidents do not occur?

Both Leveson (2004) and the analytical framework emphasized how the hierarchic system with government on top sets the boundaries for the next level, in this case the safety

management in the different organizations. This involves both permission to drill and the regulations established for the industry to follow. Still, an important part of Leveson's (2004) theory is the need for feedback loops. Feedback loops involve how those who are regulated communicate with those who establish the regulations, all in an effort to harness the power of the hierarchical system so that it is under constant improvement. For the benefit of all parties, "[g]overnment must close the existing gap and industry must support rather than resist that effort" (National Commission, 2011:vii).

"The Inquiry finds that if PTTEPAA had observed its own Well Construction Standards and given effect to the various approvals given by the NT DoR, the Blowout is unlikely to have occurred" (Montara Commission, 2010:13). "The NT DoR made a major error when it approved the Phase 1B Drilling Program in July 2009" (Montara Commission, 2010:13). According to the inquiry, this was contrary to best oilfield practices.

"The American regulation system of the offshore industry is characterized by strong owners and employers, where intense lobbying ensured that the industry could continue more or less as before, despite a more active regulation. It was no accident, but a strong desire to expand oil operations offshore that eventually became essential for the actual public regulation of safety offshore" (Ryggvik, 2012:13).

One of the similarities between all three accidents is that each state profited from this industry. In other words, just as management within the organizations must balance the need for profit and the development of safety, so must the government. Much of Norway's revenue comes from the oil and gas industry; in fact, Statoil is partly owned by the state of Norway. As the National Commission stated, "[f]rom birth, MMS had a built-in incentive to promote offshore drilling in sharp tension with its mandate to ensure safe drilling and environmental protection" (National Commission, 2011:56). It is obvious when you read Chapter 3 of this report (National Commission, 2011) that the policies and ideology basically encourage the US. When MMS tried to introduce something, it did not receive support, either political or financial, from central authorities. In addition, the industry demanded self-determination. Politicians were on the same side as the industry, with financial gain as a high priority and long-term investment in safety a low priority.

For the balance between profit and safety to be optimal, "[f]undamental reform will be needed in both the structure of those in charge of regulatory oversight and their internal decision-making process to ensure their political autonomy, technical expertise, and their full consideration of environmental protection concerns" (National Commission, 2011:vii).

It is important for the regulators to be aware that organizations drift from stage to stage, depending on their context, degree of complexity, and how tight/loose the couplings are. Regardless of whether or not the regulatory requirements are functional or detailed demands, this must be taken into consideration. Changes will occur; therefore, organizations need to have a formalized relationship with their regulators to ensure that regulatory requirements are also as optimal as possible. When one communicates both how the requirements function and how they don't, a proactive environment in which actors communicate with each other can be established to devise the best possible requirements and procedures to achieve the best safety outcome for the organizations and still fulfill the meaning and intention of the regulatory requirements.

Of course there would be challenges in the process of determining which rules should be considered and how to implement these rules in every region, because although this is a global industry we must still take into account the individual differences of each region, both culturally and historically. As one can see from the findings in the reports from the Montara and the Macondo accidents, the relationship between the regulator and safety management was inadequate. In the search to find commonalities across the accidents/incident, the Norwegian system does not quite fit the description of a poor or inadequate relationship between the regulator and industry/safety management. Perhaps the formal relationship among the three parties' in the Norwegian system is a recipe for other regions to follow. This does not mean that the Norwegian cooperation system is perfect, but it might have diminished some of the issues the two others confronted. "One could argue that participation of the employee representatives that are so central to the Norwegian system, has a positive safety impact. Participation is however, a democratic right with an intrinsic value that can not be quantified" (Ryggvik, 2012:61). That said, transfer of the Norwegian system to other regions might be easier said than done.

4.1.6 Section summary

To sum up, the management system is a key factor in all stages of an organization's lifespan. Management is affected by its relationship with its regulatory regime, and this relationship will be reflected in the organization.

However, it might be healthy for the organization not to have a micromanagement system, as in stage 3 (applied), where subunits might do things a little bit differently, but more safely. What's important in this case is the crucial need for management to have established the standards in the design stage. This is essential for establishing how the organization will meet and handle challenges that arise in the drifting periods. The system must take into consideration all of the stages in the practical drift, approach operations with a collective mindfulness, and take into account the long-term approach on costs and benefits. Finally, management systems need to take a proactive stand when it comes to changes that occur during the lifespan of an organization, which the analytical framework clearly revealed.

4.2 Communication

Communication is complicated and challenging. This discussion addresses how communication and different communication systems in all stages of drift, both upward and downward, in an organization work to encourage safety. The importance of communication is also visible in the different stages of practical drift in that communication is affected by the drifting between the different stages. Also, while drifting from stage 4 to stage 1 (the redesign stage), how one communicates lessons learned from prior accidents or incidents will be discussed. How did communication affect the occurrence of these accidents and, most important, do similarities exist when it comes to communication across the three accidents?

4.2.1 Multiple organizations – multiple subunits

Subunits will be developed within all organizations due to different reasons. In this section, issues concerning how subunits detach themselves from the organization and drift towards failure will be discussed. The discussion revolves around the development of subunits and how this affects communication both internally and between organizations and their subunits.

