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High-Risk High-Reward: Hydrocarbon exploration in frontier markets – a safety roulette?

Master in Risk Management and Societal Safety
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Acknowledgment

This thesis process is best described as a journey. It has been challenging yet enriching to dive into this topic of safety management of hydrocarbon exploration in a developing country from the authority's perspective.

I would like to express my sincere gratitude to the Revolutionary Government of Zanzibar, specifically my informants. Thank you for allowing me to conduct my study in your beloved country and for having the confidence in sharing with me your development plans in this coming sector and I hope that assurance is perceived well placed.

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Abstract

In the high-risk high-reward industry of oil & gas, the prerequisite is a safety focused managed strategies and operation. Given Zanzibar's two other main income industries being offshore related, tourism and fishing, the decision makers need to pull off a rabbit of hat when introducing this new oil & gas industry in to their country.

In this complex system of hydrocarbon exploration there are elements in that system that compromise of technical, societal and environmental, each with its root causes for failure and successions. Taking into account these complexities, there is a need for safety case regime – a safety management system compromising identifying the potential hazards, hazardous events, designing control system and ensuring its effectiveness.

With the research question in mind, *How does a developing country government handle risk when exploring for hydrocarbon?* The focus is how safety management can be utilized in managing this sector with its socio-technical system where decision-making in the 'blunt-end' can result in discrepancies in the lower levels of the 'sharp-end' leading to conflict and information mismatch.

Understanding the concepts of safety management and the complexities it endures when taking in the context of the socio-technical system and its decision gates is vital to grasp the procedure of opening up for an oil & gas exploration in a frontier market. The concept of complexity in decision-making in a high-risk industry is the cornerstone of this paper.

The theories presented is to lay a foundation for what risks that might occur in developing this industry in a vulnerable society.

The research ambition with this paper is to make a contribution to the importance of highlighting safety management as a tool in the planning of hydrocarbon exploration.

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Definitions

Risk	Risk refers to uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something humans value (Aven & Renn 2010:3)
Vulnerability	Vulnerability is a system property that influences the consequences should an unwanted event occur. Reducing the vulnerability will therefore reduce the risk related to a hazardous event, whereas the opposite is not necessarily true. The attributes of vulnerability are sensitivity (to a certain type of stress) and adaptive capacity for accommodating change. Vulnerability is influenced by factors both internal and external to a system (Rausand 2011:60)
Uncertainty	Uncertainty refers to the difficulty of predicting the occurrence of events and/or their consequences based on incomplete or invalid data bases, possible changes of the causal chains and their context conditions, extrapolation methods when making inferences from experimental results, modelling inaccuracies or variations in expert judgments. Uncertainty may results from an incomplete or inadequate reduction of complexity, and it often leads to expert dissent about the risk characterization (Aven & Renn 2010:12)

Chapter 1 – Introduction

The hydrocarbon exploration, an international high-risk high-reward activity, the start of the oil & gas industry, has often been viewed as a value creation tool as it can reap benefit from being an underground asset to an economic gain. Given the asset creation tool it is, many countries in the world have sought after this *black gold*. It has given fuel to the technological advancement for most developed countries and given some countries the right incentive to reach development as in the sustainable goals of no poverty, health, infrastructure, education and so on (UN 2019). Given that oil & gas is accustomed as a technological advancement tool, Beck (1992) argued, the industrial and technical evolution of modern society has given rise to an era of risk production, which is global in nature but local in impact. In this risk society, the number of real and perceived threats continues to grow and take less transparent forms that exceed existing countermeasures (Høyland 2018:7). When the flow of technology crossing international borders increases, we will assume that risk also will be transferred and transformed in their new environment (Olsen & Lindøe 2009:743). As technology is transferred and take less transparent forms, (Njå, Solberg and Braut 2015:3), elucidate the mastery of risk is the mastery of the all-time riddle: what will the future be like? In modern times, this has been modified to: what is most probable that the future would look like? Rausand (2011:53) describes the risk as a game of Russian roulette. Whereas, the hazardous event, probability and consequence is all under one activity, e.g. as in when the Dutch discovered large gas reserves in 1959, i.e. the Dutch disease. They started with this hazardous event, the probability of gain became less as gas is a relatively capital-intensive business and the consequence prompted investment to rush out of the country, crimping future economic potential (The Economist 2019). Thus, given the short abstract of the possible (and impossible) asset creation from hydrocarbon, the illustration shows a need to manage this asset to create lasting benefit. In order to do so, the starting point need to be a sturdy foundation in place prior commencing on the development and operations of this new industry. Rasmussen & Svedung (2000:10) describe compared to the stable conditions of the past, the present dynamic society brings with it some dramatic changes of the conditions of industrial risk management.

When introducing an industry of this magnitude, a need for safety focus and regulation becomes more apparent. The safety regulation in the offshore oil and gas industry is to large extent goal-oriented, i.e. high level performance measures need to be specified and various type of analyses have to be conducted to identify the best possible arrangements and measures according to these performance measures (Aven & Vinnem 2005:15).

The focus on safety and a safe operation goes hand in hand with the extraction of those resources. With the recent example of an unsafe operation is the Deepwater Horizon blow- at the Mexican gulf whereas an uncontrolled blowout occurred on the Macondo field in April 2010, and resulted in a violent explosion and fire that killed 11 people and injured many more. The rig sank after two days, but the oil continued to leak from the well for a long time. More than four million barrels poured out before they managed to stop the leak 87 days later (Norwegian Petroleum Safety Authority 2014). If safety is not dealt with in operation it can lead to catastrophic consequences for people and environment. Possible risk scenarios comprise of the national – interest, safety, security, steering, management, transparency, capacity and competence (Al-Kasim 2006:246) summarises what a nation needs to look into beforehand a production and development. With that in account, safe operation is an element that the country needs to address prior to the opening of acreage for exploration.

To ensure that the petroleum industry takes important public interests into account and that resources are utilised as effectively as possible, the petroleum industry must be well organised, with clearly defined areas of responsibility (Norwegian Petroleum 2019).

1.1. Case country – Zanzibar

As the oil and gas exploration spur has increased in East Africa in the last 6 decades, the level of successful explorations has expanded. As the Revolutionary Government of Zanzibar located in the East African Coastal Basins where multiple explorations are taking place at the present moment, the topography of the basins disposes of huge deposits of marine based sedimentary rocks of high hydrocarbon potential (Zanzibar Policy 2016:9), increasing the appetite for potential findings. Zanzibar being the other part of the United Republic of Tanzania (URT), established in 1964, declared in 2009 through a high level discussion that came into conclusion for preparation to be made for Zanzibar and Tanzania mainland to manage oil and gas issue separately on each part respectively (Zanzibar Policy 2016:9). Given this, Zanzibar with its oil & gas upstream policy details that there is a need for an extensive exploration works to get a better understanding on the possible prospects of hydrocarbon resources, in potential size and structure for commercial feasibility. This including is securing their continental shelf through application for extended coastal state sovereignty, as Zanzibar includes most of their eastern area beyond the Exclusive Economic Zone (EEZ). This will then extend Zanzibar’s nominal boundaries and with it, the increased prospects of striking ultra-deep-water commercial hydrocarbons (Zanzibar Policy 2016:6). The possible prospects of hydrocarbon exploration are set to both onshore and offshore.

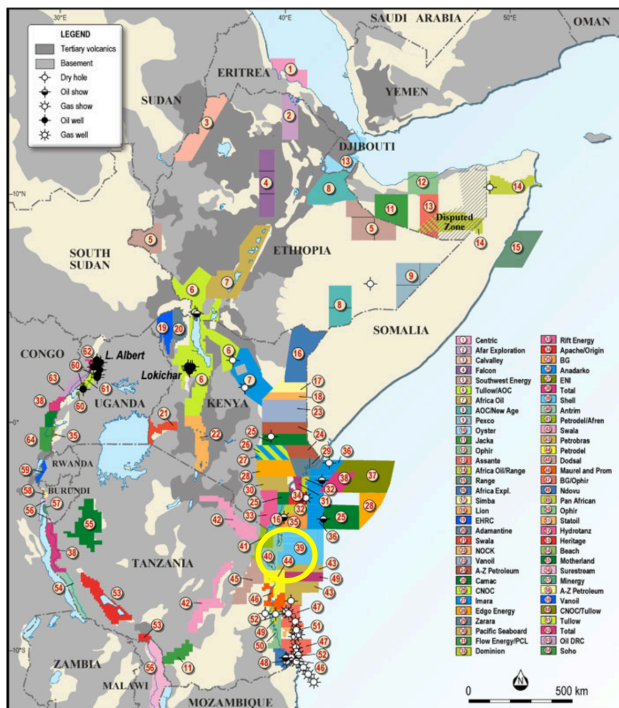


Illustration 1: Oil and Gas Exploration in East Africa (GEOXpro 2014)

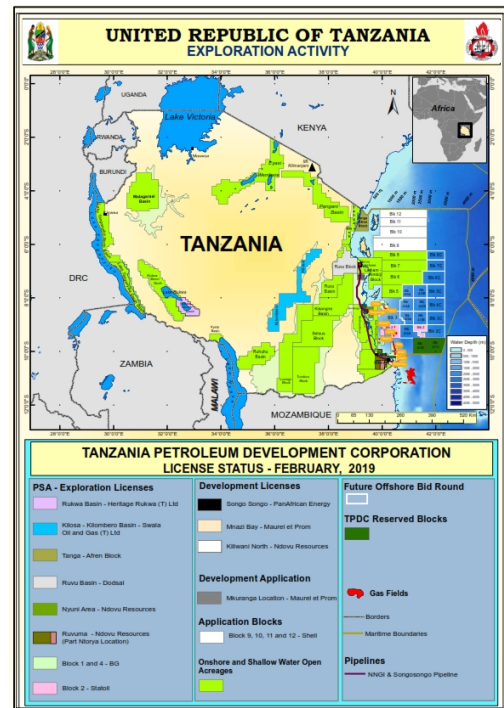


Illustration 2: Tanzania Activity Map 2019 (TPDC 2019)

Currently, there is one company that has concluded offshore seismic activity in one area of the possible acreage, RAKGAS – Ras al Khaimah-based state-owned company from the United Arab Emirates. Being relatively new in the game, Zanzibar is the young player that in the phase of building the petroleum industry has institutions that are just taking form to meet the coming industry.

With the given incentives and desires to develop a sustainable nation, most developing countries look into the notion of hydrocarbon potentials as a value creation tool for developing their country. With that in mind, there are various risks that arises with the start of this venture. In the case of the neighbouring countries most prospective discoveries have been gas. As the need for natural gas has increased in the world in this later time, gas exploration has become an industry in itself then just a by-product of the oil production. In any case the active involvement of the host country is essential for completing the complex and necessary set of agreements on gas sales (Al-Kasim, 2006:255).

With its complexities, exploration for natural resources can be seen as the backdrop of arising latent safety hazards that could occur in an already vulnerable developing country coping with various societal development challenges such as, amongst others, providing a sustainable infrastructure, energy, work, health and school to all citizen. By introducing this new sector of high-risk high-reward could in fact lead to a safety roulette jeopardising the current nature of sustainability but could, on the other hand, give the right incentive for a fast-paced development in the country to support the already challenged societal vulnerabilities.

1.2. My research proposal is therefore,
How does a developing country government handle risk when exploring for hydrocarbon?

The research problem embodies various underlying issues that needs to be addressed to give a comprehensive discussion on the question. The supporting research questions are:

1. What risk activities are associated with hydrocarbon exploration?
2. What kind of strategies do the authorities have to maintain safe operation?
3. How does the government institutions interact in this phase of petroleum industry development?

The aim of this paper is to highlight the dire needed focus on safety management as a means for developing a sustainable future in the aspect of hydrocarbon potentials as a value enhancing tool.

1.3. Limitations in the study

Given the complexities this topic represents, limitations will be added whereas the focus is firstly defined to this industry from an authority perspective and not from a company perspective. The industry activity is set to offshore activities, excluding onshore as onshore activities harbour other additional factors when developing this industry. As this research is viewed from the hydrocarbon exploration aspect, the future industry development is not included. Also, there also other elements of industry control that is not included, given the exploration phase, the self-regulation processes within companies participating in this industry and the set of requirements such as international standards (ISO-standards).

Other circumstances that are excluded from this research is safety culture aspect as that involves further in-depth study of institutional interactions. Political decision processes are omitted given its volume.

Context

This chapter presents the proposition to this paper on hydrocarbon exploration in the context of a developing country government perspective. When approaching this topic, there are certain aspects of the petroleum industry development in a country that needs to be explored.

Prior establishment of petroleum industry, there are various phases of this industry that needs to be addressed. During an opening process, all relevant arguments for and against petroleum activities in the area in question are taken into account (Norwegian Petroleum 2019:Petroleum act and licensing system).The intention is to show how the host country as the owner of the resources can interact with the licensees in the various phases of petroleum operations in order to enhance the value creation process (Al-Kasim 2006:149). The Petroleum value chain can be viewed as a government standard overview of the industry which enables the authority establishing this activity in their land to determine and process. This will give an overview of what can be expected and then create insight to the various hazards that might arise and needs to be addressed in this high-risk industry. Through good understanding of the hydrocarbon recovery process and enable a good safety management system gives good incentives for value creation. The focus on hydrocarbon exploration is based in the first two phases of the petroleum value chain, the pre-licensing phase and exploration phase. Based on the literature presented in this chapter, the petroleum value chain is as illustrated 3, below:

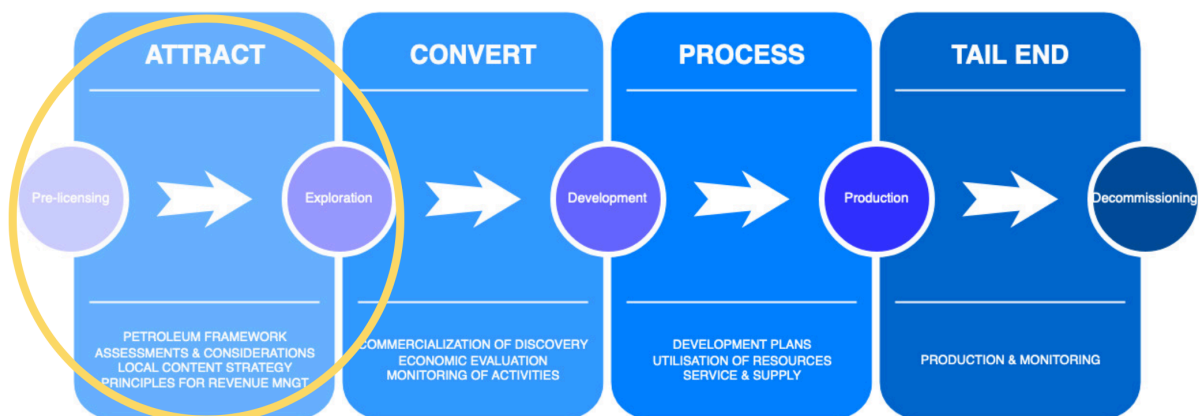


Illustration 3: Overview over the Petroleum Value Chain

The various stages of the petroleum value chain characterise the aspect of tools in safety management model presented in the Aven, Boyesen et.al (2016:70) adaptation of Rasmussen and Svedung's socio-technical system. Aven, Boyesen et.al (2016:73) describe the categories of the various forms within tools aspect as;

1. Laws and Regulation

This includes the including laws, regulations, rules, and other requirements set in place for the industry to meet and state actors described interaction (Aven, Boyesen et. al. (2016:73).

2. Guides, standards and supervision

As the industry development advances, structure is needed in the form of organisation, assessments, governance, management and decisions, supervision and control (Aven, Boyesen et. al. 2016:73).

3. Counselling and stimulation

Stimulation is about schemes aimed at individuals and organizations to stimulate these to move in a particular direction, thereby achieving desired safety. This includes incentives, motivation, coaching, exercises, training

I. Pre-licensing

In this first phase of the extraction, a foundation needs to be laid in order to ensure the proprietor reaps the benefit of this commodity. The first step is to dispose a national **petroleum framework** that ensures the proceedings for this industry. This is to ensure that petroleum resources in the country are efficiently converted into lasting benefit to the society. The key concepts in this definition are efficiency of operations and lasting benefit to the society (Al-Kasim 2006:133).

1. Laws and regulations

In the **petroleum framework** the regulatory principles are in place prior exploration – the state policy, acts, legislation, regulations, institutions and licensing strategies. This also includes various other factors that the country needs to **assess** to make considerations prior exploration. The impact assessment shall elucidate the consequences the opening an area for petroleum activities may have on commercial activities and environmental aspects, including the possibility of pollution and expected economical and social effects (NPD 2018). An environmental report, Strategic Environmental Assessment (SEA), is prepared in which the likely possible environmental effects of a proposed plan or programme, and in some instances also policies and legislation (Norwegian Ministry of Environment 2003:2). The environmental report and the results of the consultations are taken into account before adoption. Once the plan or programme is adopted, the environmental authorities and the public are informed and relevant information is made available to them. In order to identify unforeseen adverse effects at an early stage, significant environmental effects of the plan or programme are to be monitored (EU 2018). In all countries that has an interest in developing their possible petroleum resources, there are certain interest and expectation that will be met by civil society.