When dealing with the interaction of multiple organizations involved in one operation, there is still a need for a management and communication system that handles the cooperation and interfaces between the organizations involved. The industry is organized so that one organization is the operator on the platform, but several organizations act as suppliers on each platform. At the Deepwater Horizon rig, BP was the operator and Halliburton and Transocean (among others) were supplying companies. At the Montara accident, PTTEPAA was the operator and Halliburton and West Atlas were involved as supplying companies. Also, on the Gullfaks C platform in the North Sea, several organizations were involved: Statoil as the operator and, among others, Seawell as a supplier. As the PD model's stage 2 illustrates, subunits develop within any organization. However, not only does management face the challenge of having subunits within its own organization, it also must deal with other organizations that also have subunits. In accordance with Turner (1997) the involvement of multiple organizations in a complex work task makes communication even harder. As the findings from the different reports have indicated, this will lead to a more complex situation with tight couplings where Snook argued the need for a top-down rule-based logic of action.

Difficulties with communication between the operator and suppliers are in fact important similarities across the three accidents, especially since each organization has its own system, its own procedures for how to do things, and its own culture for how and what to communicate. This, of course, affects how it can cooperate and communicate. In such cases there is a need for a bridging system that that ensure compliance between the different systems.

At the Macondo blowout, there were obvious communication problems between BP and Halliburton. For example, Halliburton was responsible for cementing expertise, but BP made crucial decisions about whether to use 15 centralizers without communicating with Halliburton. (A centralizer's function is to place the liner/casing pipe in the middle of the drilling hole so that cement on the outside is placed correctly. If the pipe is not positioned properly in the middle of the hole, the cement on the outside will not lay properly around the pipe. This can lead to the formation of channels in the cement through which oil and gas can flow.) (National Commission, 2011).

The National Commission report clearly argued that among the failures in management and training of personnel "…better communication both within and between BP and its contractors..." would have prevented the Macondo accident (National Commission, 2011:122). BP's own investigation report indicated communication issues between BP and Halliburton when it came to the planning, design, execution, and confirmation of the cement job (BP, 2010:33). The Montara inquiry (2010) discovered systemic failures of communication between PTTEPAA and Atlas personnel. For example, Atlas was not involved in the actual decision during two critical procedures; this reflects a poorly formalized relationship/cooperation. These examples are clearly similar to the Gullfaks C incident, and the IRIS report stated this in the discussion of sharing knowledge and learning across organizations and subunits, the report said that "several of the informants experience Statoil as closed and that suppliers have little insight and understanding of the processes that occur along the way" (IRIS, 2011:84). As one can see, communication issues were included in multiple drift stages, which is consistent with the analytical framework.

The SINTEF report (2011) after the Macondo blowout stated that regular meetings (weekly) between the operator and the drilling-contractor should have been held to ensure safety-critical issues. Linking this to management issues, there is a need for the operator to be much more involved in day-to-day operations. Similar recommendations were also made in the two other cases.

All of the accidents involved issues concerning communication between the organizations involved, in both planning and operation stages. In the first stage, the analytical framework

emphasizes the importance of management's presence, where communication at the top level between the organizations needs to set the standard for the rest of the operation. As discussed in the management chapter, the design stage is where one plans the whole process and operation (and maintenance), and one must delegate different responsibilities, processes, and procedures to be used. This is where a rule-based logic of action is needed to set the standard for both your own organization as well as for cooperating organizations. For this effort to be as successful as possible, communication is essential. Without communicating the issues that need to be addressed in this stage, chances are the organization will never achieve its goals and it is unlikely to follow the procedures specified. As subunits form and drift further away from the rule-based logic of action, communication between the different subunits will also drift further away as a natural consequence, and this must be taken into account. Something must be done to fill this gap.

The Norwegian system is characterized by the three-party cooperation between management, employees, and the government, which is an important element when it comes to communication. In addition, there is also a demand to involve employees in the planning or design stage. Drifting further to the next stages in the model, as the operation starts and time passes, subunits arise. When subunits have the time to develop and drift further and further away from the rule-based logic of action, communication between the different units will be affected and become more challenging. As Westrum put it, "[w]here there is lack of dialogue, unpleasant things will happen" (Westrum, 2009:5-8). This might have been what happened in the operation of the organizations, which indicates a drift from stage 3 to stage 4. Although understanding that something was wrong, the different subunits did not manage to get back to a rule-based logic of action to prevent the accident from happening and the communication between the subunits was inadequate.

As the PD model explains, when an organization drifts from stage 3 (applied) to stage 4 (failed), the different units are forced to assume that others are following and acting in accordance with procedures. How can one be certain that this is the case without communicating? According to Reason (1997) effective communication is determent for the identification and removal of latent pathogens.

4.2.2 Lessons learned?

How to take experiences from past events and learn from them can be essential in how the organization develops with respect to both safety and production outcomes.

Lessons from prior well incidents on the Gullfaks field and other Statoil fields were poorly transferred within the Statoil organization. The Gullfaks team did not make use of its own expertise in areas such as Managed Pressure Drilling (MPD). The IRIS report (2011) also said that Statoil had difficulties involving other organizations in its network of learning.

The operator (BP) did not share important information with its contractors and the contractors did not share important information with BP or each other (Transocean and Halliburton). Transocean failed to adequately communicate lessons from an earlier near-miss to its crew, which had occurred in the North Sea four months earlier. The National Commission stated that one of the recurring themes in these accidents was in fact "failure to share information" (National Commission, 2011:ix).

"PTTEPAA's records and communication management were defective, particularly the exchange of information between on- and offshore personnel, between night and day shifts, between offline and online operations, and in relation to milestones such as the installation of secondary barriers" (Montara Commission, 2010:10).

When operating in a high-risk industry like the oil industry, communication is of the essence to ensure that everyone has the same understanding of safety-critical issues. The logic of action must be consistent with the situation and must be loud and clear to all parties in the operation. Without communication, which Champoux (2000) stated involves information sharing, feedback, integration, persuasion, emotion, and innovation, organizations have no clue whether they have the same view and knowledge of an operation or situation. Without equal knowledge about prior lessons learned, the risk of personnel doing something they're not supposed to increases. The IRIS report (2011) stated that the sharing of knowledge occurred to a greater extent internally and to a lesser extent between Statoil and suppliers. Even within one organization, sharing information and knowledge between installations was

also inadequate (IRIS, 2011:83). All of these accidents show that communication failed, either inside the organization or in the interface between organizations; either way, the principal is the same: There is a need to focus on communication systems to ensure that everyone involved has the same information available at all times. This also involves knowledge from previous accidents such as the accident at Snorre A and former incidents at Montara VHP.

4.2.3 Report systems

Report systems are one part of communication channels in an organization. This discussion shows how parts of the communication system fail and can affect the development of unwanted events.

At Gullfaks C, there were also issues about messages of concern, or the feedback/reporting system. When employees saw that things weren't as they were supposed to be, they faced a sub-optimal system for handling their concerns. Any system for reporting must be available, easy to handle, addressed to the appropriate authority, and dealt with. Although there seems to have been a low threshold for reporting in multiple ways, either information still did not reach management or management did not respond to the messages of concern. The IRIS report (2011) revealed this problem and concluded that no matter who was right the feedback and reporting system were not optimal. The report system is, of course, an essential part of the communication system. The reason for a low threshold for reporting might be attributed to the three-party system in Norway, where organizational actors not only have the ability to state their concerns, they also have a duty to speak out if they sense that something is wrong (Arbeidsmiljøloven, 2005:§2-3).

In contrast, both the Australian and US systems differ from the Norwegian in this area. However, even though the Norwegian system facilitates a reporting system, through both laws and regulations, either the system itself was not sufficient to ensure that messages of concern reached the right authority and/or the authority did not act upon those messages. In other words, it is not enough to have regulations in place; one needs to act in accordance with them. This requires a rule-based logic of action where everyone knows how to report and to whom, and feels assured that those receiving the messages act upon them. According

to the analytical framework, this again shows how different stages affect the logic of action within an organization. As mentioned earlier, employees, especially in the Norwegian system, are involved in the planning process. However, as time passes and operations continue, the demand for employee involvement and reporting still applies. The fact that organizational actors drift away from this rule-based logic of action and toward a task-based logic of action might also affect the degree to which actors actually report and how the management system responds to the reports. According to Tinmannsvik (2008), silent deviation arises. Actors do things a little bit differently and adjust how they proceed. Instead of proactively reporting issues of concern involving a task, they solve the problem within their subunit using a task-based logic of action. This might be the right way to address a specific task, but it must not become standard. Consistent with Reason (1997), adequate reporting systems and culture are essential in achieving a safety culture.

4.2.4 Lack of documentation

How to document important discussions and decisions is also an important part of the organization's communication system. This section discusses how important written documents can be in eliminating failures.

At Gullfaks C, there were indications of trouble during the whole process, from the planning stage through the incident happening; however, no action was taken. Thus, it is obvious that the communication systems did not work as they were supposed to, either from a sender's perspective or from a receiver's perspective. Communication problems at the Gullfaks C platform also included scant documentation of discussions held in different meetings, which clearly affects how one can communicate what has been discussed (IRIS, 2011). How one documents discussions in protocols or otherwise is part of an organization's communication system. The challenge is that only those participating in the meetings are certain to have received the required information. If important information is left out and not written down, how can one be certain that the information will reach the relevant organizations and persons involved? At Gullfaks C, it seems that it has been a tradition not to document the discussion from different meetings; only the conclusions seem to fit in the protocols. As the IRIS report (2011) from the Gullfaks C accident showed, a discussion of whether to cement well C06 or not was held. In addition, whether one should drill in one or two sections was

discussed. These essential discussions were not recorded in any documents, which excluded important elements in this operation. When discussions, objections, proposed amendments, and similar items are not written down, those who did not participate in the meetings might think that there were no problems. This is one of the issues Turner (1997) promoted as an information problem, where “there is always someone who knew.”

Like in the Gullfaks C incident, the protocols were not detailed at the Deepwater Horizon rig; “…it does not appear that BP’s team tried to determine before April 15 whether additional centralizers would be needed” (National Commission, 2011:116). The inquiry did not state directly whether or not this was discussed in prior meetings, but the report stated that BP and its contractors must have “…decision making protocols of the many different contractors involved in drilling a deepwater well” (National Commission, 2011:122). Inadequate protocols for safety-critical issues that had been discussed meant that critical information was not transmitted to everyone, and certainly not to Halliburton. After the accident on Montara, one of the recommendations made by the inquiry concerned the issues around documentation. ”Relevant personnel from licensees and rig operators should meet face to face to agree on, and document, well control issues/arrangements prior to commencement of drilling operations” (Montara Commission, 2010:358).