When it comes to allocation of contracts, perhaps the most common type of agreement world-wide is the so-called Production Sharing Agreement (PSA). The basic principle in this agreement is that the recovery of cost as well as the profit sharing between the contractor and the government takes place in the form of gaining access to agreed portions of the crude oil that is produced and saved by the contractor (Al-Kasim 2006:163). A PSA model stages are illustrated below:

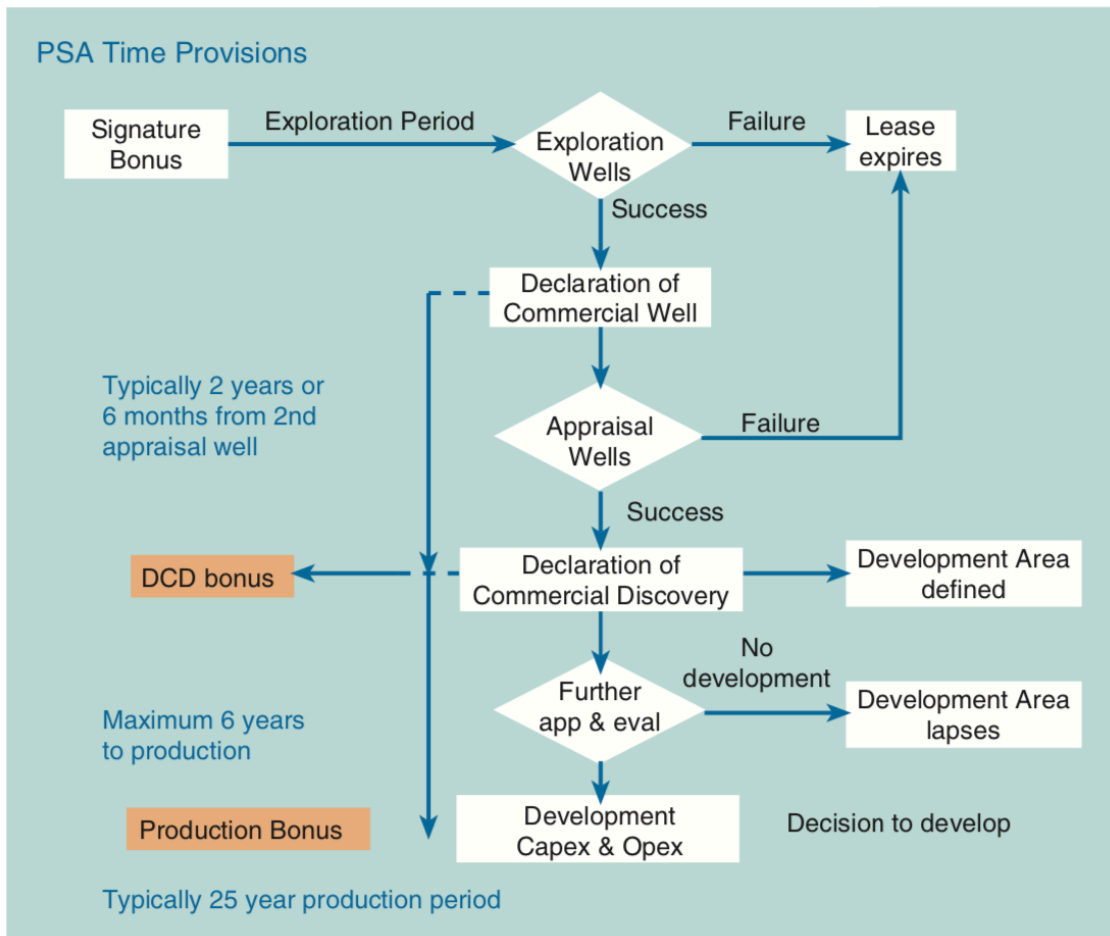


Illustration 4: Example of sequence of events in a PSA (Frank, et al. 2008:13)

2. Guides, standards and supervision

As the industry development advances, structure is needed for optimal gain of investment for the country. As the government invests time & resources to *benefit* from the possible non-renewable assets underground revenue management principle is vital. Among the most important clarifications that need to be provided by a host country to potential licensees are the fiscal terms for operations. A fiscal regime is intended to regulate the economic relationship between the government as the landowner and the investor as the licensee or the contractor. In designing a fiscal regime the host country should therefore aim at achieving optimal balance between incentives to the oil companies on one hand and net returns to the host country on the other. It should be pointed out that the net returns to the country are not exclusively financial. The returns embrace intangible as well as example of tangible benefits accruing to the society from petroleum operations. An example of intangible

benefits is the technological transfer that occurs as a result of petroleum operations and the institutional development associated with them (Al-Kasim 2006:166-167). In Norway for example, direct and indirect petroleum-related activity is the growth of the service and supply industry. The Norwegian service and supply industry consists of more than 1100 companies providing goods and services in all stages of the value chain, including for example seismic and rigs, engineering services and drilling rig equipment, valves, nuts and hoses for yards, advanced offshore supply and service vessels, subsea technology and offshore maintenance services (Norwegian Petroleum 2019:The service and supply industry). The illustration below highlights the possible development from petroleum operations:



Illustration 5: Direct and indirect petroleum-related activity (Norwegian Petroleum 2019)

This pre-licensing phase is a crucial start-point to the government as it lays the incentives for the other phases to come. This phase marks the starting point for the government to ensure a good resource management that will benefit the social

framework in the country. To the host country, petroleum operations can be the stimulus to industrial development, employment, upgrading of the infrastructure, civic development, development in education and so on (Al-Kasim 2006:156). In other words, ensuring a good resource management is the crucial first stage in developing a safe industry and that the catalyst for development.

3. Counselling and stimulation

When it comes to a **local content strategy** is an approach that most government relate to, ensuring the public of their perception of the petroleum industry. It aims to leverage the extractive value chain to generate sustained and inclusive growth through economic diversification and employment opportunities (WB 2016). As this industry, as experienced globally, represents direct and indirect petroleum-related activity in a country, the expectations are high among the local people as it might generate direct additional income and the expectation is even more so when *the oil strikes* at a developing country.

II. Exploration

1. Laws and Regulation

In the start of exploration, the country has made some preparations to meet the industry prior the start of a possible extraction and development. As the petroleum industry preparations are established, heretofore, the following phase is the exploration phase. In this phase of industry advancement, the **commercialisation of discovery** is to be established to generate laws and regulation. In the first stage, to confirm discovery, a mapping of prospective acreage needs to be done to confirm (positive) results. If the results of the early geological and geophysical studies are positive, further seismic survey across major basins and sub-basins will be carried out to assess these on individual basis (Al-Kasim 2006:151). Seismic data acquisition is used to map potential petroleum resources in the subsurface. The seismic acquisition activity is mainly conducted by the oil and subsea seismic companies (NPD 2019).

2. Guides, standards and supervision

During the seismic acquisition, in Norway particularly, a fishery expert joins the vessel. The fishery expert plays a very important role as adviser to the management on the seismic vessels. The fishery expert shall contribute to creating understanding between the industries, as well as contribute to good coexistence at sea. He/she must act objectively towards the players (NPD 2019). Once the acquisition of data through a seismic survey is completed, the data interpretation is concluded, the 2D & 3D seismic is given to the government for own interpretation of data. The government can then analyse the data and have their own understanding of the possible potentials in their land. The data obtained from the above-mentioned surveys are very valuable to the host country in designing both the general petroleum policy and specific terms of licensing round. In addition, the data are of potential value to interested applicants once the perspectivity of the country has been acknowledged by the petroleum industry.

3. Counselling and stimulation

Under favourable circumstances the host country can eventually recover the cost incurred in collecting the data by selling it to interested oil companies (Al-Kasim 2006:151). Following the data acquisition and interpretation, construction of detailed maps is outlined, a test drill is regularly suggested by the operating company to confirm a possible discovery of the extent and volume of hydrocarbons. This process is to confirm the commercialisation of discovery. Once the extent and volume are defined, the need to determine profitability follows by a revenue evaluation of explored wells. This gives the proprietor a room for **assessing the economic merits** of developing the discovery in terms of costs and potential benefits.

Monitoring of petroleum activities by approving further testing and suggest / approve alternative plans for drilling gives an opportunity to establish (update) the regulation of plans and selection of technology for the development phase.

Chapter 3 – the Theoretical Framework

This chapter presents the various theories and models that reflect the importance of safety focus and management of the high-risk industry it represents. When accidents are considered, the aspect of safety management as a theoretical framework is often utilised and the causation mechanisms it represents. These theories have importance to elucidate the research problem stated with the supporting research questions.

Setting a theoretical framework on this topic on hydrocarbon exploration in a developing country from the authority's perspective, there are various theories that need to be addressed to cover the topic fully. In order to govern this high-risk oil & gas industry, the framework in this theory chapter is the focus on safety management of having the right tools and measures to govern this industry as its operation comes with various active failures that can lead to accidents given the latent conditions present in the system. The interaction of the government institutions involved is also included as this can give room for uncertainties in operation. The socio-technical theory takes hold on the interaction between the decision-making level, 'the blunt end', and the operative level, 'the sharp end', on how they interact when it comes to safety management and the migration of boundaries of acceptable performance. This involves information processing and awareness of possible errors that can occur thus establishing a high reliability structure of awareness in the organisation of this industry from a government point-of-view.

1. Roots of organisational accidents

Latent conditions and active failures

The aspect of organisational accidents was presented by James Reason (1997) which draws on the distinction between human error and organisational failures. Since people design, manufacture, operate, maintain and manage complex technological systems, it is hardly surprising that human decisions and actions are implicated in all organisational accidents. Human interaction is in all systems, given our human nature, actions with errors can have direct impact in the system of operation. Reason distinguishes between the causation of the determining factors of accident as active failures and latent conditions. Active failures are

defined as 'the sharp end' of the system whereas an unsafe act trigger a direct impact on the safety of the system. These direct impacts in the 'sharp end' is described as the operations in the system where the actor steering on the direct impact such as pilots, control room operators, maintenance personnel etc. Latent conditions on the other hand is hibernating failures, vulnerability in the system, that that may be present for many years before they combine with local circumstances and active failures to penetrate the system's many layers of defences. They can arise from strategic and other top-level decisions made by the governments, regulators, manufactures, designers and organisational managers (Reason 1997:10). In a high-risk industry such as the oil and gas industry where active failures can happen every day. As all systems harbour latent conditions; an accident simply makes them manifest (Reason 1997:236). This illustrates the need for a strategic approach to accident prevention mechanisms to safeguard the system – to handle the vulnerabilities. Therefore, the more exhaustive the inquiry, the more latent conditions it will uncover (Reason 1997:236).

High hazard systems may employ several levels of defences in order to bring the total calculated risk to an acceptable level (Kjellén, 2000:85). This is referred as 'defence in depth' and illustrated by Reason in the 'swiss cheese model'. The nature and variety of defences is to serve multiple functions. Reason defines this as 'defence-in-depth' where successive layers of protection, one behind the other, each guarding against the possible breakdown of the one in front. All defences are designed to serve one or more of the following functions (Reason 1997:7):

- to create *understanding* and *awareness* of the local hazards
- to give clear *guidance* on how to operate safely
- to provide *alarms* and *warnings* when danger is imminent
- to *restore* the system to a safe state in an off-normal situation
- to *interpose* safety barriers between the hazards and the potential losses
- to *contain* and *eliminate* the hazards should they escape this barrier
- to provide the means of *escape* and *rescue* should hazard containment fail

With these kinds of preventions in mind having an engaging safety system for the hydrocarbon exploration in Zanzibar could give the upcoming oil & gas industry management

awareness in the form of creating the right policies, legal framework, institutional set-up, culture for reporting of failure to create a robust organisation to safekeep the society, environment and so on from the harm this high-risk industry imposes.

2. Safety Management as a tool and model

The term safety is often used as preventive measures where the intention is to reduce the likelihood of something unwanted to occur or reduce the consequences of unwanted events. Safety is also used in a wider sense, as the ability of a system to avoid damage and loss. The safety concept has also several facets. Safety can be related to the physical environment, such as technological systems, products and the environment in general. Safety can be related to human and social factors, the human behaviour, the structure and functioning of organizations, or the politics and decisions of society. Safety can also be linked to different levels, such as individual, organization and society, or to different phases of a process, such as planning / design, implementation / operation and changes / settlement. Individuals, interest groups, private companies, government agencies - all can to a greater or lesser extent influence and control safety. We can influence safety through our actions and the choices we make (Aven, Boyesen et.al 2016:16). In the oil & gas industry a safety management system is used to ensure no harm is caused in implementation and whilst in operation. For a government that is to start a high-risk industry a proactive approach to safety management is needed.

Aven, Boyesen et al.2016 state that a model on safety management is a tool for mapping and managing safety. It provides as a guide on how to enact a safety system to reduce vulnerability, latent condition, in the system through managing this new industry. Once established a basis for a safety management in operation, the need for the right tools and measures is crucial to institutionalise. This needs to enact with the set framework given in advance. The instruments in the framework needs to address the components of the given incentive to start the new industry, enhancing the society from a developing country status. Aven, Boyesen et. al (2016:68) addresses in the safety management model three main elements: Goal, tools and framework conditions.

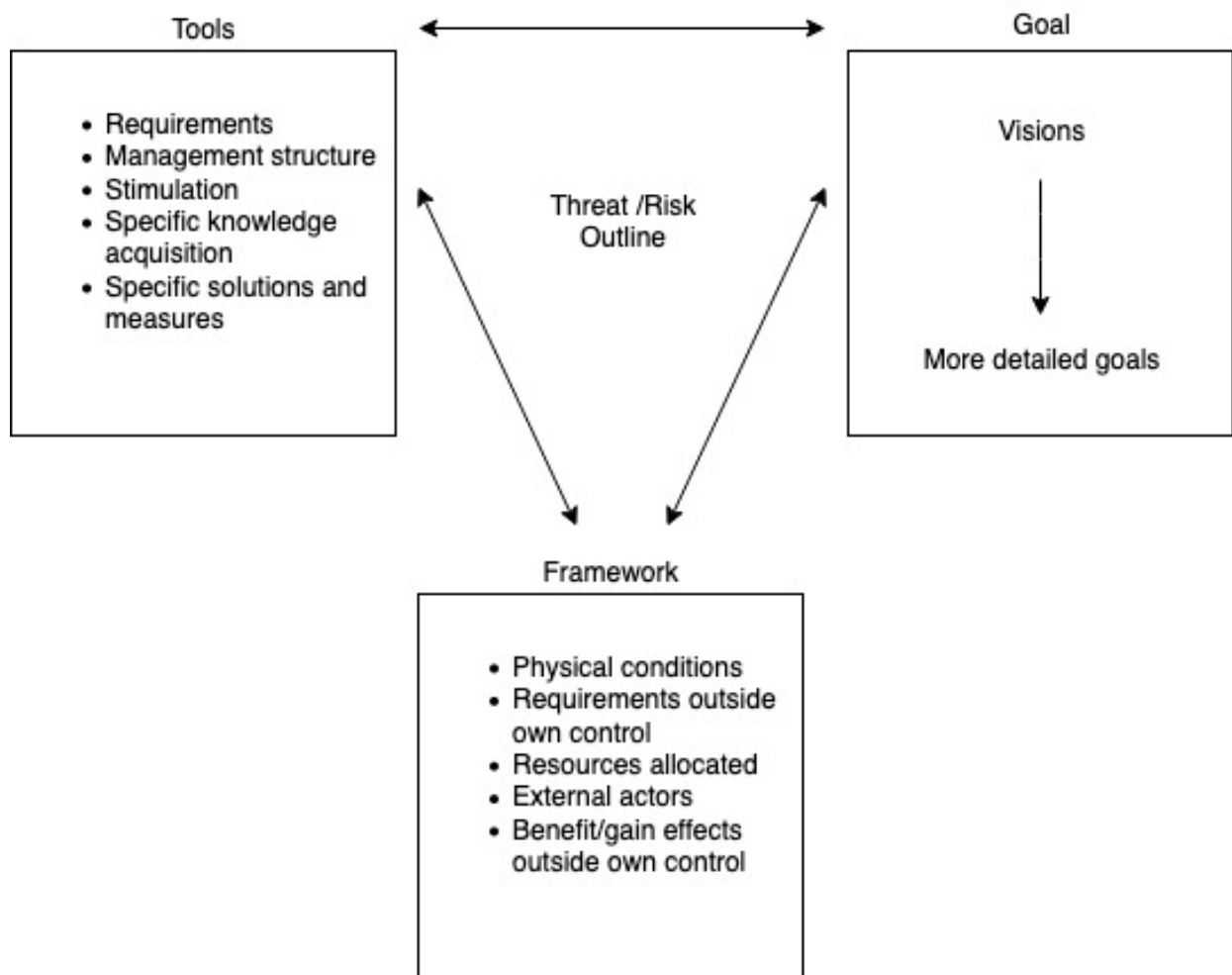


Illustration 6: Safety management model

Aven, Boyesen et al. 2016 describe the safety management model in three interactive phases of goal (vision), tools (measures) and framework. The set condition of **framework** is normally placed in the limitations of human, technological and physical constraints, natural conditions, laws, social norms and time constraints. Within the framework in Zanzibar, the aspect of keeping safe management of operations is that the government steer the oil & gas industry in the direction that benefits the people living in the country and safekeeping the environment.