As part of an adequate communication system, protocols for safety-critical issues should be included. This industry should require a better protocol system with its work form, with shift work (night/day), and with personnel on- and offshore. To ensure that everyone involved receives information from safety-critical discussions is important, even though those in the meetings might have found solutions to potential problems or decided to discard a potential problem.

In addition to adequate protocols, and as an example to how organizations can be affected by their regulator, the extent of required documentation of management systems varies. Ryggvik (2012) discussed the difference between the Norwegian and US systems in relation to this which clearly reflects the characteristics of the various systems. A group of organizations in the US Offshore Drilling Industry showed their clear “resistance against MMS attempts to facilitate that the companies' management systems should be

documented so that these could be regulated and inspected, as were the case in the Norwegian system. The companies used the improvements in injury and lost time injury (LTI) statistics to indicate that they did not need further regulation" (Ryggvik, 2012:69). Once again, one can see that the relationship between the regulator and the regulated will affect how well the organizations to their job, in this case the degree of documentation.

The same issues that were discussed regarding the report system are also valid when it comes to the discussion of protocols and written documentation; how thorough the documentation of discussions is might differ as the organization drifts through different stages. This again shows the link between the management system and the different stages, especially the importance in the design stage of having a clear procedure regarding how safety-critical discussions and assessments are to be protocoled.

4.2.5 Section summary

Adequate communication systems is an important tool to bridge the gap between subunits and between subunits and its organization in order for them not to drift away from the organization or detach themselves from the rule based logic of action.

There were obvious difficulties with communication and information transmission in all of the accidents. One of the issues in all three accidents was that multiple organizations were involved. When more than one organization is involved, communication will be more challenging than if there is only one responsible organization at each well. On the other hand, this is how this industry is organized, by multiple organizations involved on one rig and on most operations. Dealing with others is something the industry must do; however, organizing in a way that fosters cooperation depends on adequate communication systems. Therefore, cooperation on multiple levels is a necessity in this type of industry.

The communication difficulties in these accidents were not one dimensional. Since communication is a way of acting, a way of cooperating, and a way of getting what you want, difficulties with communication arose in different situations, at different levels, at different times, and between different people/roles/organizations. How the organizations drift from stage to stage clearly complicates the communication and sharing of information. The industry must take a closer look at its communication systems, including the state of the

procedures and systems for good and effective communication where a low threshold for reporting exists.

Sharing safety-critical information is essential. As Turner (1997) stated, issues concerning communication can be found in every organization; therefore, one cannot say that problems with communication mean that accidents will occur. On the other hand, both Turner and the findings of this thesis show that communication issues are part of the cause of these accidents. Communication seems to be an issue that one doesn't address explicitly, that is more or less taken for granted. Communication is an organizational factor that needs to be addressed more systematically to prevent accidents. Without a proper communication system, essential parts of the organization are being neglected.

Explicit communication and a proactive approach to silent deviations are important elements in avoiding drifting from stage 3 to a stage 4. This also demands the management controls and systems established in the design stage and a proactive management that observes its operation and how the systems are working. This again depends on open communication, upward and downward, to achieve the best possible safety outcome. Depending on which stage an organization is in, management needs to make sure that everyone has the same understanding of both the stage they're in and what type of strategy that is needed, a task-based or a rule-based logic of action

4.3 Procedures

Procedures are important elements in a rule-based logic of action. This discussion mainly revolves around the importance of adequate procedures for the whole process; procedures developed in the design stage affect drifting in the organization. Also, they affect how one might be forced to not act in accordance with procedures and move the organization toward failure.

Since procedures involve procedures for competence, appropriate management, communication, and other areas, challenges related to the procedures involve how they are

created, who establishes them, on which ground they are established, how they work, and how they are followed up over the lifetime of the organization.

Procedures are a central element within the analytical framework. Procedures are established by the industry and/or organizations themselves as a way to meet regulatory requirements or internal standards. The different cultures in the different regions studied in this thesis will, of course, affect how one develops these procedures and how they are implemented. While the Norwegian system is characterized by three-party involvement, the US system by the operators' strong role in self-determination, and the Australian system by cooperation between the state as an inspection authority and the operators, some differences will, of course, exist. At the same time, when taking a closer look at how procedures work by using the analytical framework, some similarities also can be seen.

4.3.1 Lack of adequate procedures

Poor transfer of experience and poor communication might indicate weaknesses in procedures. Even though the PSA report (2010) did not state this, the research conducted by IRIS (2011) indicated failures in procedures concerning risk assessment, especially in how the organization did or did not learn from previous accidents such as on the Snorre A platform. How were the procedures for transferring key learning points from one rig to another? Also, the failure to involve the MPD might indicate a failure in procedures over whom to involve in different operations. Frustration over complicated and to some degree misleading procedures established by management might also be a cause of why personnel develop their own local ways of doing things. The IRIS report clearly stated the frustration among employees about these issues; "[c]ontrolling documents are perceived as complex and difficult to deal with" (IRIS, 2011:108).

The National Commission's inquiry report cited in several places inadequate procedures, a lack of procedures, and in some cases a failure to train personnel in accordance with established procedures. This included procedures such as the performance and interpretation of the negative pressure testing of the cement (National Commission, 2011:135), management of change, risk analysis, and peer reviews (National Commission, 2011:125).

At the Montara well accident, the most prominent cause was inadequate procedures. The inquiry found that procedures were poor and deviant and, at best, ambiguous. The inquiry after the Montara well accident clearly identified the lack of adequate procedures within PTTEPAA and suggested that these shortcomings in the company's procedures led directly to the blowout (Montara Inquiry, 2010:6).

Both the WOMP and Well Construction Standards (WCS) were inadequate; one example of this is the lack of procedures regarding how PTTEPAA would address risk. That many "PTTEPAA employees and contractors interpreted aspects of the WCS differently illustrates the ambiguity and inappropriateness of the WCS" (Montara Commission, 2010:9).

As one can see, failures in procedures for risk assessment and for involving the right personnel are commonalities across the accidents/incident. However, failures in procedures differed from accident to accident. This might have something to do with the relationship between the regulator and organization, organizational culture, and other organization-specific aspects. The Montara accident report clearly identified the lack of appropriate procedures as one of its main findings. The IRIS (2011) research after the Gullfaks C incident identified issues concerning procedures, and even though PSA did not explicitly state this as a prominent cause, it can still be read out of both the PSA (2010) and IRIS (2011) reports concerning this incident. Also, at Macondo, inadequate procedures, especially concerning risk assessment and how to handle changes in an operation, were deficient.

4.3.2 Regulatory regimes' effect on the development of procedures

Regarding the Macondo accident, the relationship between the regulatory regime and the industry is an interesting aspect of how well the procedures were designed and followed. Since the organizations claimed independence and self-determination, it appears that the MMS and the organizations did not see eye to eye about the functions of the different procedures. At Gullfaks C issues concerning the relationship between the regulator and Statoil were discussed. "It has been developed a practice where it occurs a state of emergency in the affected part of the organization when PSA comes with its orders after events. 'Everyone' must put everything else aside and concentrate on developing and implementing measures in order to close the PSA's orders" (IRIS, 2011:90).

One can clearly see the link among regulatory regime, safety management, and the work process in the forms of procedures; how they are designed and how well they work is affected by the relationship between the regulator and the regulated. As is the case at Gullfaks C, when subunits are more or less forced to drop what they are doing in order to fulfill the new requirements set by PSA, shortcuts will be taken and the drifting towards failure will occur. One is now drifting away from the rule-based logic of action where you follow procedures, towards taking the shortcuts needed to fulfill the new ones. Even if the orders set by PSA are intended to increase safety, in worst case the opposite will happen as a result to the shortcuts being made.

As BP's own inquiry stated, "When well influx occurs, rapid response is critical. The rig crew needs effective procedures and must effectively implement them to maintain control over deteriorating conditions in the well" (BP, 2010:43).

The relationships or interaction between the regulatory regimes and the organization, the macro level, ultimately affected the meso level within organizations, or how one followed the procedures.

While the US system has been characterized by a strong lobbying industry where self-determination has been an important principle, regulators have had minor or little real impact on the industry. The Norwegian system, on the other hand, has had a culture of cooperation with three-party involvement where all parties have both a duty and the privilege to contribute. The Australian system is characterized by functional but complicated sets of demands and regulations where the employer is established as the only responsible party. One can almost say that the Australian system consists of parts of both the Norwegian and the US system.

4.3.3 The importance of designing procedures

Despite the differences in procedures across the accidents/incident, important similarities still existed. Those similarities concerned the intention to even have procedures at all. Procedures are supposed to be helpful tools in fulfilling regulations and rules set by the

government and the industry or organizations themselves, not the cause of ambiguity. As stage 1 (design) in the practical drift shows, there is a need for safety management to take the steps concerning the choice of procedures seriously; this is where management plans and designs the operation, using mindfulness to foresee what might go wrong and how to correct course if the organization is drifting in that direction. As the analysis framework also shows, the drifting process over the lifetime of an organization, where it goes from tight to loose coupling and has differing degrees of complexity, affects the occurrence of subunits and how they actually execute their jobs. How well one follows procedures within this drifting process varies from the rule-based to the task-based logic of action. However, without the foundation of a good rule-based logic of action, a task-based logic of action might drift even further away from the intent of the procedures than this model itself even considers. On some level, subunits might even be "forced" to devise their own way of doing things to operate safely because of inadequate procedures. For example, the Montara accident report clearly stated that "Well Construction Standards were at best ambiguous and open to different interpretations" (Montara Commission, 2010:9). Different units interpreted standards differently. If the organization has not implemented functioning procedures and a culture for reporting, openness, and communication, the actual way of doing things might drift far away from how management thinks personnel are doing things. Even though management is responsible for the whole operation, how can it be held responsible when it does not know what is happening within its own organization and operation? As the IRIS report (2011) stated, management had the impression that procedures were followed no matter what, but responses from personnel indicated the opposite; they felt that the procedures were complicated and not that easy to comply with. During a drift from stage3 to stage 4 (failed), if the subunits do not manage to shift back from a task-based logic of action to a rule-based logic of action, accidents can happen.