The steering route in the safety management aspect is stating a **goal** with the operation. It must be clear which 'success criteria' the results will be considered for. The 'success criteria' can be based on values such as economic, life & health, environmental etc. Content is

important factor to the measure of value, and only then can the goals be an aid in prioritizing resources (Aven, Boyesen et. al. 2016:70). Establishing a safety goal is an objective for the authority to reach for the society in this high-risk industry. Safety goal is a dynamic and future oriented process to achieve through planning, maintenance and advancement, and in the case of hydrocarbon exploration in Zanzibar, the goal is to ensure a sustainable developing through the economic gain from these resources.

Through tools and measures in the safety management system, there are endless of instruments to strengthen the safety in operation and they are of different aspects. Aven, Boyesen et. al. (2016:73) Categories of the various aspects; a

1. **Requirements**, including laws, regulations, rules, and other requirements.

Whereas the authority, in the case of Zanzibar, shapes the preferred laws and regulations for the industry to meet and frame the internal interaction amongst the state actors.

2. **Management structure and exercise**, including organization, planning, governance, management and decisions, supervision and control

Focus on the establishment of appropriate systems for management and governance related to the use of the other categories of instruments, such as:

- i. design of goals and visions
- ii. design appropriate solutions and measures
- iii. use of various forms of analyses and assessments to assess their goodness
- iv. use of stimulation measures, such as incentives

3. **Stimulation**, including incentives, motivation, coaching, exercises, training

Stimulation is about schemes aimed at individuals and organizations to stimulate these to move in a particular direction, thereby achieving desired safety. This can be anything from incentive schemes to HSE campaigns. In the case of hydrocarbon exploration in a developing the incentives could be a better framework condition for companies to come and invest in their country. These incentive schemes could be particularly heightened when there is a regional 'competition', when neighbouring countries are at the start phase of the petroleum industry and the geological appetite can swing towards any other countries present at the continental rift. Additionally, to

stimulate the state actors to be concurrent. Training and exercise can mean focus on the authority's capacity and competence to meet the industry.

4. **Specific knowledge acquisition**, including analysis, research, accident investigation and other tools for increased insight and decision support.

Knowledge acquisition comprises on how the various measures and solutions work together to increase knowledge and insight to the sturdiness of the safety system.

5. **Specific solutions and measures**, including technical, organizational and operational measures.

Knowledge, insight and experience in all three areas are a prerequisite for success.

Produced here are solutions and measures implicitly and explicitly designed to reduce risk and vulnerability. This is specifically crucial in the oil & gas industry which stimulations are given for seek the safer solutions in all aspects whether it is technological, organisational or operational.

These categories both overlap and are dependent of each other such as regulations that require certain technological solutions. For example, as in the oil & gas industry, there are certain technological solutions are preferred during exploration to that triumph over other solutions given the environmental condition in the acreage of exploration.

3. Distributed levels of decision-making

The oil & gas industry is a complex system with many layers of processes and decision-making commands. Brehmer (1991) writes that in a complex system, many activities take place in parallel. At a given moment, each actor may have incomplete or inaccurate knowledge about the state of the system and the ongoing activities. A system is characterised by distributed decision making to the extent that it lacks a centralised decision-maker and each decision-maker has a model and information of a limited part of the problem (Rosness 2010:81). The dynamic measurements in managing a safety system with its possible latent conditions and engaging active failures, creates a need to handle what might occur such as further uncertainties in operation if not monitored. As the oil & gas industry includes the involvement of many government actors, this can create complication in the aspect of decision-making,

information flow and high reliability structure of awareness in the organisation of this industry.

4. The Socio-technical System

A good representation of system interaction of many actors is the socio-technical system presented by Jens Rasmussen (1997). The socio-technical model comprises on how a technological system consists of interaction between actors at different levels with self-directed actions (Engen et. al. 2017:149). The control of risk, as well as the production of accidents, takes place at many levels, ranging from political systems to individual operators and even technical systems (e.g., automatic process control and safety systems). Each level can influence each other in an integrated and tightly coupled system. Higher levels can influence lower levels through, e.g., explicit instructions, by the provision and limitation of resources, by establishing incentive systems, or by determining how decisions are to be made at lower levels. On the other hand, lower levels may use discretion when they interpret and implement directives from higher levels, they may control the information flow to higher levels, or they may bypass a level and direct a lobbying effort at the level above (Rosness 2010:83).

The migration model, presented below, show how actions within one activity may change the boundary of acceptable performance for another activity. Adaptation in a complex organisation, where several actors are migrating more or less independently within the space of acceptable performance. In practice, individual freedom and these persistent variations do not constitute a legislator or management to set limits on action and measures. Individuals at all levels will have to set limits on their own behaviour in light of the freedoms the system provides, and the situations they are put into (Engen et. al. 2017:148).

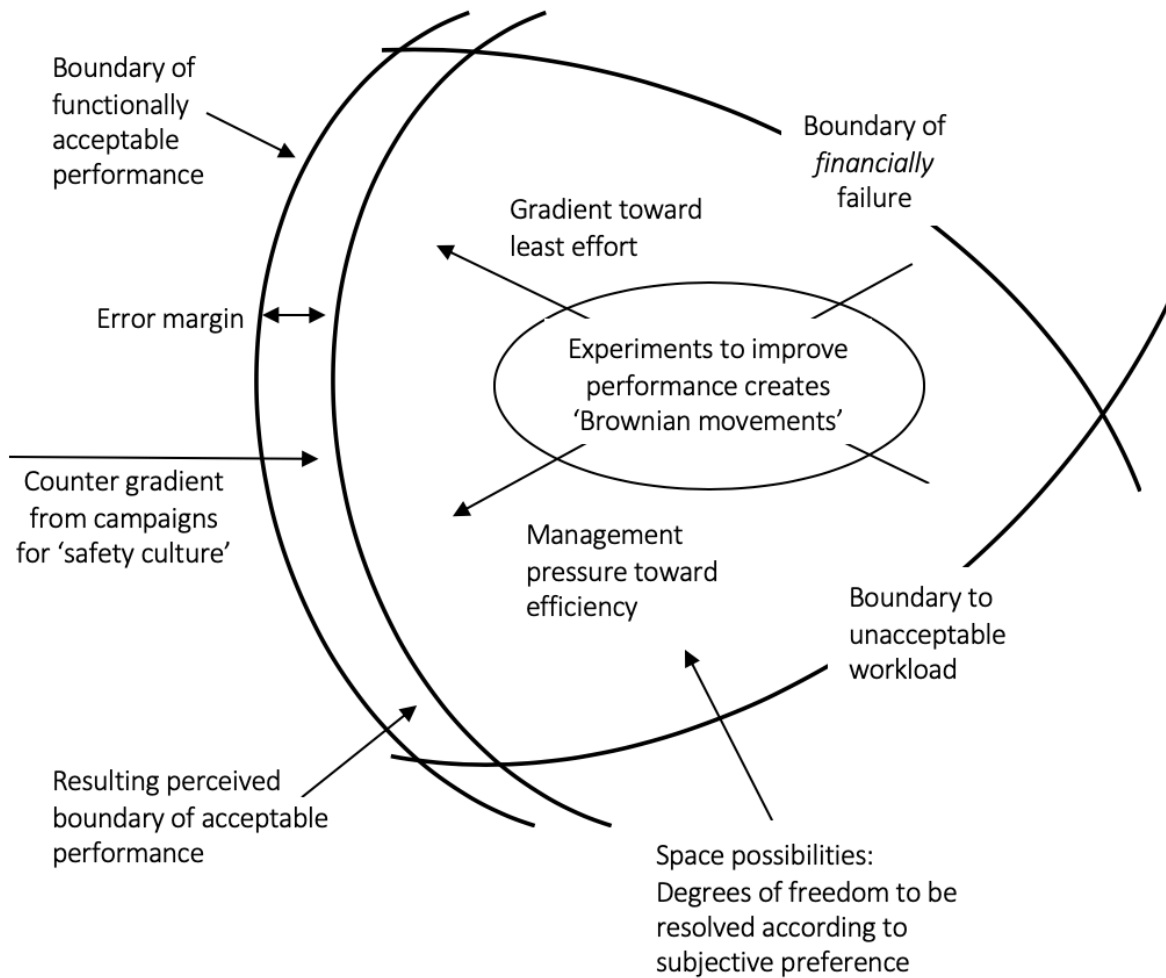


Illustration 7: The migration model (Engen et. al. 2017:148).

Rasmussen (1997) theory on the socio-technical system presenting the dynamic interaction in decision-making in between level on the 'sharp end' and on the 'blunt end'. With the various levels of actors and the interaction it entails, information flow it generates can create unsafe operation if not properly addressed. With this, a level of conflicting objectives can be met. Many levels of politicians, managers, safety officers, and work planners are involved in the control of safety by means of laws, rules, and instructions that are verbal means for the ultimate control of some hazardous, physical process. They seek to motivate workers and operators, to educate them, to guide them, or to constrain their behaviour by rules, so as to increase the safety of their performance. Compared to the stable conditions of the past, the present dynamic society brings with it some dramatic changes of the conditions of industrial risk management (Rasmussen & Svedung 2000:10). When it comes to exploration, there are

multiple government actors involved in developing the petroleum industry in the country. The various actors and their various responsibilities open up for conflicting objectives in this process. The government is interesting in opening for the industry as it could generate more income and other government actors would be cautious given the safety aspect of it such as environmental considerations that need to be met. Safety is an objective that may conflict with other objectives. The conflicts are rarely conspicuous or distinct in terms of clear choices, but day-to-day adaptations will, directly or indirectly, be subject to pressures or gradients stemming from different objectives. From a safety viewpoint, the danger is that safety is gradually sacrificed in relation to other objectives (Rosness 2010:93).

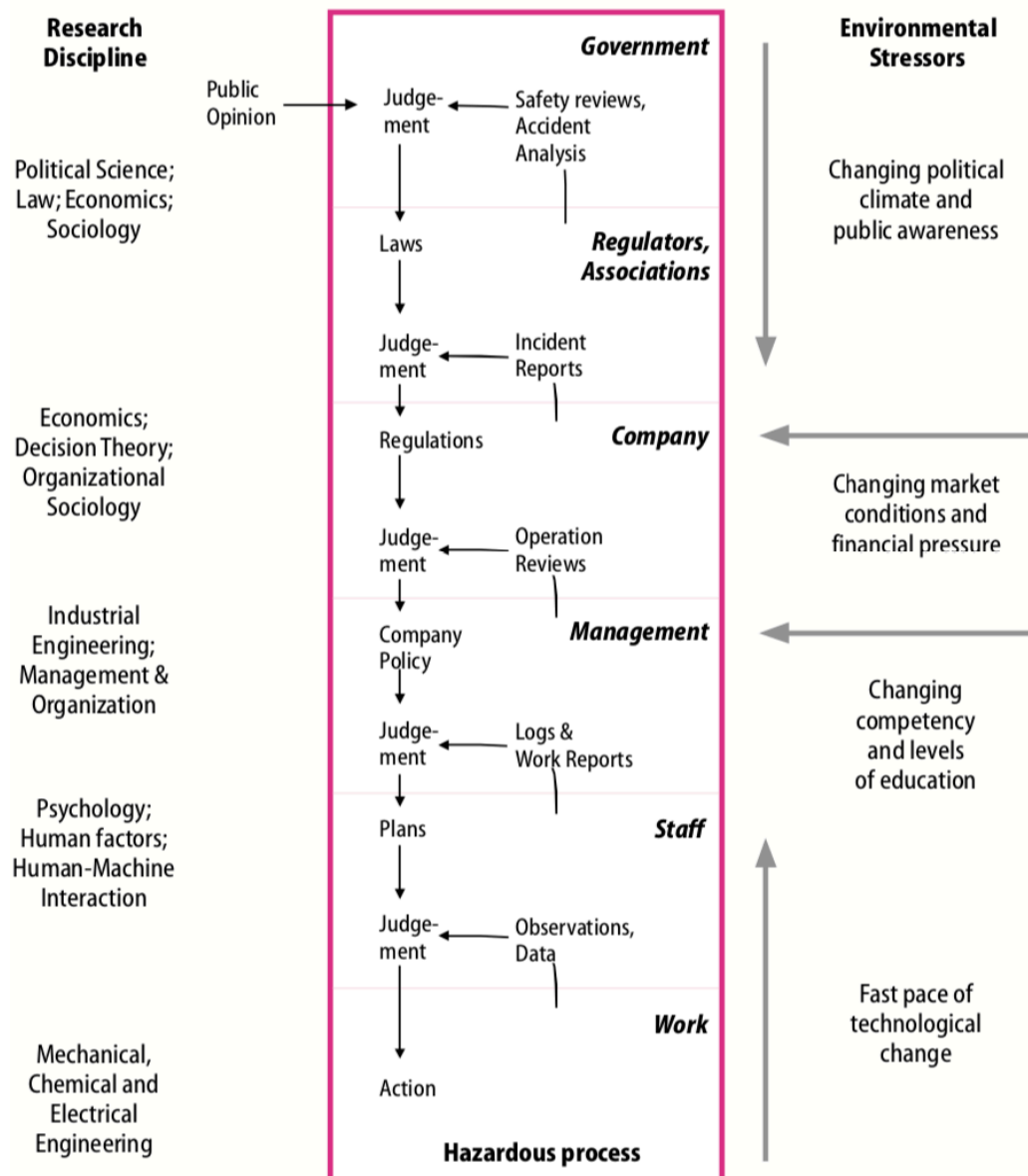


Illustration 8: Many nested levels of decision-making are involved in risk management and regulatory rule making to control hazardous processes. This social organization is subject to severe environmental pressure in a dynamic, competitive society. Low risk operation depends on proper co-ordination of decision making at all levels. However, each of the levels are often studied separately within different academic disciplines (Rasmussen & Svedung 2000:11).

With these conflicting perspectives, gives a room for increased vulnerability in the system. Rosness (2010:85) describes the conditions under which actors make decisions strongly influence the decision processes and outcomes. We thus expect decision criteria, procedures, and outcomes to be related to (1) how close an actor or decision forum is to the hazard and (2) the level of authority of the actor or forum. These relationships are complex, since decision-makers also adapt to circumstances not covered by these two dimensions. In order to illustrate the logic of the model, we will consider routine operations in some detail. Actors at a low level of authority and close to the hazard, such as drivers, process operators, and ship crews, often experience uneven workloads because their tasks are event driven. Their decision making is often constrained by limited situation awareness (Woods et al., 1994). They may not receive the requisite information to build a complete and updated model of the situation, they may not have enough free information processing capacity to maintain an updated system model, or they may lack mental models that adequately represent the properties of the larger system. (Brehmer, 1991; Rasmussen, 1997). These classes of decision-making are illustrated below (Rosness 2010:86):

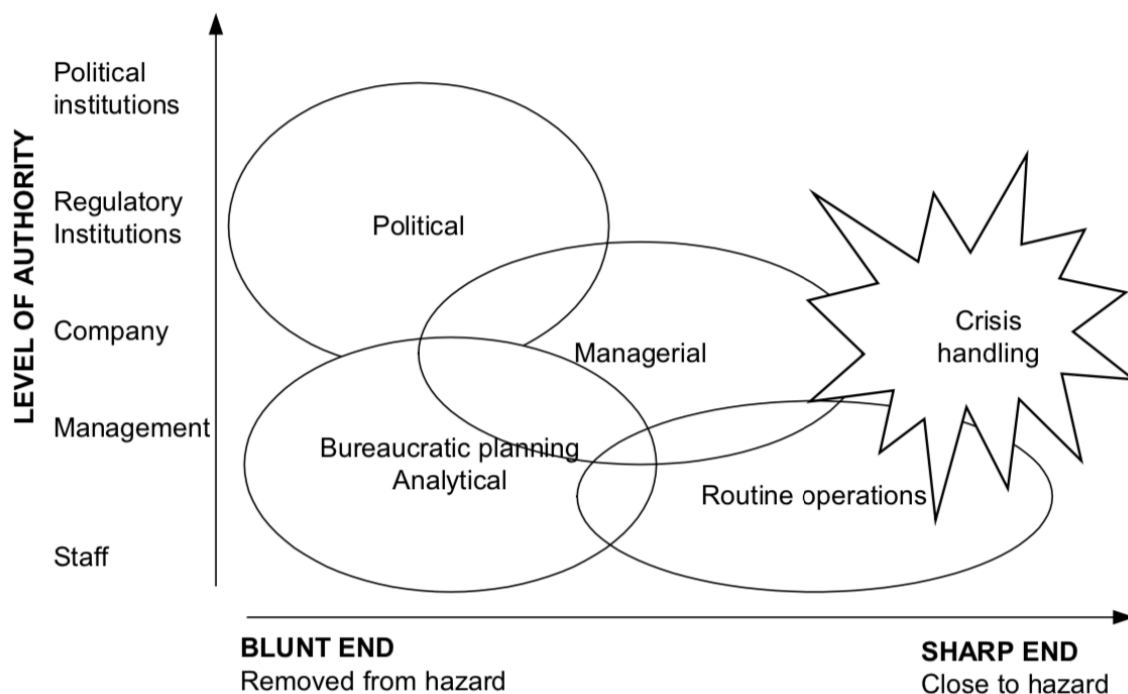


Illustration 9: Classes of decision-making

In the table xx below highlights the figure xx above of the actor interactions. It is expected that the various types of decision setting to face other constraints, and to adapt by focusing on different decision criteria (Rosness 2010:87).