The process of shifting back to a rule-based logic of action at the appropriate time might be harder when the procedures created in the design stage are initially inadequate. This notion was supported by how the organizations did not manage to transfer critical learning points from previous accidents/incidents, how someone at the Gullfaks C did not manage to involve the staff with the right competence, how one at the Macondo site did not manage to properly consider the risk due to changes, and how one at the Montara site initially did not

create adequate procedures at all. All this occurred after management failed to implement appropriate and efficient procedures in the design stage.

4.3.4 Section summary

The relationships between the regulatory regimes and the industry have an effect on how management designs and implements procedures within its organization and how well the procedures will function and be implemented by personnel. The relationship at the macro level sets the foundation for the healthy development of procedures and how to comply with rules and regulations – sort of a culture bearer. Even the Norwegian system, which involves all parties, is not flawless; no system is. However, one of the key successes is that there exists a relationship and dialogue among the regulators, the employers, and the employees. Even though the relationship might not be perfect, the intention of it is well respected and lies as a foundation for safe operations in the industry. The degree of involvement from the different parties is not pertinent to this thesis but might make for an interesting discussion for later research. However, what is part of the conclusion in this section is the need for the involvement of all three parties so as to develop procedures that are respected and complied with to achieve operational safety. In this lies what has already been discussed in the communication chapter, the importance of a proactive stand to change procedures if necessary to avoid the dangerous drift from stage 3 to stage 4.

4.4 Competence

The competence personnel possess is crucial. This part will therefore discuss the need for the right competence and how this was or was not ensured by the organizations.

Like procedures are tools on multiple issues concerning organizations and how to get things done, competence is the main resource in an organization – the people performing the actual jobs.

4.4.1 Crucial decision made by the wrong people

Statoil did not use the appropriate competence in key processes. “A dedicated risk coordinator responsible for risk management was never appointed, and the group conducting the operational risk assessments lacked the necessary expertise to conduct proper risk analyses” (PSA, 2010:4). Personnel lacking skills or expertise were responsible for analyses and making key decisions and these decisions included the failure to use MPD expertise for the MPD operation. There was a change in organizational structure (the merger between Statoil and Hydro) and the replacement of personnel (a lot of people with great experience left the organization and there was insufficient transfer of knowledge). No one managed to transfer knowledge between former and forthcoming human resources/competence at Gullfaks (IRIS, 2011:110)

In addition to failures in the management decision-making process and communication, both within BP and between BP and its cooperating organizations, “…training of key engineering and rig personnel would have prevented the accident at the Macondo well” (National Commission, 2011:122). BP (2010) itself stated that lack of competence was one of the issues that caused this accident. Management failed to ensure that personnel fully considered the risks in the operation/work task. For example, during the negative pressure test of the cementing, several issues related to competence and procedures were inadequate. Neither BP nor Transocean had procedures for running or interpreting the negative pressure test, nor had they trained their personnel to do so (National Commission, 2011:119). (The negative pressure test was used as one of the testing methods to ensure that the barrier of the cement was adequate.)

PTTEPAA’s senior personnel had only limited experience with batch drilling and batch tieback operations. By failing to test all barriers properly, PTTEPAA’s personnel on the rig demonstrated inadequate understanding of the company’s WCS. They also failed to comprehend the manifest problems in the cementing job for the 9-⅝” casing shoe (Montara Commission, 2010).

Once again, the importance of having a well-planned recruitment strategy in the design stage might be crucial to the rest of the drift over the lifetime of an organization. When the

work is executed, management needs the right competence at each concrete work task. Competence includes education, knowledge, and experience – both explicit and tacit. The competence the management has within its organizations will determine how well the organization undergoes the drifting process and how subunits are developed and function/dysfunction, including how well one shifts from rule-based to task-based logic of action when the situation demands it.

In these two accidents and one incident, it seems that failures in all of the stages developed—from the design stage of strategy and recruitment, to how personnel developed their subunits, to how personnel did not manage to shift from a task-based logic of action to a rule-based logic of action when needed. Ultimately, what caused these accidents were wrong decisions made by people without the competence to make them. A statement that supports this assertion was taken from the National Commission report: "…individuals often found themselves making critical decisions without a full appreciation for the context (or even without recognizing that the decisions were critical)" (National Commission, 2011:123). At some point, employees can, by a rule-based logic of action, do their work in a satisfying way, but this will only take the organization so far. In stage 3 (applied), this might in fact be the best and safest path. To be creative and develop a task-based logic of action when the situation demands it, as in stage 3, organizations need a competence that corresponds to the situational task. This is also stated in the National Commission report: "[i]t takes good experienced personnel to understand the situation and cope with it" (National Commission, 2011:44). Then again, to have the ability to go back to the rule-based logic of action when that is demanded, just tacit knowledge and task-based practice will not be sufficient. Management must also set competence to be in second position and do what is demanded in a rule-based logic of action to follow established procedures. This will ensure that everyone knows exactly how to perform and exactly what others are supposed to do. Again, one can see the importance of having appropriate procedures for competence to be used in the best possible way to achieve operational safety and avoid accidents or incidents.

As Nordhaug (2007) stated, having the right competence might be a determinant to surviving competition in the market. As can be seen from these two accidents and one incident, there are some crucial commonalities showing that possession of the right

competence is in fact crucial. Common to all of the three is the fact that personnel without the proper skills or expertise made critical decisions both in planning and in operation. In addition, failure to detect and address safety-critical issues and risk assessments arose.