Decision mode	Dominant constraints	Dominant decision criteria	Typical problems
Political	Conflicts of interest	Robust consensus	Inconsistency Non-optimal decisions Erosion of safety margins
Managerial	Information processing capacity	Find an option that is good enough (satisficing)	Inadequate problem definitions Stick to SOP Erosion of safety margins
Analytical & Bureaucratic	Hands-on knowledge	Comply with rules & standards Optimise selected attributes	Unrealistic assumptions Deficient models Erosions of safety margins
Routine operations	Workload Situation awareness	Smooth, efficient operation Optimise workload	Slips Miss warnings Local rationality Erosion of safety margins
Crisis handling	Stress Time to obtain information and act	Avert catastrophic outcomes Avoid extreme stress levels	Defective coping if danger materialise

Table 1: Dominant constraints, decision criteria and typical problems in different decision modes.

These decision-making processes create complexities in the safety performance (Aven & Renn 2010:25).

5. Failure of foresight

To safekeep a complex system, understanding root causes is crucial. In discovering the root of accidents, Turner (1976) has a different approach on the matter on how organisational accidents occur. Through the interactions in the human interplay of the socio-technical system, Turner defines this as the root causes of organisational accidents through the unnoticed information flow discrepancies in the system about hazards. In this theory Turner man-made disasters describes six critical stages where the process of leading to accident is presented in table 2: (Rosness 2010:70).

The sequence of events associated with a failure of foresight: (Turner 1976:381)

<p>Stage I</p>	<p>Notionally normal starting point:</p> <p>(a) Initial culturally accepted beliefs about the world and its hazards:</p> <p>About the world and its hazards are at this point sufficiently accurate to enable individuals and groups to survive successfully in the world. This level of coping with the world is achieved by adhering to a set of normative prescriptions.</p> <p>(b) Associated precautionary norms set out in laws, codes of practice, mores, and folkways</p> <p>This level of coping with the is achieved by adhering to a set of normative prescriptions that are consonant with accepted beliefs. Such prescriptions about the precautions necessary to avoid recognized hazards are embodied in laws, codes of practice, mores, and folkways. When unfortunate consequences follow on a violation of these sets of norms, there is no need for any cultural readjustment, for such an occurrence serves to strengthen the force of the existing prescriptions.</p>
<p>Stage II</p>	<p>Incubation period: the accumulation of an unnoticed set of events which are at odds with the accepted beliefs about hazards and the norms for their avoidance.</p> <p>A chain of discrepant events develop and accumulate unnoticed. For this to happen, all of these events must fall into one of two categories: either the events are not known to anyone or they are known but not fully understood by all concerned, so that their full range of properties is not appreciated in the same way that they will be after the disaster (Lawrence 1974). In this incubation stage the failure of foresight develops.</p>

Stage III	<p>Precipitating event: forces itself to the attention and transforms general perceptions of Stage II</p> <p>Such an event arouses attention because of its immediate characteristics. For instance, the train crashes, the building catches fire, or share prices begin to drop. More significantly, the precipitation incident also makes it inevitable that the general perception of all the events in the incubation period will be transformed, by offering criteria the identify the incubation network of events so that the process of transforming the ill-structured problem into a well-structured problem may begin.</p>
Stage IV	<p>Onset: the immediate consequences of the collapse of cultural precautions become apparent</p> <p>The precipitating event is followed immediately by the onset of the direct and unanticipated consequences of the failure, an onset which occurs with varying rate and intensity, and over an area of varying scope (Carr 1932).</p>
Stage V	<p>Rescue and salvage – first stage adjustment: the immediate post collapse situation is recognised in ad hoc adjustments which permit the work of rescue and salvage to be started</p> <p>The stage of rescue and salvage, in which rapid and ad hoc redefinitions of the situation are made by participants to permit a recognition of the most important feature of the failure and enable work of rescue and salvage to be carried out.</p>
Stage VI	<p>Full cultural readjustment: an inquiry or assessment is carried out, and beliefs and precautionary norms are adjusted to fit the newly gained understanding of the world</p> <p>When the immediate effects have subsided, it becomes possible to carry out a more leisurely and less superficial assessment of the incident, and to move toward something like a full cultural adjustment of beliefs, norms, and precautions, making them compatible with the newly gained understanding of the world.</p>

Table 2: The sequence of events associated organisational accidents

For an organisation to gain control over system it must be able to take as many distinct actions as the observed system can exhibit.

With these aspects of information flow which can lead to discrepancies in the system, the notion of creating resilience as preventing measures in the system speaks louder. The need to create awareness in the system is thus crucial in a safety aspect.

Summary

In this notion of creating a safe management system for this industry from a government perspective, primarily the exploration phase, the various theoretical aspects create as a backdrop for the coming chapters of results and discussion. Latent condition is a vulnerability in the system that is yet to be discovered given the poor routines that lead up to creating this vulnerability. Vulnerability can be reduced through safety management approach with a cognitive understanding on triggering factors to latent conditions that could lead to an organisational accident in the context of the authority's approach to the management of the hydrocarbon exploration in Zanzibar. Establishing effective systems to capture and constantly analyse vulnerabilities, thus, creates cognitive understanding of this hydrocarbon exploration system.

Chapter 3. Research design and Methodology

To grasp and understand the research proposal of how a developing country handle risk when exploring for hydrocarbon potential, a research methodology is needed to uncover the phenomena.

Research strategy - selecting the research methodology

Research strategies provide a logic, or a set of procedures, for answering research questions, particularly 'what' and 'why' questions. As the social science have developed, a number of ways of doing this have emerged. The research problem at hand to be answered needs exploring through various methods and in this chapter, the methodology to be used to uncover will be presented. The definition of methodological approach is described by Mills as methods are the procedures used by men trying to understand or explain something (Blaikie, 2000:8). Qualitative method is used an information collection to undercover the phenomenon of the research proposed.

The allure of qualitative research is that it enables you to conduct in-depth studies about a broad array of topics, including your favorites, in plain and everyday terms. The definition qualitative research is considered to cover; studying the meaning of people's lives under real-world conditions, representing the views and perspectives of the people in a study, covering the contextual conditions within which people live, contributing insights into existing or emerging concepts that may help to explain human social behaviour and striving to use multiple sources of evidence rather relying on a single source alone. In other words, qualitative research is driven by a desire to explain these events, through existing or emerging concepts (Yin 2011:6-7). Qualitative method is used aimed at providing interpretation to answering the research problem in mind: How does a developing country government handle risk when exploring for hydrocarbon?

As the research problem aims at uncovering how the authorities handle risk, the construction of their reality quickly becomes the focus and through that, abductive research is chosen as the strategy to disclose. Blaikie (2010:19) describes abductive strategy starting-point is the

social work of the social actors being investigated: their construction of reality, their way of conceptualizing and giving meaning to their social, their tacit knowledge. This can only be discovered from the accounts social actors provide. Their reality, the way they have constructed and interpreted their activities together, is embedded in their language. Hence, the researcher has to enter their world in order to discover the motives and meanings that accompany social activities. The task is then to redescribe these motives and meanings, and the situations in which they occur, in the technical language social scientific discourse. Thagaard (2018:198) illustrates abductive strategy as an approach means that the theory is developed on the basis of systematic and in-depth analyses. The importance of an empirical foundation is crucial because theorizing that is not based on data can easily be mistaken and contain weaknesses. Abduction can also be linked to the researcher's theoretical background providing perspectives for interpretations of the data's meaning content. Thus, the abductive strategy focuses on the intensions and interpretations of the actors interviewed, how they describe their everyday life, this approach on assists in enlighten the research problem.

Research design

A research design is an integrated statement of and justification for the technical decisions involved in planning a research project (Blaikie 2010:15). Starting with a research proposal on hydrocarbon exploration in a developing country quickly developed to view the topic from an authority's perspective. The shaping of the research problem slowly took place as the level of information flourished. However, the aspect of hydrocarbon exploration in a developing country was immutable. To discover the ray of this topic a research method was established.

Data collection

The choice of data is considered the core activity in a research. The data collection is defined as cross-sectional, confined to the present time (Blaikie 2010:201). In the collection of data both aspects of primary and secondary data have been utilised.

Primary data are generated by researcher or researchers who is/are responsible for the design of the study, and the collection, analysis and reporting of the data. These are 'new' data used, to answer specific research questions. Research questions identify what the

research wishes to achieve, and a research design should make it very clear what activities are to be undertaken (Blaikie 2010:8). The researcher can describe why and how they were collected.

Secondary data are raw data that has been collected by someone else, either for some general information purpose, such as a government census or other official statistics or for a specific research project (Blaikie 2010:160). Secondary data utilised in this research are the state actor approved documents for the public, in this case, the Petroleum Policy and the Petroleum Act. The policy highlights the strategy the government has in the developing of the industry through implementation, control and possibly correcting measures and activities that will enable to achieve the set goals. The act is the specific legislation to set to meet the standards set in the policy.

The primary data collection has been observation and interviews. Blaikie (2010:80) describes the observation, as an active participant in the process. Answers to 'how' questions a different kind of description; a possible state of affairs has to be described and ideas about how to get there have to be provided. The observation took place in Zanzibar to collect the data, conduct interviews present at the offices of the actors, travelling in the outskirts of the Unguja island – through this a view on the country's infrastructure. Given that the country is in the state of exploration there are no physical representation of the industry in the shape of installations such seen in a producing country. The interviews were scheduled with the various actors present in the country – the authorities, the civil society and the industry actors. Interviewing, in combination with reasonably extensive observation of actual social situations, provides a useful alternative to participant observation (Blaikie 2010:207). Thus, providing array of understanding of the topic of hydrocarbon exploration from the authority's perspective in an emerging market. The interviews took the form of an semi-structured interview method whereas Blaikie (2010:207) describes this as it seeks to obtain descriptions of the interviewed world with a view to interpreting the meaning of the described phenomena; It has a number of topics to cover, as well as some suggestions for questions. At the same time, it is characterized by openness with regard to changes in the order and formulation of questions, so that one can pursue the specific responses given and the stories the interviewees present (Kvale & Brinkmann 2009:137-138). The case of interviewing high-

level authority representatives proved that a semi-structured interview form was essential as there were some limitations. This is mainly because this is a highly sensitive topic whereas 'state secrets' are preserved. This line of questioning gives room for the aspect of getting positive response without pushing for 'undisclosed' information.

In the process of finding the informants, a request was sent to government officials in Zanzibar. A positive response was given, and meetings were scheduled.

The informants in this process have been 'coded', anonymised. Blaikie (2010:211) described this method as the central activity in qualitative data analysis is a special kind of coding. Such coding can facilitate description, but it is also used for analysis and theory generation. Thagaard (2013:28) characterises anonymity as the principle of confidentiality means that the researcher must anonymize the participants in the project when the results of the study are presented. The 'coding' of the informants has been presented in figure xx.

Previous research on the topic

When looking at what previous research have been done on the topic of hydrocarbon exploration in a developing country from an authority's perspective proved that it is little research based on this topic, even more so with a safety management focus. The previous research has mostly been based on technical aspects of hydrocarbon exploration such as geological aspect of exploration, fiscal system design, possible physical resources, resource governance based on good governance principles and historical econometric study. Making this research different from previous research.

The sensitivity of the topic

An important note must be given to the sensitivity of the topic. Knowingly, since oil & gas is an industry that can generate massive income to a country, such as in the case of Norway, there are certain elements to generate that income that is perhaps difficult to disclose given the present time of exploration. This entails state strategy on the methods used to secure that income and from a political aspect, this is a vital governing tool for secure development for the citizens in the country. As Zanzibar is in the stage of planning for possible future

income of that magnitude, there were certain aspects of the study that was deemed sensitive given some elements were in the process of getting approval from the government. However, given its sensitivity, the aspects presented here are not considered 'state secrets' but public knowledge and information.

The research process

The research process commissions on the research strategy of answering the procedure of the 'what', 'why' and how questions.

As the data gathering process started, the first aspect of it was to conduct informal talks with industry actors in Norway and abroad to collect information on which country would prove as a good case-country. Given the dynamics in East Africa of the number of countries that are in the exploration phase, an excessive research period was given to secure a country that is willing to speak on their safety management strategy. Due to the nature of the study, it was only natural to conduct a field work in the country to grasp the whole aspect of development of a petroleum industry. A period of 2-weeks of field work was conducted in Zanzibar in April. The duration of the field work might be viewed as short, however, as interviews were scheduled prior departure from Stavanger proved it was sufficient. During the stay, the 'snowball' effect was utilised, after each interview a lead might pop up thus creating an opportunity to meet non-government actors that can detail the whole aspect of hydrocarbon exploration in the country.

The process of collecting data and completion of this research paper is illustrated in table 3.

Time frame	Activity	Purpose	Objective
January - February	Thesis strategy development	<p>Selection on the scope of the project on non-renewable resources.</p> <p>Finding theories and research based on the topic of safe oil & gas exploration in a developing country from an authority perspective</p> <p>Informal talks with industry actors in Norway and abroad to collect information on which country would prove as a good case-country.</p>	Establish a coherent understanding of the topic.
March	<ul style="list-style-type: none"> - Data collection strategy - Literature review - Theory work 	<p>Establish contact with a country in that phase.</p> <p>The dynamics in East Africa when considering petroleum activities is interesting and that lead to selection of a country that can prove data collection to be admissible.</p>	<p>The choice fell on Zanzibar, particularly because of the union agreement on economic partition between mainland Tanzania and Zanzibar.</p> <p>A request was sent to Zanzibar to conduct data collection.</p>
April	- Field work in Zanzibar meetings with	To collect knowledge on the subject. Once received the public documents from the authority in Zanzibar, commenced with the analysis. Thereafter, scheduled meetings in Zanzibar to conduct the field work in April.	To create knowledge-based foundation on the subject from a government perspective.

	<p>9 petroleum industry actors</p> <p>- Theory work</p>	<p>Arrangements were made with the authorities to schedule meetings along with assurance on meeting non-governmental stakeholders.</p> <p>Upon arrival, a letter of request was signed and handed to the government to describe the purpose of the field work and was granted interviews with various government officials. Once the approval was given, the interviews took place in intervals.</p>	<p>Once collected the data in Zanzibar, the journey went back home to Stavanger and continue with the data collection with Norwegian industry actors.</p>
May	<p>- 5 additional meetings with Norwegian industry actors</p> <p>- Theory work</p>	<p>Becoming uncertain after Zanzibar, more interviews were conducted - 5 meetings with Norwegian industry actors with different disciplines to get a holistic view on the subject.</p>	<p>To create knowledge-based foundation on the subject from a government perspective.</p>
May, June & July	<p>Finalizing the research project</p>	<p>Analysis of the discovery is mapped in the results and completion of the paper.</p>	<p>This process has given the author excessive understanding of the complexity of this industry from an authority perspective in a developing country. How they need to govern and increase knowledge on the field of exploration to secure a safe management.</p>

Table 3: The progression of the research

Literature review

The secondary data collection was the two literature awarded from Zanzibar. The two documents are the core elements from an authority's perspective which represents foundation for the industry.

Literature	Purpose	Objective in study
The Petroleum Policy of Zanzibar, 2016	Serves as a guideline for the industry. Though the policy has basis from 30 other policies developed by the Zanzibari government, this is particular for the development of the oil & gas industry.	The policy grants the study an understanding of government expectation to the industry thus enabling research grounds in the government perspective
The Petroleum Act of Zanzibar, 2016	The Act is a legal basis for this new industry, promoting judicial proceedings for the development.	The act supplements the policy as a directive for the industry thus enabling research grounds in the government perspective.

Table 4: Literature analysis overview

Interviews

When it comes to selection of informer, the core strategy has been it must be authority representatives, in highest level to decision-making. Theoretical sampling is concerned with constructing a sample (sometimes called a study group) which is meaningful theoretically and empirically, because it builds in certain characteristics or criteria which help to develop and test your theory or argument (Mason 2002:124). As this research is based on an institutional level of safety management, there was a need to secure interview with those closest for the decision-making process.

The informants interviewed are on the following level is presented below, illustration 10, in Rasmussen and Svedung's socio-technical system:

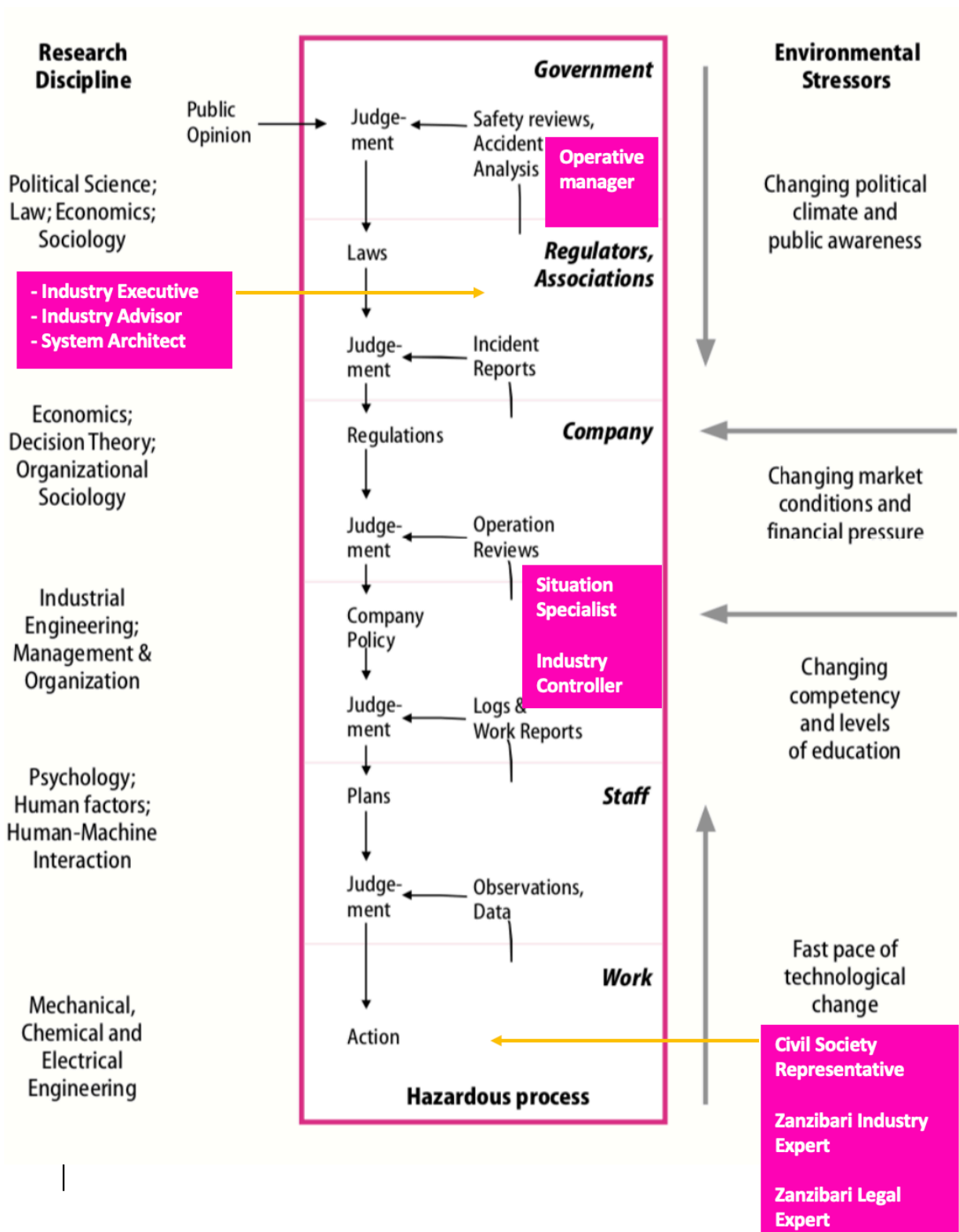


Illustration 10: Level presented in Rasmussen and Svedung's socio-technical system (Rasmussen & Svedung 2000:11).

Data analysis

The final core element of a research design is the specification and justification of the methods to be used to reduce and analyse the data. Methods of data reduction transform the raw data into a form in which they can be analysed (Blaikie 2010:25). Once the data was collected and analysed, it was structured through coding. The starting point of the topic was how the government in a developing country handle risk, and thus the coding represented the aspect of safety management to highlight their method of handling risk. Blaikie (2010:26) describes this as the decision on methods of analysis needs to be made in conjunction with other design decisions, and before the research commences.

Validity and reliability

In the aspect of validity and reliability comes in the terms of evaluating the research. Validity derives from the term valid. If your research is valid, it means that you are observing, identifying or 'measuring' what you say you are (Mason 2002:39). In this research, the validity highlights the aspect of information collected and analysed is connected with the topic of hydrocarbon exploration in a developing country from an authority's perspective. The literature acquired is government approved documents and the informants were authority representatives thus confirming validity.

Reliability involves the accuracy of your research methods and techniques. How reliably and accurately do they produce data? How can you maximize their reliability? (Mason 2002:39). When concerning this research, the accuracy of the directed questions, the relevancy to the theoretical perspective was at issue. As the focus was to uncover how the authorities manage the safety in hydrocarbon exploration, the questions assisted as a mapping of the phenomena.

The informants were interviewed in a period of 60 minutes. A declaration was signed prior interview with government stakeholders whereas a disclosure of the nature of the paper was given. However, as this declaration was not distributed to all informants and information was given prior the interview. The information given was:

- The purpose of the research
- The reason why the informant was chosen

In addition, to illustrate risk understanding, the bow-tie was used at the start of the interview. A bow-tie diagram depicts the relationships between an identified hazardous event, its causes and consequences, and the barriers that have been implemented to reduce the probability of the hazardous event and to mitigate its consequences (Rausand 2011:119). This was used to create an understanding of the safety management tool that were to be used in the research.

After the interview an opportunity was given as a follow-up, if needed. All interview prospects were based in Zanzibar and are Zanzibaris.

Ethical reflection

Blaikie (2010:31) presents that most research involves intervention in some aspects of individual and social life. There is always a risk that even asking someone quite innocent questions could be disturbing to that person. It has therefore become normal practice for the ethical implications of a social research project to be made explicit, together with the procedures to be used to deal with them. The following points are usually included in codes of ethics;

- *Voluntary participation.* Research participants cannot be required to be involved, and, if they agree to, they must know that they have the right to withdraw at any time.
- *Obtaining informed consent of research participants.* This involves informing participants of the nature and purpose of the research, the methods that will be used, what will be required of them, and how the results will be used.
- *Protecting the interests of the research participants.* The research participants' privacy must be protected by ensuring that their anonymity is preserved and confidentiality of the data guaranteed.
- *Researching with integrity.* The researcher must ensure that the research is conducted according to acceptable standards of practice and without fraud, deception or dishonesty.

These ethical reflections were preserved in the matter of firstly following the requirements of the authorities that an application with the nature of the research was described and an

approval was given to initiate with the data collection in Zanzibar. Secondly, in the beginning of each interview a presentation of the nature of the research and the purpose of the interview was given including a theoretical framework of the research was given through the presentation of the bow-tie model. Additionally, a request was stated whether the interviewee wanted to participate with the interview and admission was granted for every interview. Information on anonymity in the research presentation of the interviewee was also guaranteed. During the interview, information given the researcher was confirmed so that no misunderstanding took place.

Strength and weakness of research design

Blaikie (2010:24) notes that's it's a good idea for the researcher to make an explicit assessment of the particular strengths and weakness of the research design.

The strengths of the research are that there is not much research done on the aspect of hydrocarbon exploration seen from the authority's perspective. This enables the author to view this topic through a range number of various aspects. Though this industry has been deemed as 'state secrets', the authority in Zanzibar shared most what they could give the process they are in.

The weakness of the paper might be characterised as the limitation of information granted to give a more cohesive research. During the time of data collection, the authorities just completed assessments, the SEA and the IEA previously. As these assessments were pending approval, limited the amount of literature to review. The timing of this research paper proved somewhat to be unfortunate for the author. The researcher would perhaps opt for waiting after the first production has started or till the final assessments were approved by the government.

Chapter 4 – Results

Presented in this results chapter is the findings of the documents retrieved and interviews with authority representatives, industry actors and civil society spokesperson conducted at present field work at Zanzibar. Firstly, an introduction to the organisation of this new sector in Zanzibar and the various actors involved is presented, thereafter, presentation of discoveries through document analysis and interviews.

In order to illustrate the mapping of discoveries, a brief presentation of the coordination of the sector in Zanzibar is presented, illustration 11, based on the stakeholders met. As previously illustrated in the context chapter, there are many mechanisms involved in this phase of petroleum exploration that the government needs to address. The various mechanisms are not solely based on the authority; the industry in the country along with the civil society need to coordinate. However, the overall oversight and management of this sector is the government's responsibility.

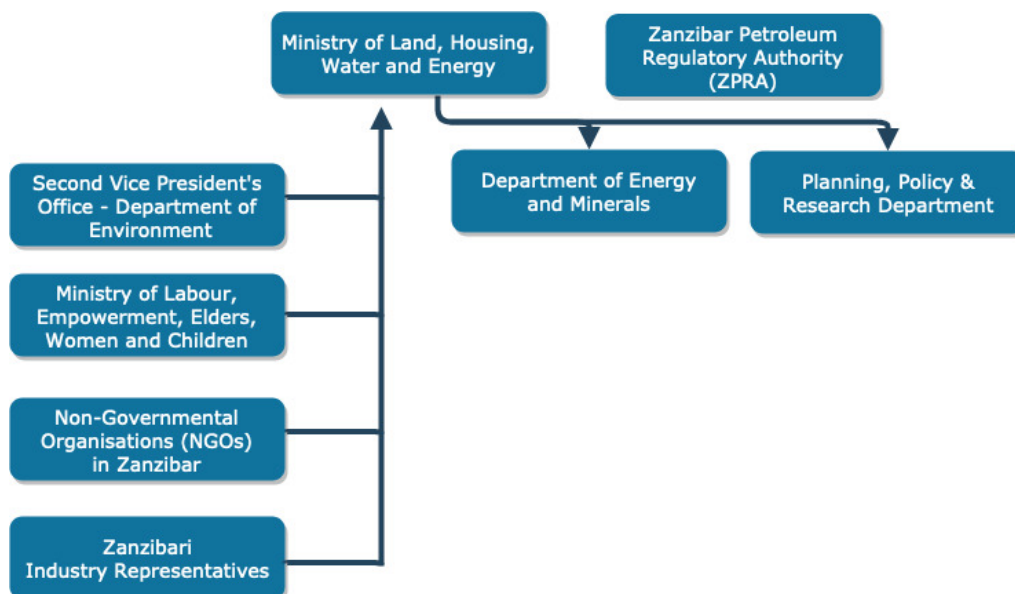


Illustration 11: Overview of Zanzibari coordination in the exploration phase

The various actors involved and their framework action and tools used is presented below, illustration 12, in Rasmussen and Svedung's socio-technical system through the Aven, Boyesen et.al (2016:70) adaptation.

System level	Tools	Framework
<p style="text-align: center;">Zanzibari Government</p> <p>↓</p> <p>Laws & Regulations ← Analysis</p>	<p>State budget Assessments Bill Reports</p>	<p>Media authority Public opinion International conditions</p>
<p style="text-align: center;">Zanzibar Petroleum Regulatory Authority</p> <p>↓</p> <p>Laws & Regulations ← Analysis</p>	<p>Laws and regulations Guides and standards Supervision Counselling and stimulation</p>	<p>Political sovereignty Research aspect Budgets</p>
<p style="text-align: center;">Ministry of Lands, Housing, Water & Energy Department of Energy and Minerals</p> <p>↓</p> <p style="text-align: center;">Ministry of Lands, Housing, Water & Energy Department of Planning, Policy & Research</p> <p>Laws & Regulations ← Analysis</p>	<p>Laws and regulations Guides and standards Supervision Counselling and stimulation</p>	<p>Research aspect Budgets</p>
<p style="text-align: center;">Second Vice President's Office – Department of Environment</p> <p>↓</p> <p style="text-align: center;">Ministry of Labour, Empowerment, Elders, Women and Children</p> <p>Regulations ← Analysis</p>	<p>Assessments Supervision Counselling and stimulation</p>	<p>Laws and regulations Guides and standards Supervision Budget</p>
<p style="text-align: center;">Non-Governmental Organisations (NGOs) in Zanzibar</p> <p>↓</p> <p style="text-align: center;">Zanzibari Industry Expert</p> <p style="text-align: center;">Zanzibari Legal Expert</p> <p>Action ← Analysis «Risk activity»</p>	<p>Knowledge and skills Motivation</p>	<p>Laws and regulations Supervisors and standards Controls Plans and resources</p>

Illustration 12: Zanzibar presented in the Rasmussen and Svedung's socio-technical system, Aven, Boyesen et.al adaptation (2016:70)

1. System Analysis

In 2016, the Revolutionary Government of Zanzibar developed a Petroleum Policy and a Petroleum Act which to set industry standard and expectation. The petroleum policy has linkage to 32 other policy drafted on basis of a sustainable development of Zanzibar. As presented in the context chapter, the practice of development of this new industry in a country the authority plan and create the execution strategy for themselves, the requirement the industry needs to meet and the participation of the civil society. This roadmap highlights the expectations from all sides and the plan to reach the goal of safe exploration. The Zanzibari Petroleum policy framework has a **vision** which states *a sustainable, transparent and an inclusive oil and gas industry contributing to strong socio-economic growth in a well-preserved environment of Zanzibar* (Zanzibar Policy 2016:49). The **policy goal** is to explore, develop and produce oil and gas resources while generating high value for sustainable development, poverty alleviation, health, safety and environmental sustainability (Zanzibar Policy 2016:49). This is the **safety goal** for the country to grow as a sustainable nation, to provide their citizens safety in development. The guiding principle of this oil & gas adventure is that the ownership of the natural resource belongs to the people of Zanzibar and that the revenues it to be aimed at adding value to the country.

The government actors presented, illustration 11, have each their mandate and function to maintain a safe petroleum operation in the country. This results chapter is based on document analysis of the petroleum policy and petroleum act with the elicited information compromised from the field work. The governmental institutional framework to facilitate the safe promotion and exploration for oil and gas in Zanzibar is presented below with their various roles and mandates with focus on the offshore exploration phase only.

1.1. Zanzibar Petroleum Regulatory Authority (ZPRA)

Is the **independent** regulator that has the role in implementation of the regulatory and legal framework. This through monitoring, reporting and verification of the petroleum operations (Zanzibar Policy 2016:92): As the **regulator**, the monitoring and operationalization of the issued licenses and their related activities is under their mandate. As **advisor** to the Ministry, they are to participate in the preliminary and main negotiations process and monitoring the implementation of the Petroleum Agreements. On the regulatory level, the regulations of

block allocation, relinquishments, acquisition and management of primary data is their responsibility. They are to enforce the laws and regulations related to the terms of contract for petroleum activities. Ensuring health, safety, environmental and labour standards in oil and gas operations and implement the integrated approach in multi- sectorial involvement in operational safeguards and performance checks is under their authority.

1.2. Ministry of Lands, Housing, Water and Energy

The role of the Ministry in this development of petroleum is carried out by the departments integrated in the manifestation of the industry – the Department of Energy and Mineral & the Department of Planning, Policy and Research, respectfully. Their mandate is to carry out, but not limited to, the following roles (Zanzibar Policy 2016:90):

Prepare grounds for a transparent, accountable, sustainable, inclusive, and participatory process of establishing **model petroleum governance** in the country with effective state’s participation. This is through to ensure clear-cut spatial boundaries of **jurisdiction in petroleum operations**. They are responsible to development of the Petroleum-related policies, strategies and action plans for the country to adopt, own and implement. The ministry is to provide pertinent information related to petroleum development before oversight committees of the House of Representatives, prepare and submit **legislations** related to petroleum’s legal and regulatory framework to the House of Representatives.

Once the Petroleum Act is passed by the House of Representatives, they are to develop **regulations** that are to set industry standards. When serious bidding with the industry (IOCs) start, negotiations and development of Model Petroleum Agreements and fall under their mandate along with **licensing and contracting** including block allocation according to the size of the reserve in the oil and gas fields in accordance with the International Best Practices of the Industry. They are to engage the international platform for **petroleum investments and data acquisition**. **Facilitate integrated planning** between the Petroleum sector and **other sectors** of the economy (Land, Water, Agriculture, Fisheries, Tourism, Environment, Health, Information, Communications & Infrastructure) and ensure **public awareness** and citizen’s knowledge on petroleum activities.

The Ministry mandate is primarily on the policy level when it comes to industry interaction, whilst on an operative level the following institutions are commission under.

1.3. Institutional involvement with Health, Safety and Environment (HSE)

There are two governmental institutions that are responsible of the safekeeping of health, safety and environment matters.

1.3.1. Second Vice President's Office – Department of Environment

This institution has various other responsibilities when it comes to the oil & gas industry activities, to carry out and in this exploration phase their role is imperative as to **ensure the environment issues are mapped** prior production and development. According to the Zanzibar Policy (2016:99), they are to **ensure the conservation and protection** of artisanal and deep-sea fishing from the potentially polluting or marine degradation activities of the petroleum industry. **Safeguarding the rights of the fishers and their respective fish landing sites** from the potentially adverse impacts of petroleum activities is crucial. And also, facilitate support in the protection of marine migratory species from adverse effects, amongst others.

1.3.2. Ministry of Labour, Empowerment, Elders, Women and Children

As Zanzibar is on the exploration phase, the potential roles of this institution in the oil and gas industry have to include the following: (Zanzibar Policy 2016:97) To ensure implementation of Occupational Safety and Health in the oil and gas sector. **Monitor** compliance with the labour standards and promote the **culture of prevention** and continuous improvement. Additionally, to investigate all occupational accident to establish root causes and develop means to prevent reoccurrence or minimizing the effect to as low as practically applicable.