The lack of staff competence at the Montara operation was obvious. Still, even though not as obvious, competence played a key role in the other accidents as well. Competence and knowledge about operations, procedures, and other elements depend on personnel's experience, training, and education. How personnel perceive a possible hazard depends on their competence and knowledge. Looking at this through a structuralist's perspective, the organization can do something about how it wants its staff to perceive risk and deal with it by having a good recruitment strategy, training programs, and procedures and guidelines.

On the Gullfaks C platform, IRIS found several shortcomings in terms of competence; "[t]here is little doubt that the combination of lack of MPD skills, poor coordination and uncertainty regarding new teams, and the fact that people with high skills and long experience had been early retired, gave instability" (IRIS, 2011:100). In addition, IRIS also stated that some of the units were loosely coupled to the organization; even Gullfaks C itself was considered a somewhat loosely coupled unit in Statoil's installations. According to the analytical framework, this created greater risk for something to go wrong, especially if subunits were performing with a task-based logic of action when they really should have been following a rule-based logic of action. The chance for subunits to actually perform according to the rule-based logic of action was low, since both Gullfaks C and subunits within the platform seemed to be loosely coupled to the rest of the organization.

After the Macondo accident, BP (2010) also did its own inquiry. One of the main findings was that competence is essential and needs to be addressed more thoroughly. The guidelines for the negative-pressure test, a critical activity, did not specify expected bleed volumes or success/failure criteria. Therefore, effective performance of the test relied on the competency and leadership skills of the BP and Transocean rig leaders (BP, 2010:41). Both the rig crew and the well site leader were expected to know how to perform the test.

"On the Macondo well, the rig crew apparently did not recognize significant indications of hydrocarbon influx during the displacement of the riser to seawater" (BP, 2010:41). A

fundamental requirement for a safe operation is to prevent influx of hydrocarbons in the well. In BP's own investigation report, one of the recommendation chapters for further developments contained several bullet points that focused on competence within the organization and how to ensure the right competence in the supplying organizations (BP, 2010).

The development of subunits is a natural consequence of the way this industry is organized, by separation of functions; the hiring of Halliburton as a specialist in cement is a good example. Separation of functions is necessary to achieve specialized expertise in certain fields, but this also implies the development of subunits.

4.4.2 Section summary

Apparently, compliance, procedures, and competence affect each other. The fact that the organizations had inadequate procedures caused, according to the analytical model and the findings in the reports, the different subunits to develop a task-based logic of action. In an organization that does not possess optimal competence, like in all of these cases, the development of a task-based logic of action leads to higher risk for incidents and accidents.

The staffs' competence in a high-risk industry is of utmost importance. Improving awareness and the ability to detect and react to early warnings in lack of control is critical; this was stated in the SINTEF (2011) report after the Macondo accident, but the concept clearly is transferable to each of the involved organizations as a general recommendation.

4.5 Compliance

The different logics of action will affect how the subunits and organizations comply with both internal and external requirements. In the discussion of procedures and competence,

compliance was a key factor because it involves how personnel comply with procedures and requirements.

4.5.1 Unrocked boat

As discussed in the procedures chapter, the procedures themselves were not, according to PSA (2010), a significant reason for the occurrence of the incident, but compliance was an issue. While planning the well, risk analyses were not carried out in accordance with Statoil's own requirements and guidelines. Despite the fact that the well was of a complex nature and represented a significant risk, only basic risk analysis methods were applied. PSA (2010) also identified a lack of knowledge and compliance with governing documents, as well as inadequate deviation treatment procedures. This included a lack of knowledge about risk management guidelines and quality assurance methods, as well as uncertainty regarding the interpretation of key concepts. Furthermore, deficiencies in documentation of the decision-making process were identified as prominent. This included little documentation for key decisions made in meetings and failure to use the Change Log, in addition to an absence of reproduction of deadlines, responsible personnel, and signatures in documents.

At the Macondo accident, several separate missteps and crucial elements lacked proper compliance, including that the cement was not adequately tested by the personnel on the rig. The Deepwater Horizon rig was reckoned by BP to be one of its safest rigs (Ryggvik, 2012). To draw a parallel to Reason's (1997) theory about the unrocked boat, this might be part of the explanation of how BP, as well as the organizations in the other accidents, could have failed to focus more on safety-critical issues. Significant time had passed since its last serious incident and the constant pressure for productivity and profit may have contributed to the disastrous situations; "[i]t is easy to forget to fear things that rarely happen, particularly in the face of productive imperatives such as growth, profit and market share" (Reason, 1997:6).

Although PTTEPAA's procedures themselves were inadequate, the company's personnel on the rig demonstrated a manifestly inadequate understanding of their content and knowledge of what they required. In fact, the inquiry discovered that none of the Montara wells (5) complied with the company's WCS.