1.3.3. Civil Society Organisations (CSO) & Non-Governmental Organisations (NGOs) in Zanzibar

The role of the Civil Society has a prominent role in ensuring the **development of the industry is favourable for the citizens**. Civil Society Organizations (CSO's), NGOs and Community Based Organizations (CBOs) play a greater role in promoting **responsible advocacy on petroleum development**, as well engaging local communities in a positive dialogue and **Corporate Social**

Responsibility (CSR), and **Local Content**. CSOs, NGOs, and CBOs can contribute greatly in ensuring **accountability** with regards to oil and gas issues (Zanzibar Policy 2016:104).

1.4. Zanzibar industry representatives

The industry representatives connected **portray how the authority manage the industry is perceived**. This is through the view of one Industry Expert and one Legal Expert.

Actors in complex systems are likely to resolve goal conflicts within a condition of local rationality. He/she is not in a position to assess the overall impact of their choices, or to assess how their choices interact with those of the other actors (Brehmer, 1991; Rasmussen, 1997). These classes of decision-making is illustrated in below (Rosness (2010:86):

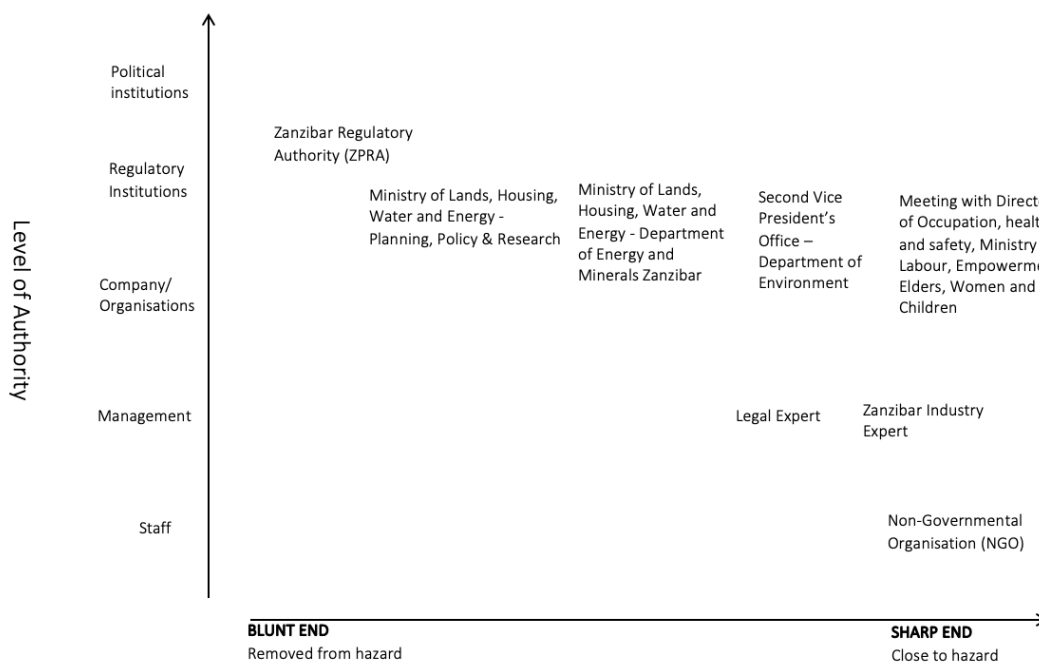


Illustration 13: Zanzibar presented in the Classes of decision-making (Rosness 2010:86)

2. Situation analysis

The policy and act are guided by numerous immutable **framework** principles, developed by the Zanzibari government to manage the industry through. The following principles presented below are those that directly touch upon the current phase of exploration. In the aspects of these framework principles, there are numerous uncertainties associated in this activity of hydrocarbon exploration. The petroleum policy highlights 35 measures in combating the uncertainties this industry provides. As the 35 measures are lengthy in this cumulation of work, the measures dealing directly with the exploration phase is presented (2016:9-33).

1. Authority and Industry

This includes the aspects found in the policy and act; capacity and institutional building, private sector participation, spirit of co-operation and delineation of maritime boundaries

1.1. Capacity and Institutional Building

The capacity building process must be inclusive of the necessary legislations, institutional, human resource and manpower. The international oil companies are expected to participate in the process through corporate social responsibility, technology transfer and through research and development.

1.2. Private Sector Participation

Given that the oil & gas industry is an international business, Zanzibar is promoting fair competition and responsible procurement process in order to ensure efficiency and productivity in the petroleum industry so as to maximize social returns for the current and future generation.

1.3. Spirit of Co-operation

The value chain of the oil and gas activities should be engaged and managed in a spirit of mutual respect, cooperation and trust. Efforts to minimize conflicts through peaceful resolution are to be emphasized. Trans-boundary issues must be resolved through constructive engagement with neighbouring countries.

1.4. Delineation of maritime boundaries

Internal and international maritime boundaries are now a major pre-requisite of any long-term negotiations between Zanzibar and the contracting parties to secure exclusive rights and jurisdiction for offshore oil and gas exploration. Many developing countries find themselves in various levels of disputes or disagreements on the status of their respective maritime boundaries. More often or not, boundary negotiations come often too late and under encouragement by the oil industry. However, this issue was identified by the two Governments and is being worked out to accommodate mechanism to demarcate maritime boundaries for petroleum blocks. This remains potential to develop into jurisdictional challenges with respect to ownership and allocation of petroleum blocks offshore.

2. Health, Safety and Environment (HSE)

This includes the aspects found in the policy and act; protection of environment and conservation of biodiversity, occupational health and safety, fisheries and tourism

2.1. Protection of the Environment and Conservation of Biodiversity

Every stakeholder involved in the country has a gain in preservation of the biodiverse environment. For optimum returns from the petroleum resource, the balance between human development, environment and biodiversity is essential.

2.2. Occupational Health and Safety

Guidance on occupational health and safety standards to stakeholders to adopt a management system that is effective in reducing incidence of work-related injuries, accidents and diseases.

2.3. Fisheries

Protection and maintenance of the fishing industry, the fishermen, and their communities is the key priority in offshore oil and gas development. Fisheries sector is the economic backbone of Zanzibar and it is the second largest self-employed sector after Agriculture. According to the Office of the Chief Government's Statistician (OCGS) of Zanzibar, the total

annual fish- catch in 2013 amounted to more than 30,000 tones, valued at Tanzania Shillings 11.8 Billion (US\$ 62.1 Million). Petroleum activities may potentially affect commercial and artisanal fisheries, resulting in a loss of key species, their prey and habitats, and the business activities of the fishers who harvest these resources. The Government recognizes the need to protect the fisheries sector while at the same time carrying out sustainable management and operations of the offshore petroleum activities.

2.4. Tourism

The key areas of concern coming out of a direct linkage between oil and gas development and the tourism sector are the preservation of the Zanzibar's pristine environment. The entire archipelago is a natural asset for both terrestrial and marine tourism. The white sandy beaches, fine lagoons, remote islets, and magnificent sand banks have all evolved around the single-most common value in a tropical marine ecosystem the coral reefs. These living natural barriers have given Zanzibar advantage point in terms of global scuba-diving expedition tourism, snorkelling and kite-surfing activities, game fishing, and even in developing strategic hotel beach resorts along the prime coastal layouts of the archipelago. The major challenges in tourism will be on how the country strengthens its protective measures and ensure the sustainability of a tourism sector that is not threatened by negative impacts of the petroleum activities, especially from offshore oil spills.

3. Local Content

This includes the aspects found in the policy and act; local content development, mainstreaming education and awareness, and corporate social responsibility (CSR)

3.1. Local Content Development

For the industry to be truly beneficial, efforts have to be taken to ensure that without affecting the investors' fundamental interests, Zanzibaris and Tanzanians respectively shall benefit first, better, sustainably and more than other immigrant workers. Vigilant mechanisms have to be in place to ensure legal presence of foreign labour force. The petroleum development sector needs to be managed in a manner that promotes development of Zanzibar and direct benefits to its people through employment, local business development, procurement of local goods and services, technology transfer, advanced training in petroleum

engineering, vocational training and other related education; recruitment and permanent employment in the upstream industry.

3.2. Mainstreaming Education and Awareness

Access to educational information is a fundamental right in activities which may have either a direct advantage or disadvantage on individuals, communities and society at large. Public dissemination and education about oil and gas development increases the national level of awareness and address key concerns on various aspects of the economic and social response to the industry. Community awareness is another vital pre-requisite for social understanding of the industry. It is logical that not everyone will be involved in the engineering aspects or other related operational works of the petroleum sector; and that the majority of people will continue to go about meeting their daily livelihoods e.g. continuing to engage in Agriculture, Fisheries, Livestock, Tourism, Trade etc. Education and awareness at this level will not only prepare the population with adequate general knowledge about the industry, but also assist in avoiding pushing the country into the so-called “Dutch Disease” syndrome.

3.3. Corporate Social Responsibility (CSR)

Corporate Social Responsibility (CSR) initiatives worldwide have supported national Governments’ efforts towards the development of local communities in the areas of operations e.g. employment, education, community development programs, and training in vocational training. Hence, CSR can become a permanent bridge of constructive engagement and relationships between oil companies, Governments, and the local communities beyond legal or regulatory requirements of the industry. Furthermore, major oil companies worldwide have extended their support in several other sectors of the local community’s development.

3. System Assessment

In the aspects of these framework principles, there are numerous uncertainties associated in this activity of hydrocarbon exploration. Taking into account the research problem, *how does a developing country government handle risk when exploring for hydrocarbon*, the framework principles presented in paragraph 2 will be assessed with support of the research questions presented:

1. What **risk activities** are associated with hydrocarbon exploration?
2. What kind of **strategies** does the authorities have to maintain safe operation?
3. How does the government institutions **interact** in this phase of petroleum industry development?

The system featured through the Rasmussen and Svedung's socio-technical system through the Aven, Boyesen et.al (2016:70) adaptation, whereas under the framework of **tools** in the safety management system are the instruments to strengthen safety in operation.

3.1. Research question 1: Risk Activities associated with hydrocarbon exploration

In the aspect of inexistence of mutually well-defined constitutional and jurisdictional responsibilities, the policy (2016:51) brings forward the challenges associated with judiciary practice in place. Its described that as this is the early phases of the petroleum industry, **absence of laws and regulations** related to oil and gas industry (upstream) due to inexistence of mutually well-defined constitutional and jurisdictional responsibilities between the Governments. It is detailed in that due to, limited legal expertise and public legal awareness on oil and gas matters. The policy presents that there are possibilities of legal conflict areas on the matters related to environment, fisheries, occupational safety and health and minimum understanding of proper procedures on oil and gas business transactions including contracting procedures (e.g. PSA, PSC, Concession).

Industry Executive informs that in the spirit of co-operation, *as policies and acts take some time to develop, approve and implement, there is a matter of **institutionalising** the outcome. The quality of the content needs to be tested out on the industry. We need to engage with the industry and agree with the industry. Then, paragraphs in the acts will be changed giving flexibility. That is a **part of solving the barrier of quality of content**.*

Under the arrangement of industry cooperation, the institutionalising aspect brings forward institutions mandated to run the industry. This is approached through the political decision on how to rule the industry.

Industry Executive touches upon **the political alignment in ruling the industry as political risk**. *This industry can bring changes in the politics. Every party want to rule the country. Want to bring about the change in the country.*

Institutional Strategy

The authority's **strategy** is a feature that illustrated the need of understanding the coordination role is in all decision-making levels.

Industry Executive includes that *in the coordination understanding of the industry on all levels, started with on a **higher level**, started with the politicians – both the national and the local politicians. Then, train the government officials to make the right decisions and then the people to make them understand why they make those decisions. That is a way of **maintaining public risk, political risk, social risk, technical risk** and so on.*

The Zanzibari Industry Expert points out *that in the matter of coordination, there is a **perception of the government** that oil is sensitive and is not to be touched. This can lead to lack of transparency. Without transparency, there will be a **shortage of cooperation** and information should not go out.*

Zanzibar Legal Expert adds that *since the institutions are young, there will be **shortage in the ability to coordinate**. We need to develop that capacity of understanding on what could develop, we need **interface with other institutions** as we don't have a common platform for information. That can lead to uncertainty.*

The Operative Manager support in these claims of lack of coordination, *that **the biggest risk is institutional transformation to meet the industry**.*

Minimum understanding of proper procedures on oil and gas business transactions including contracting procedures involves transparency in contracts.

Industry Executive argues that **stability is contract managed**. *Companies that deal with developing countries, they can get the information needed. This affects the industry and might lead to corruption. Difference between developing countries and developed countries is that system of government, political set-up is that is quite sustainable including transparency, accountability, integrity in the system itself. Adds value to what has been done. **Everything is***

defined by the law, meaning stability not in struggle with that. Developing countries lack of laws and regulations – vacuum in that area. Start with new industry, complicates the issue. Petroleum decree from the 1950s. Mining decree as well from colonial times. Integrity developing country is not defined, complicates the oil & gas industry, that is an expensive industry. We need to develop everything from scratch from regulation of transportation etc. No law and regulation on all aspects of developing the new sector. International oil companies will use that weakness and rise up every high risk, and politicians will use that for their interest.

Possible legal conflicts

As the issue of maritime boundaries touches upon the sovereignty, the policy indicates that the key issue is the lack of clear-cut and demarcated maritime boundaries for upstream petroleum activities for Zanzibar, thus affecting the existing petroleum blocks which are allocated under the previous arrangements set under the Union jurisdiction (Zanzibar Policy 2016:67).

The Maritime boundaries situation was heavily emphasised by the Zanzibari Legal Expert. The main issue is that since Zanzibar is de facto part of the United Republic of Tanzania, all maritime boundaries are shared with mainland Tanzania, thus, creating a legal issue with licensing of blocks whereas the boundaries are not set on where Zanzibar has autonomy and where its shared with mainland. ***This is the biggest risk for Zanzibar. Its hanging on a cliff.*** ***What is the jurisdiction of Zanzibar?*** *Perhaps only onshore. There is no agreement, no law and not defined EEZ (Exclusive Economic Zone) boundaries. As Zanzibar shares maritime boarders with mainland Tanzania and Kenya, this can cause disputes like Kenya and Somalia now.*

Standardisation

In the policy, its emphasised that there is an absence of a specialized HSE Unit for petroleum sector, absence of a legal environmental monitoring and performance standards, weak Environmental and Social Impact Assessment process in oil and gas industry (Zanzibar Policy 2016:81).

There are possibilities of legal conflict area on other matters related tourism and fishing. These two, mostly offshore related sectors, are the breadwinners for the countries. In the policy, it is noted that fisheries sector is the economic backbone of Zanzibar and it is the second largest self-employing sector after Agriculture. According to the Office of the Chief Government's Statistician (OCGS) of Zanzibar, the total annual fish-catch in 2013 amounted to more than 30,000 tones, valued at Tanzania Shillings 11.8 Billion (US\$ 62.1 Million). Petroleum activities may potentially affect commercial and artisanal fisheries, resulting in a loss of key species, their prey and habitats, and the business activities of the fishers who harvest these resources (2016:22).

Industry Executive that *from the policy, oil & gas should not harm. Tourism is always the first priority. However, **technology is to its job**. Meaning then that with technological advancement, the oil & gas industry could prosper with the right technological incentives. As this represents a technological risk, it can be maintained. There should be efficiency in the industry to avoid technical risk and the production sharing agreement provided most of the risk to the company, major international risk in investment which drives the company to be efficient in cost and risk of failure to be reduced.*

Situation Specialist direct this model of integration as challenging. *Zanzibar is surrounded by oil & gas blocks, in the same area as tourism and fishery. In other words, integrated, interlinked economy with the environment – need to diversify the view on this industry.*

Legal environmental monitoring plan is part of the implementation process to safekeep the environment on the negative effects this high-risk industry can have on the environment.

Industry Executive highlights that there are certain HSE concerns when operation offshore. *The drilling is 12NM (approx. 20KM) away from country. The risks with that is environmental issues and costs will be higher. Could be an option with directional drilling.*

The Situation Specialist interviewed in Zanzibar, illustrate the illusive planning that is need prior production and development. They opt for *midterm scenario setting of eventualities of risk. We are running out of time and there is a lot of pressure in starting this industry. We are*

in the state of looking at the long-term and midterm risks. A commission has been planned to look at this. We are creating awareness to them on environment as the stakes are higher. Conducting a survey is not enough, we are in the process of implementation of the SEA (Strategic Environmental Assessment). This industry touches upon the social aspect in the sense of the people directly affected by it, intended and unintended social consequences. We presented 13 recommendations to the government based on the SEA findings. As environmental issues will reach all, we need to accept inclusive and criticism and advice and promote that's continuously. Still on the early phase of oil production – who can you convince when we don't know.

System Architect touches on that there is little environment risk, when it comes to onshore, *Zanzibar is a little land with loads of forest. There national forests and they are protected.* When it comes to the regulation on oil & gas, the Industry Controller states at that *we don't have national standards in place, but we are using the international industry standards. Such as the ISO standards, and the OSHA (mainland) standards. We are in process to get the tools, standards in place.*

From a different aspect of pull factor with the industry taking place is what it can bring in the future. The Industry Advisor presents of the danger of a possible blow-out. *With the Macondo accident, which has been a real eye-opener in the industry, we see that since we don't have an oil spill response strategy and operation in order, the outcome would be catastrophic in our vulnerable nature.*

Counselling and Stimulation

The Policy expresses on development and implementation of the petroleum local content strategy. There is also a need for building a skilled and competent local workforce in the petroleum industry, hence, develop a human and institutional capacity to meet the demands of the industry. To adopt international best practices that encourage international oil companies to prioritize local employment, local business development, and procurement of local goods and services is the focus (Zanzibar 2016:64).

Industry Executive representative shows the strategies put in place to educate and create awareness with the people – *train the people in the area, students in oil & gas. We give good incentives such as good loans and give awareness. The best opportunity to students that want to go to study oil & gas related subjects. Started this in 2016 and started getting employed at ZPRA. People are in the market to increase the local experts as we don't have all the professions in the oil & gas present such as economists, geologists. That's why we take people out to study.*

Though, limited legal expertise and public legal awareness on oil and gas matters, the informants' touch upon the aspects of civil society understanding on the legal obligations in these contracts. Corporate Social Responsibility is company waiver for establishing good relationship with the local communities. In the Zanzibar Petroleum Act (Article 137) it is stated that the company and a contractor shall on annual basis, prepare a Corporate Social Responsibility plan jointly agreed by the relevant local government authority based on Zanzibar Corporate Social Responsibilities Strategies Plan. Plan should be submitted by the company to a local government authority for consideration and approval. Subject to the provisions of this section, every local government authority shall:

- a) oversee the implementation of Corporate Social Responsibility action plan; and
- b) provide awareness to the public on petroleum projects in their areas.

The policy touches upon that there is a need for a systematic CSR initiative in Zanzibar for social incentives, mutual trust, and confidence building measures between the people and petroleum investors (Zanzibar Policy 2016:63).

The Zanzibari Legal Expert features that *there is little role of CSR present and what does it involve? That creates uncertainties.*

Civil Society representative states that *there is little involvement with the industry now. Local people and communities can get advantage from the CSR projects and give returns back to the people in the form of water, other social architects, health projects and so on. In coming month of February there will be a nation meeting on the understanding of CSR.*

3.2. Research question 2: Authority strategies to maintain safe operation

In the form of maintaining safe operation, the condition of competence, incentives and quality of content is thus essential.

The institutional preparation and agreements are to provide for an effective institutional arrangement related to oil and gas industry for the management, monitoring, coordination, reconciliation, compatibilities and linkages between the petroleum authority and other relevant stakeholders (Zanzibar policy 2016:53).

Through these strategy goals, the authority is to accomplish this by tool and measures stated in the policy and act. The petroleum act (2016:7) describes the role of the minister, through the authorities, as eight measures of duties and responsibilities to meet the industry. The ones directly impacting the exploration phase are;

- granting, reviewing, suspending and cancelling of petroleum exploration and development licences.
- formulating and reviewing regulations in the petroleum industry
- causing inquiries to be conducted in to accidents or disasters caused by petroleum activities
- develop petroleum related policies

The strategy goals are imbedded in the operations which can either safekeep the industry or give room for uncertainties.

Assessments

The policy indicates that prior all activities, the authority's is to carry out assessment of existing marine conservation areas and feasibility studies for future marine protected areas (Zanzibar Policy 2016:75). The authority's to undertake a detailed risk assessment of the oil and gas sector and implement the risk mitigation programs (Zanzibar policy 2016:87). Those implementing strategies are to assure the safety management are put in practice.

The operative manager states numerous strategy initiatives validate the petroleum operation started in 2012.

The implementation started in 2012 whereas *we completed EIA (Environment Impact Assessment) for onshore. This included the natural forest reserves in Zanzibar, the Jozani forest (Unguja island) and Ngezi forest (Pemba island). The exploration stops because of UNESCO requirement. Also, because we have approx. 600.000 tourists in the high season and competing interest due to the uniqueness.*

In 2016, EIA offshore was conducted. *This was in 800m depth including teasing (transiting area with mainland). Also, marine observation was completed, over the economic area, area concerning tourism sector and the nature considering fishing in the southern and eastern part. In 2019, we collected a commission to work on the validation of oil & gas exploration with ZMA (Zanzibar Maritime Authority) in the form of a Strategic Environmental Assessment (SEA).*

Operation

As these assessments were completed, there was an interest to execute with seismic survey for data collection. Last time seismic survey was done was in 1985 when Geosource conducted a seismic survey in Southern part of Pemba with little information on interpretation except for the fieldwork reports. In October 1986, Petro Canada International Assistance Corporation (PCIAC) undertook a short marine seismic survey over Pemba channel. The objective of the project was to gather regional seismic data for the first time in this relatively un-explored channel. The seismic data was evaluated in order to improve the understanding of the regional geology and hydrocarbon potential. The acquired data demonstrated the possibility of the commercial exploration potential in the area based on the regional nature of that data. The most interesting thing in the data evaluation was the discovery of the geological sequence of thick and rich tertiary section deposited under changing conditions producing variety of geological environments suitable for hydrocarbons development depending upon the hydrocarbon prospects. Extensive 2D seismic survey was done offshore Zanzibar by 2000 which provided geological information of the area used for licensing blocks 8, 9, 10, 11 and 12 (Zanzibar 2016:4).

The Operative Manager informs that *in 2019, seismic conducted with ROV (rotating operating vehicle), not using cable. Big ship with robot was used, a record shovel and no seismic ship. We completed the seismic and now waiting for the data.*

The seismic acquisition has had its challenges whilst in operation. The System Architect informer points out that *the seismic disturbances with the fishing nets and this created instability in the fisherman because of limitation in the fishing days. The geophones created problems because of the blasting from the equipment created pressure in the water. Ferry routes had to be limited though this was short term solution, only two days. But when the production starts, the impact will be bigger.*

The Civil Society representative illustrates that *most of the people in Zanzibar depend on the fishing. If oil is explored in the area they are told to move, and the fish will not be there afterwards. There should be more involvement.* If a company is exploring oil & gas, they should incorporate the local people. The people living that area are used with tourism which is little money. Oil & gas is bigger industry and 5% should be invested in that local area. People think government might discourage that. The government should 'support that idea.

Once collected and interpreted data, the Industry Executive marks that *the first test drill is within 3 years and first production within 6 years (2026).*

Industry Supervision

To maintain safe operation, a strategy on institutional capacity building and competence was presented in the policy. The strategy is to link the industry actors through build, develop, strengthen, enhance and improve administrative, management, and scientific skills towards petroleum development requirements linked to their sectors. The implementing strategies are enhancing the capacity of local governments in dealing with oil and gas industry. To strengthen the key institutions to cope with the development of oil and gas industry. Promote retention for best and most qualified staff within the Government's institutions. Promote learning institutions to be in line with institutional capacity building program and establish

centralized coordinating mechanisms for institutional capacity building on oil and gas core sectors (Zanzibar Policy 2016:65).

During the data acquisition, the seismic operation, Operative Manager illustrates the interaction with oil companies as challenging. Being a newcomer and young institutions, *it was not easy when doing the seismic the Operative Manager adds, the company wanted to do it quickly. We focus on coexistence with the industry but there was pressure from the company. Because of timing, company wanted to do seismic a whole day but we put in a time limit for the other industries in our country to do their business (fishing and tourism).*

It is noted that through the interaction with the industry, an implementing strategy on the compliance of the industry actors; the authority, industry and the civil society is needed. In the implemented strategies in the policy on local engagement it is highlighted that **through** Zanzibar Local Content Policy and Plan, an interactive stakeholders' forum in oil and gas industry (Government/LGAs, oil companies, oil service companies, local private sector, local Communities, education sector, financial sector) to ensure that all the objectives of local content policy in oil and gas industry are achieved. It is to provide mechanism for gradual employment and empowerment of the local competent and hi-tech professional by International Oil companies, and to enhance vocational training for Zanzibaris (Zanzibar Policy 2016:65).

The local development strategies presented was carried out through numerable measures. The Operative Manager features awareness as a mechanism as a compliance initiative. *We carried out an expectation management program starting in 2017. In late 2017, we spoke with different institutions, schools, villages so there is no chaos and no quarrels when we start with exploration. The awareness is still ongoing as we need to make sure the people understand the process. With the companies, they were instructed on the local employment agreement. This is in the law, and regulation and also included in the PSA. The local jobs recruitment strategy was implemented. Local employment, through the company, was started firstly as temporary jobs during the seismic. More than 80% employed at RAKGAS company office here during the exploration – driver, mechanics, IT, cleaning etc. When it comes to the goods and services, the*

company was instructed to use Zanzibari market. The company wanted to be based in Dar for the areal footage. We would lose on airport taxes, accommodation, food etc.

With the strategies in place for the exploration activities, the Operative Manager added that though they don't have all the professions in place to implement the local development plan, that will change in the next 5- 10 years to come as there is education strategy on what to study for the coming industry and at the same time keep the other sectors alive.

Zanzibari Industry Expert expresses the same concern when It comes to local engagement. *The immigration of workers from mainland can lead to job and social problems. When they come, they don't leave, and this is difficult when it comes to job security. The social aspect that we have an Islamic culture.*

Civil society representative highlight that the government *have experience from the tourism industry. People have high hopes but because of the migration, the reality becomes different. The experience from the tourism industry is that Kenya & mainland (Tanzania) come for jobs because of the lack of skills needed in Zanzibar. The people was not prepared of the requirement for employment, the skills needed. This is because of the lack of awareness. The government learned from the tourism industry, prepared for this industry as a lesson learned, they have to prepare. If you look at the alternative energy project, funded by the EU, they made report and the stakeholders were involved.*

The Operative Manager answers to this as a *cost recovery risk. Migration from neighbouring countries as seen in the tourism industry that why we have strategies to learn from this.*

3.3. Research question 3: Government institutions interaction

The universal precept to enhance safety management is a thorough interaction in the system. This is illustrated in the policy (2016:8) as development of an appropriate institutional setup for the country in line with several other key sectors throughout the whole petroleum value chain. As previously stated in paragraph 2, the institutions dealing directly with this petroleum industry are young, established in 2016, there are challenges as the institutions are taking their forms. The institutional arrangements in oil & gas exploration is that the Tanzanian Petroleum Development Corporation (TPDC) currently has the authority to manage oil and gas within the whole of the URT. Under this arrangement, exploration areas in Zanzibar have been divided into a number of onshore and offshore blocks. With the most recent offshore fourth licensing round of 2014, a fifth one is about to follow in line with TPDC marketing strategies which include Deep Water Offshore blocks east of Zanzibar (Zanzibar policy 2016:5). Though, the URT has a recognised delegation of duties when it comes to licensing, recently, the United Republic of Tanzania accommodated issues of oil and gas in the Petroleum Act 2015 that allows respective parties in the Union to manage their own resources in the respective jurisdictions. In addition, the decision to remove oil and gas from Union matters is in the proposed Union Constitution (Zanzibar policy 2016:10).

When touching on union matters, the System Architect mentions that when RAKGAS came, they signed an agreement with mainland. *Zanzibar terminated the contract with RAKGAS to build a new one. Gave opportunity for those with contract to continue on new contract under Zanzibar terms. This allowed to us to build a relationship with RAKGAS, scholarships were created and in order for RAKGAS to proceed, we had to make policy and acts.*

The Legal Expert places a huge focus on this matter of union. *The fiscal regime must be attractive. Right now, its ad-hoc. Zanzibar is given mandate to explore, develop and even collect revenue but it not as easy as that. When the companies have some operations in Tanzania and Zanzibar, they create a common account. If a company decides to have a joint account, Zanzibar can't say no. Royalty and other income comes in that account. That creates a central holding and might suffer in revenue collection.*

This creates uncertainties in the aspect of authority interaction to handle the risk this industry portrays.

However, the Operative Manager adds that that mainland and Zanzibar are on *the same grounds to improve the economy. The risks are simple and complicated at the same time when it comes to boarder areas (with mainland). This discussion will take place when that time comes on the matter of joint ventures, like Norway and the UK.*

Institutional set-up

The objective in the policy is to provide for an effective institutional arrangement related to oil and gas industry for the management, monitoring, coordination, reconciliation, compatibilities and linkages between the petroleum authority and other relevant stakeholders. The policy states that the Government shall establish a transparent, viable, delineated, and an independent institutional and administrative system for upstream petroleum industry based on the model constituting of a Ministry, an independent regulator, and the national oil company. The implementing strategies are to establish an independent regulatory authority to oversee all pertinent requirements to negotiations, agreements, allocation of blocks, exploration, production, decommissioning, and all its economic, social, environmental, health and occupational safety safeguards. Establish a national oil corporation that will ensure the state's participation in commercial operations of the oil and gas extraction and review and strengthen the existing institutions responsible for energy to meet the long-term requirements of the proposed architecture of institutional governance on oil and gas matters. (Zanzibar policy 2016:53)

The institutional set-up in Zanzibar may offer complications. As in the case of the institutions their role and mandates increased with the introduction of the petroleum sector to the *country. The System Architect highlights that the combination is a problem. In addition, as the petroleum sector is added in all institutions, many institutions don't want any other institution to interfere. There is a lack of coordination and all is interlinked. Coordination is mentioned in the policy but not in practice.* A challenge is introduction when it comes to this topic of the interaction of safety and economic development. *Most of the blame is put on environment for*

when they are following their mandate and work, they are not being friendly to the economic development.

The Situation Specialist states that the mantra of the exploration has started on the a 4th level and not on a 1st level when it comes to political, economic, societal, environment. This has been brought up with the other institutions. The contractors is destroying the environment. There is a need of coordination on high level. Arguing with the government, overwhelming advice before we rush. Give ourselves a pause to see what collation of energy, tourism & informal resource (fishing) before this midterm and confirm the process. There have been conducted sensitivity and scenarios map. Invest in time & resource integrated plan (oil & gas) cross sectoral capacity, implement policy, plans and legislation.

Its argued that there is a need to give priority for implementation. We would need to, adds the System Architect, to build technical capacity is all areas (institutions) but when you don't have the capacity, you'll be in trouble. We will not repeat the mistakes from tourism in petroleum such as in tourism houses where omitted by the sea and it not allowed now due to increased knowledge.

Chapter 5 Discussion

In this chapter, the theory and results will be discussed. The presentation of this chapter is best illustrated with the use of the migration model. In this complex system of hydrocarbon exploration, Rosness (2010:81) writes that the migration model illustrates the adaptation process in a complex system with distributed decision making (Rasmussen 1994b). The migration model show how actions within one activity may change the boundary of acceptable performance for another activity. Adaptation in a complex organisation, where several actors are migrating more or less independently within the space of acceptable performance. In practice, individual freedom and these persistent variations do not constitute a legislator or management to set limits on action and measures. Individuals at all levels will have to set limits on their own behaviour in light of the freedoms the system provides, and the situations they are put into (Engen et. al. 2017:148).

The aspect that ensures a safe management of the activity of hydrocarbon exploration is imbedded in the coordination strategy, information processing and decision-making process. Through this exercise one can uncover the latent symptoms in the system. The migration model is as presented in **illustration xx** where the components are modelled to the hydrocarbon activity in Zanzibar.

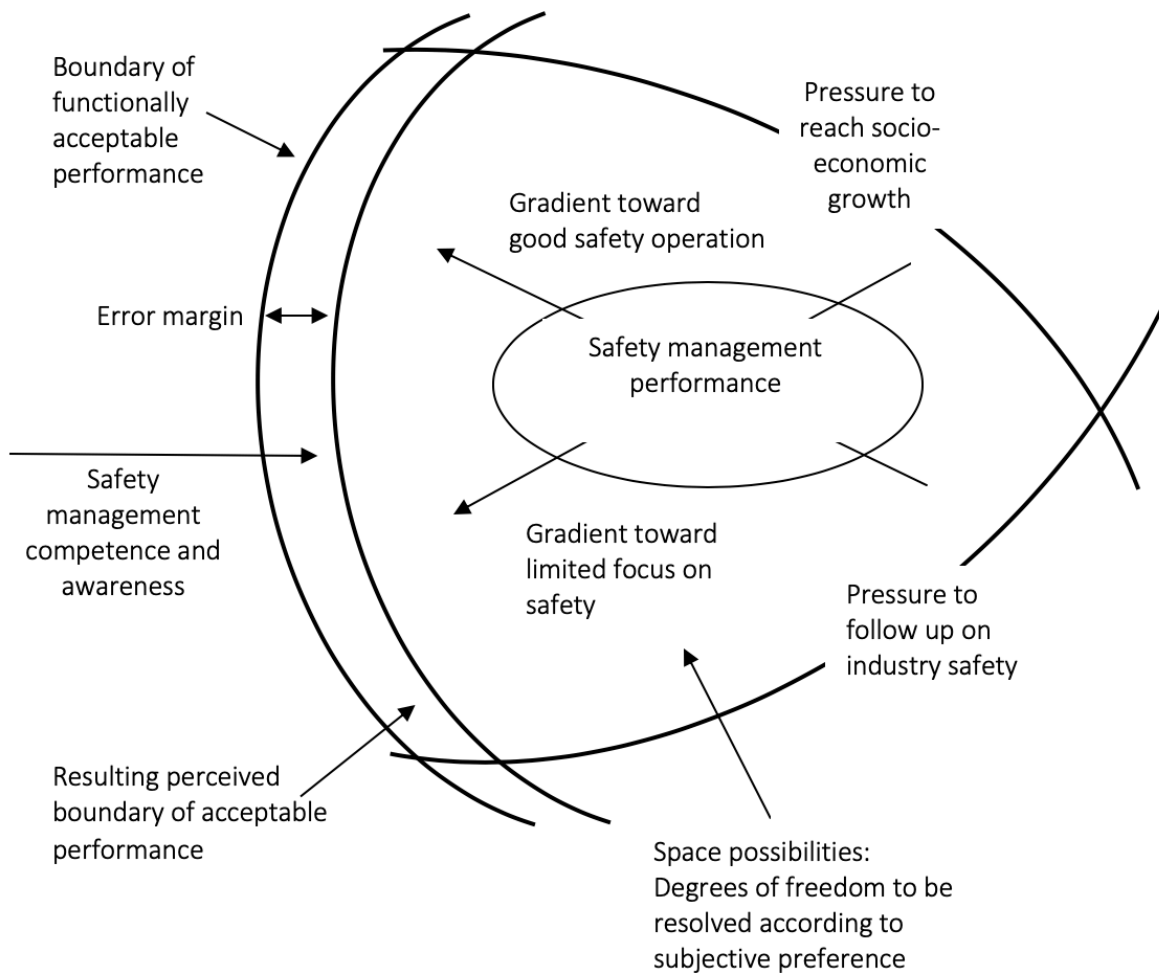


Illustration 14: Migration model as illustrated in the aspect of Zanzibar hydrocarbon exploration.