In the analytical framework, compliance is linked to safety management and the PD process. This shows how the day-to-day organization actually acts in accordance with safety management and how this shift depends on the stage the organization is in. It also includes how safety management complies with the different stages in the practical drift. The reason for not complying with procedures and shifting to a rule-based logic of action when the situation demands it might have something to do with the Reason's (1997) unrocked boat theory, where one does not manage to shift to the right logic of action because one has drifted so far away from imagining the possibility for accidents to actually occur. Compliance is, of course, closely tied to the logic of action because compliance with procedures involves acting in accordance with a rule-based logic of action. Then again, as mentioned, this might not always be possible, as in the engineered stage where one might think that compliance and following a rule-based logic of action is not the best and safest way to act. At this stage, one might demand, unconsciously, that the competence of personnel in the subunits needs to comply with their own task-based logic of action to operate more safely and efficiently. When it comes to these accidents/incident, the way in which rules and procedures were complied with emerged in all stages. How they were complied with in the design stage clearly affected the rest of the operation process and how personnel felt almost forced to do things that were not in compliance with the organization's procedures.

4.5.2 Complying with regulators' requirements

An important aspect of compliance is how one manages to comply with all of the requirements established by the regulators and how this might affect the drifting towards failure. Regardless of whether the requirements are detailed or function based, they are still requirements that need to be acted upon.

As discussed, the Norwegian system has a framework and function-based set of requirements where how the organizations comply with them is more or less up to the organizations. The US system has a large number of detailed requirements that must be fulfilled and the Australian system is more function-based, but still has complicated and comprehensive requirements.

How the regulators organize their requirements and expectations of the organizations will also affect how well the procedures set by management function and how well they are complied with by the organization's subunits.

After an incident or accident, the regulator will also investigate and establish requirements. At least, this is the case in Norway and the US. In Australia, the regulator does not give instructions or orders, but makes recommendations to the Ministry.

The point being made in this section is that these requirements after investigations are often time-limited and come as additional requirements on top of the requirements organizations already have. This can lead the organizations and their subunits to feel more or less forced to take shortcuts to meet the requirements. These shortcuts can cut across what was intended. The move here is from a rule-based logic of action to a task-based logic of action, where shortcuts offer the solution to meeting the requirements within specified deadlines. As the practical drift demonstrates, this is when the risks gets higher and dangerous events can occur in the moving towards failure.

"Everyone must put everything else aside and concentrate on developing and implementing measures to help close the PSA's orders" (IRIS, 2011:90).

4.5.3 Section summary

This section has offered additional discussion of how the organizations and their subunits have complied with requirements and procedures. How one complies depends on how adequate the procedures are in the first place and how the drifting process from one stage to another clearly has an effect on how well organizations comply with the rule-based logic of action. This compliance is more or less determined by how adequate the procedures feel for the subunits and whether they feel forced to use their own logic of action and drift toward the failure stage.

5.0 Conclusion

This research demonstrated how important organizational factors are in an organization's drift from stage to stage to end up in failure. This thesis contributes to understanding how an increasing focus on key organizational factors (management, communication, competence, procedures, and compliance) helps in understanding how accidents in the offshore drilling industry can occur. These are essential issues that offshore drilling organizations need to address sooner rather than later. Even though one can claim that technical problems are the direct cause of an accident, there is a need to determine the potential for how a focus on organizational factors can eliminate or at least reduce the chances for technical failure because problems would be detected sooner, handled more properly, and eventually eliminated.

What the discussion in this thesis has shown is how the different factors also interact with each other and both affect and are affected by the practical drift process over the lifespan of an organization. The nature of relationships between organizations and their regulatory regimes also represents a key finding and an issue that needs to be thoroughly addressed by the industry.

How can organizations manage and communicate to avoid accidents such as these in the future? How do organizations secure the right type of competence for each job and work task? How can personnel organize their way through safety procedures so that the procedures are optimal for offshore drilling operations from a global perspective? How do organizations secure compliance between what they should do and what they actually do? Lessons can definitely be learned from these accidents and, in addition, this thesis aims to suggest in-common underlying organizational factors found across the accidents/incident, which hopefully will provide an even deeper understanding of how accidents like these can occur.

As has been shown in this thesis, no system alone is completely reliable when it comes to preventing accidents. We have discussed different regulatory regimes and at least three different ways of organizing - and still accidents have happened. The industry needs to keep this in mind going forward, always knowing the latent potential that something might go wrong. Only then will the industry be on the alert to do what is in its power to prevent accidents from occurring. Reason (1997) described this as the principle of the unrocked boat, Snook (2000) as the practical drift. It is essential to address the five organizational factors described here because these factors are considered barriers for preventing accidents from happening.

It is hoped that this thesis has made a contribution to the prevention of offshore drilling accidents. Further research should be undertaken with the intent to provide an even deeper understanding of how the underlying organizational factors affect the development of offshore drilling accidents.

This study has emphasized the importance of recognizing that an organization is always in motion, with different contexts and different degrees of couplings and complexity. It is only when organizations are aware of and acknowledge this fact that they can organize themselves in a safer way, without the effort affecting production and income in a significant way. Organizations must understand themselves and their subunits they must reduce the distance between various parties involved in the offshore drilling industry. Organizations must be willing to share learning points from past events, both internally and externally. They also have to increase their focus on communication's role in this important work. Organizations operate in different stages and must therefore have a proactive attitude toward the various subunits' ways of performing, which may require revision of current procedures. To encourage compliance with procedures and other requirements, the procedures and requirements must be meaningful and easy to understand for those executing them. This means that management must involve all the relevant parties in the design of these procedures and requirements, precisely to ensure a common understanding of what is needed and how to work to achieve internal and external goals in a competitive industry.

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