Through this presentation of the migration model, the key target is the steady safety management focus whilst in operation. The pressure to reach socio-economic growth can lead to gradient towards limited focus on safety. If the activity reaches past the boundary of functionally acceptable performance, the safety operation is lost, and accident will occur.

1. What risk activities associated with hydrocarbon exploration?

The risk potential in this system of hydrocarbon exploration is abundantly described in the results chapter. The aspects of risk accentuate the level of latent conditions in the system. This is illustrated as the **error-margin** in the migration model. Reason (1997) describes this as the root of organisational failures. Since people design, manufacture, operate, maintain and manage complex technological systems, it is hardly surprising that human decisions and actions are implicated in all organisational accidents. The risk findings in the results chapter is characterised as young institutions, lack of competence in the area of oil & gas (supervision and standardisation), lack of integration and pressure from higher level due to political ambitions. All of these elements are latent conditions in the system that will drive towards organisational failure, accident, if not managed.

Zanzibar emerged in this oil & gas industry once they *'adopted'* the RAKGAS contract in 2015, thereafter, the institutionalisation of the industry was manifested in 2016 through the Petroleum Policy and Petroleum Act. The institutions in the country took form once the role and mandate were expressed in the policy, leading to, creating a safety management performance indicator in the form of a safety goal. The safety goal is that the country to grow as a sustainable nation, to provide their citizens safety in development. Hereafter, legitimating the institutions to drive the safety performance in the system. As latent conditions are vulnerability in the system and can arise from strategic and other top-level decisions made by the government, the institutions in the *'sharp-end'* has the advantage to ensure safe management in the system as they are closest to the hazards and in that identify the possible latent conditions.

In the socio-technical system, the government is the highest level of decision-making in the country, meaning, the focus on socio-economic growth can create pressure on the lower levels of operation, creating gradient towards limited focus on safety to ensure that prospect. Rosness (2010) defines this as safety is an objective that may conflict with other objectives. As the objective is that Zanzibar is to develop and use the oil & gas revenues as a value creation

tool, politically, it is an incentive to reach that goal of socio-economic growth. The Industry Executive highlights this a political risk. *This industry can bring changes in the politics. Every party want to rule the country. Want to bring about the change in the country.* The authority's strategy is a feature that illustrated the need of understanding the coordination role is in all decision-making levels. Hence, the aspect of coordination in all levels is crucial and Industry Executive includes that *in the coordination understanding of the industry on all levels, started with on a **higher level**, started with the politicians – both the national and the local politicians. Then, train the government officials to make the right decisions and then the people to make them understand why they make those decisions. That is a way of maintaining public risk, political risk, social risk, technical risk and so on.*

The common platform indicated is perhaps the view in the 'blunt-end'. In the 'sharp-end' the understanding is somewhat different. Zanzibar Legal Expert adds that *since the institutions are young, there will be shortage in the ability to coordinate. We need to develop that capacity of understanding on what could develop, we need interface with other institutions as we don't have a common platform for information. That can lead to uncertainty.* The Zanzibari Industry Expert points out *that in the matter of coordination, there is a perception of the government that oil is sensitive and is not to be touched. This can lead to lack of transparency. Without transparency, there will be a shortage of cooperation and information should not go out.* The Operative Manager support in these claims of lack of coordination, *that the biggest risk is institutional transformation to meet the industry.* With these conflicting perspectives, gives a room for increased vulnerability in the system. Woods et.al (1994) introduces the that the relationships, 'sharp-end' and 'blunt-end' are complex, since decision-makers also adapt to circumstances not covered by these two dimensions. Their decision making is often constrained by limited situation awareness and this gives room for enhanced probability for organisational failure. Turner defines this as the root causes of organisational accidents through the unnoticed information flow discrepancies in the system about hazards (Rosness 2010:70). Turner (1976) introduced the failure of foresight principles that when ignored organisational accidents occur. In Turners model of failure of foresight, the incubation period is highlighted as the accumulation of an unnoticed set of events which are at odds with the accepted beliefs about hazards and the norms for their avoidance (Turner 1976:381). In other words, the incubation period is during which latent errors accumulate.

The dynamic measurements in managing a safety system with its possible latent conditions creates a need to handle what might occur such as further uncertainties in operation if not monitored. To monitor that system, the incentive is experience in the field. As Zanzibar is new to this industry of oil & gas, there a lack of competence to create the right incentives for what Reason defines as 'defence-in-depth' where successive layers of protection, one behind the other, each guarding against the possible breakdown of the one in front. The lack of 'defence-in-depth' is presented as having the right industry set-up of supervision and standardisation.

The elements constituting supervision and standardisation is elucidated as laws and regulation designed for this industry. As this industry is new, the 'defence-in-depth' is scrutinised as Zanzibar is at the early stage of development. The lack of guidance on how to operate safely, to provide alarms and warnings when danger is imminent, as in deviation from the laws and regulation thus creates uncertainty in operation at this present moment. This is to be restored through dialog with the industry and conclusion from assessments. These principles from the 'defence-in-depth' design helps to illuminate safety steering whilst in operation. Additionally, to enhance on the element of 'defence-in-depth' is the proactive strategy of local involvement to help set industry standards. By containing and eliminate the hazards in this phase of uncertainty, the civil society representative states that though there is little involvement with the industry there will be a nation meeting on the understanding of CSR. This can provide the means of escape and rescue should hazard containment fail – the lack of laws and regulation at this moment.

2. Research question 2: What kind of strategies does the authority have to maintain safe operation?

The strategy goals (Zanzibar policy 2016:53) that is imbedded in the operation of hydrocarbon exploration can either safekeep the industry or give room for uncertainties. With the lack of standardisation and supervision, in the form of requirements of laws and regulations needed to ensure safe operation, the operational strategies imbedded in the system, the management structure and exercise, stimulation, specific knowledge acquisition, specific solution and measures, can assist direction in keeping the hydrocarbon operation within the range of safety till the necessary laws and regulations are in place.

These operational strategies in the system can help the institutional arrangement as highlighted in the policy and act as the preparation of the oil & gas industry. The tools and measures present in the safety management model highlight the need. Aven, Boyesen et. al (2016:73) introduce that through tools and measures in the safety management system, there are endless of instruments to strengthen the safety in operation and they are of different aspects. In the aspect of requirements, how to meet the industry and vice versa shapes the preferred laws and regulations for the industry to meet and frame the internal interaction amongst the state actors as it is presented in the migration model's **space of possibilities** whereas the degrees of freedom to be resolved according to subjective preference is imbedded in the institutions roles and mandates. In the eight measures of duties and responsibilities to meet the industry stressed in the petroleum act (2016:7), the authorities are to grant, review, suspend and cancel of operational licenses, review and formulate regulations, inquire and investigate unsafe operations, and develop the approach on safe management in this activity. This concludes with the management structure and exercise aspect in the safety management model. Conducting assessments is in this period the most valuable operational strategy to ensure the effect this industry will have on the country. The investigation, which is an executive order from the decision-making level, grants the authority valuable knowledge and ensures trust from the lower level in Rasmussen's socio-technical system.

There have been conducted three assessments in the period 2012 – 2019, whereas two of the assessments were an EIA (Environmental Impact Assessment), one for potential onshore activities and the other for offshore activities and the third a SEA (Strategic Environmental Assessment). These initiatives are to validate the petroleum operation as stated by the Operative Manager. The Offshore EIA, with *was in 800m depth including teasing (transiting area with mainland)*. Also, *marine observation was completed, over the economic area, area concerning tourism sector and the nature considering fishing in the southern and eastern part.* In 2019, we collected a commission to work on the validation of oil & gas exploration with ZMA (Zanzibar Maritime Authority) in the form of a Strategic Environmental Assessment (SEA). The focal point of the assessments is to give the authorities that enhanced knowledge so that with this they can generate understanding and create standards and supervision to monitor the exploration activities. This is to act as one of the measures in combating the latent conditions that arise in the error-margin in the migration and ensure that **the boundary of the functionally acceptable performance** is not jeopardised. This is highlighted in the safety management model as specific knowledge acquisition which compromises of acquisition on how the various measures and solutions work together to increase knowledge and insight to the sturdiness of the safety system (Aven, Boyesen et. al.2016:73)

Operational strategy includes also the specific solutions and measures to be made to ensure safe operations. Aven, Boyesen et. al. (2016:73) indicate this as what is produced here are solutions and measures implicitly and explicitly designed to reduce risk and vulnerability. Though Zanzibar is in the start phase of a possible petroleum development and production, the specific solution in collecting data has been concluded. The experience with this choice of solution have been varied. The seismic acquisition has had its challenges whilst in operation. The System Architect informer points out that *the seismic disturbances with the fishing nets and this created instability in the fisherman because of limitation in the fishing days. The geophones created problems because of the blasting from the equipment created pressure in the water. Ferry routes had to be limited though this was short term solution, only two days. But when the production starts, the impact will be bigger.* The Civil Society representative illustrates that *most of the people in Zanzibar depend on the fishing. If oil is explored in the area they are told to move, and the fish will not be there afterwards. There should be more involvement.* As knowledge, insight and experience in all areas are a prerequisite for success,

if not taken lesson from this approach, this can indicate the future processing of selection of solutions and measures. The Operative Manager indicates that the technological solution for the seismic acquisition was *conducted with ROV (rotating operating vehicle), not using cable. Big ship with robot was used, a record shovel and no seismic ship*, indicating that this technological solution was better than the latter.

With these conflicting perspectives, gives a room for increased vulnerability in the system. Brehmer (1991) states that actors in complex systems are likely to resolve goal conflicts within a condition of local rationality. He/she is not in a position to assess the overall impact of their choices, or to assess how their choices interact with those of the other actors. In the choice of technological standard would then require further dialog and understanding so that the other industries in the country doesn't get negatively affected by this new industry.

To maintain safe operation, a strategy on institutional capacity building and competence is crucial. In the policy the strategy is to link the industry actors through build, develop, strengthen, enhance and improve administrative, management, and scientific skills towards petroleum development requirements linked to their sectors. This then includes all actors in all levels in the socio-technical system. The experience in the lower levels is that the more information is essential as the way it is processed from the higher levels is not sufficient.

Investment in knowledge of the operation in the system creates competence in monitoring when and where unsafe operation diverges towards the **perceived boundary of acceptable performance**. This is through the settled standards and supervision of the industry. However, lack of competence and awareness creates an opportunity for migration towards **boundary of functionally acceptable performance**, accident to occur. Competence and awareness are the mechanism of ensuring latent conditions to be detected, this is then solely dependently on system understanding and coordination.

3. Research question 3: How does the government institutions interact in this phase of petroleum industry development?

The various actors present in this **space of possibilities** in the migration model, each with given roles and mandates and might create conflicting perspectives given the degrees of freedom presented in this space. If there is weak interaction between the actors, they might collide and move towards an unsafe operation and if undiscovered become a latent condition. Rosness (2010:83) describes that since each level can influence each other in an integrated and tightly coupled system. Higher levels can influence lower levels through, e.g., explicit instructions, by the provision and limitation of resources, by establishing incentive systems, or by determining how decisions are to be made at lower levels. On the other hand, lower levels may use discretion when they interpret and implement directives from higher levels, they may control the information flow to higher levels, or they may bypass a level and direct a lobbying effort at the level above. The control of risk becomes challenging in this system. This is experienced in the institutional set-up in Zanzibar as the organisation of it may offer complications. As in the case of the institutions their role and mandates increased with the introduction of the petroleum sector to the country. *The System Architect highlights that the combination is a problem. In addition, as the petroleum sector is added in all institutions, many institutions don't want any other institution to interfere. There is a lack of coordination and all is interlinked. Coordination is mentioned in the policy but not in practice.* A challenge is introduction when it comes to this topic of the interaction of safety and economic development. *Most of the blame is put on environment for when they are following their mandate and work, they are not being friendly to the economic development.* It can be seen as the coordination is a classic sign of dominant constraint given the pressure to reach socio-economic growth creating erosion of safety margin as presented in the political decision mode in the decision criteria table by Rosness (2010:87).

The institutions dealing directly with this petroleum industry are young, established in 2016, there are challenges as the institutions are taking their form. Since 'adopting' the contract

from URT and creating an industry to monitor this company and institutional arrangements in oil & gas exploration is slowly taking its form

Chapter 6 Conclusion

– who can you convince when we don't know.

This hydrocarbon exploration with its latent conditions can give room for uncertainties and vulnerability in the system. The safety goal for Zanzibar is the target of generating hydrocarbon as value creation tool to develop the country, thus, a pressure to reach socio-economic growth. In the process of reaching that level, safety considerations might be diverged. The pressure to follow up on the industry safety might create disturbance in the system to reach that level of safety management. The socio-technical system gives room for aspects of risk which accentuate the level of latent conditions in the system whereas the safety management system combats this development of uncertainty. The aspect that ensures a safe management of the activity of hydrocarbon exploration is imbedded in the coordination strategy, information processing and decision-making process. The safety management system is intended to be driven by the 'sharp-end' as they have the most situation awareness. Through this exercise one can uncover the latent symptoms in the system. Within this error margin, there is an additional barrier of boundary of acceptable performance. The measure of safety management competence and awareness can lead the operation back to the expected performance of safety management.

Further research

During this thesis accomplishment, there were various discoveries that touch upon the future development of this industry. There are many interesting stages and elements presented in the petroleum value chain and given the dynamics of developing this industry through the perspective of an emerging market government. If the safety management focus presented here were to be established, an interesting aspect that arises how will the next phases be given if this approach were to be practiced, and can one secure a safe management of the system in its fullest form? What other mechanisms can ensure safe management of the oil & gas industry in the phases of development and production. Likely, other factors that drive the sector towards uncertainties in those phases than just the discoveries in this hydrocarbon exploration research paper.

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Appendix 1

Interview Guide Zanzibar

As a declaration was signed prior interview with government stakeholders, a disclosure of the nature of the paper was given. Prior interview, all informants were given the following information:

- The purpose of the paper
- The reason why the informant was chosen

The bow-tie model was used as an illustration as not all were familiar with risk management.

All interview prospects are based in Zanzibar and are Zanzibaris.

Authorities:

1. How would you describe risk?
2. What are the undesired events that might occur with the start of oil exploration?
3. How does Zanzibar address safety & security issues within offshore oil exploration?
4. What is your framework for decision -making? What are the mechanisms?
5. What is the procedure for allocating licence in Zanzibar?
6. How do you meet the industry that have more experience in this sector? What are the main challenges?
7. How do you address the local content aspect?
8. What are the main challenges when addressing the activities, in exploration phase, that needs to be implemented?
9. When exploration is being conducted, what are the main challenges towards the existing sectors of tourism and fishing?

Industry:

1. How would you describe risk?
2. What are the undesired events that might occur with the start of oil exploration?
3. How does Zanzibar address safety & security issues within oil exploration?
4. How do you meet the authority? What are the main challenges?
5. How do you address the local content aspect?
6. What are the main challenges when addressing the activities, in exploration phase, that needs to be implemented?
7. When exploration is being conducted, what are the main challenges towards the existing sectors of tourism and fishing?

Civil Society:

1. How would you describe risk?
2. What are the undesired events that might occur with the start of oil exploration?

3. How does Zanzibar address safety & security issues within oil exploration? Onshore and Offshore.
4. How do you meet the industry that have more experience in this sector? What are the main challenges?
5. How do you meet the authority? What are the main challenges?
6. How do you address the local content aspect?
7. What are the main challenges when addressing the activities, in exploration phase, that needs to be implemented?
8. When exploration is being conducted, what are the main challenges towards the existing sectors of tourism and fishing?