# INVESTIGATION INTO THE CURRENT PROJECT RISK MANAGEMENT PRACTICES WITHIN THE LIBYAN OIL AND GAS INDUSTRY

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# INVESTIGATION INTO THE CURRENT PROJECT RISK MANAGEMENT PRACTICES WITHIN THE LIBYAN OIL AND GAS INDUSTRY


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# DEDICATION

*'This PhD research Thesis is dedicated to all members of my family'*

My deepest gratitude goes to my family for their unflagging love and support throughout my life; this thesis is simply impossible without them. I am indebted to my father, for his care and love. He worked industriously to support the family and spare no effort to provide the best possible environment to finish my thesis.

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# ABBREVIATIONS

| | |
|---|---|
| ADNOC | Abu Dhabi National Oil Company |
| AHP | Analytical Hierarchy Process |
| AIPM | Australian Institute of Project Management |
| APM | Association for Project Management |
| BoKs | Bodies of Knowledge |
| BP | British Petroleum |
| BPD | Barrels per day |
| BSI | British Standards Institution |
| CAQDAS | Computer Assisted Qualitative Data Analysis Software |
| CSFs | Critical Success Factors |
| E&P | Exploration and Production phases |
| EIA | Environmental Impact Assessment |
| EOR | Enhanced Oil Recovery |
| EPC | Engineering Procurement and Construction |
| EPCM | Engineering, Procurement and Construction Management |
| EPSA | Exploration and Production Sharing Agreements |
| ERM | Enterprise Risk Management |
| EY | Ernst & Young |
| FEED | Front End Engineering Design |
| FMEA | Failure Mode Effect Analysis |
| FMECA | Failure Mode Effect and Criticality Analysis |
| FST | Fuzzy Sets Theory |
| GCC | Gulf Cooperation Council |
| HAZID | Hazard Identification |
| HAZOP | Hazard and Operability |

| | |
|---|---|
| HSE | Health, Safety and Environment |
| IEEE | Institute of Electrical and Electronics Engineers |
| IMF | International Monetary Fund |
| IOC | International Oil Company |
| IPA | Independent Project Analysis |
| IPMA | International Project Management Association |
| IRGC | International Risk Governance Council |
| IRM | Integrated Risk Management |
| ISO | International Organization for Standardization |
| KPC | Kuwait Petroleum Corporation |
| LAB | Libyan Audit Bureau |
| MCS | Monte-Carlo Simulation |
| MENA | Middle East and North Africa |
| MoD | Ministry of Defense |
| NIOC | National Iranian Oil Company |
| NNPC | Nigerian National Petroleum Corporation |
| NOC | National Oil Corporation of Libya |
| NOCs | National Oil Companies |
| OGC | Office of Government Commerce |
| OPEC | Organization of the Petroleum Exporting Countries |
| PDVSA | Petroleos de Venzuaela, S.A. |
| PERT | Program Evaluation and Review Technique |
| PFG | Libyan Petroleum Facilities Guards |
| PIG | Probability-Impact Grid |
| PLS | Progressive Lump Sum |

| | |
|---|---|
| PMBOK | Project Management Body of Knowledge |
| PMI | Project Management Institute |
| PRAM | Project Risk Analysis and Management |
| PRINCE2 | PRojects IN Controlled Environments |
| PT | Probability Theory |
| QRA | Quantified Risk Assessment |
| RMR | Risk Management Road Map |
| TQM | Total Quality Management |
| UNECE | United Nations Economic Commission for Europe |

# ABSTRACT

The continued increase in the world's population means increasing global energy demands. According to the best estimates available, hydrocarbons will be the main contributor to meet these energy needs. However, oil and gas projects pose significant risks, as they are large, complex and involve a considerable number of stakeholders and technologically difficult. The literature shows that many projects in the industry fail as a result of improper risk management practices. The literature also shows that although some scholars doubt the effectiveness of these practices, according to others, a positive relationship exists between applying these practices and project success.  This research focuses on Libya, an important player in fulfilling the world's energy demands, where the oil and gas industry is crucial to the national economy.

Given the conditions existing in Libya, appropriate project risk management for the oil and gas industry needs is important. The aim of this research is to investigate the current project risk management practices in the oil and gas industry in Libya. This research follows a single case study approach. The data collection method adopted for this study was qualitative. Thirteen semi-structured interviews with top managers, project engineers and advisors were undertaken to achieve the aim of the study. Documents were also reviewed to support the findings from the interviews.

Results show that awareness of the concept of project risk management is still very low in Libya and there is a lack of project management culture and risk management in particular. This research also demonstrates that although these practices are already being applied to some extent, this relies on the prior knowledge and experience of specific individuals, rather than on a systematic, documented procedure. The lack of financial resources and the shortage of experienced and qualified personnel due to the country's current situation and as well as a lack of clear organisational vision within the oil and gas industry in Libya, all limit the implementation of effective project risk management.

However, results also show that even though there is no written procedure for project risk management practices within the Libyan oil and gas industry, participants believe that applying these practices can increase overall project performance. This research contributes to theory and practice by implementing set of recommendations for developing an effective project risk management practices within the Libyan oil and gas industry. The researcher concludes that project risk management practices contributes to project success within the Libyan oil and gas industry.

# Chapter 1 Introduction

## 1.1 Background of the study

It has been argued that the oil and gas sector is one of the most important sectors due to its significant influences on all aspects of other businesses (Akinremi, Anderson, Olomolaiye, & Adigun, 2015; Badiru & Osisanya, 2013). All countries are affected by the industry in some way either as producers or consumers of oil and gas or both. Thus, the industry is of strategic economic importance to the global economy, as it influences not only the economic development of a country but also the development and services of other sectors (Ajah, 2014). Furthermore, Dayanandan and Donker (2011) argued that oil and gas are major resources that are in high demand, and their effects on national and international financial markets cannot be overlooked.

According to British Petroleum (BP) (2016), the need for energy supplies will continue to increase as the world's population increases; it is predicted that the population will experience an increase of approximately 1.5 billion, reaching a total population of 8.8 billion by the year 2035. Hydrocarbons will continue to be the main source of energy (responsible for nearly 80% of total energy sources in 2035) fuelling the world economy, with the Middle East and North Africa (MENA) region being the main suppliers (BP, 2016; IEA, 2015).

The Organisation of the Petroleum Exporting Countries (OPEC) is a body that consists of 14 member countries, 8 of which are located in the MENA region (Algeria, Iran, Iraq, Kuwait, Libya, Qatar, Saudi Arabia and the United Arab Emirates). According to OPEC (2015), more than 66% of the world's oil reserves are located in the MENA region. Therefore, the region plays an important role in meeting the future global energy demand. Libya, a country that is currently experiencing considerable security and political unrest, plays an important role in supplying hydrocarbons to meet the world's demands.

Given the current difficulties in Libya, Luft (2006) indicated that the oil and gas industry is facing serious challenges related to oil-producing countries, especially those suffering from social and economic challenges that make them particularly prone to conflict and political instability (e.g. Libya), such as unemployment, a democracy deficit and the failure of regimes to diversify their economies. These challenges could be exacerbated over time, resulting in an unwelcoming investment environment in these countries, which in turn affects the development of their oil and gas projects.

Investments and developments are achieved through projects, which are the fundamental means by which a business can advance (BS-6079-3, 2000). Projects are the backbone of the oil and gas industry activities that aim to meet the global energy demands; however, oil and gas projects are challenging, as they are complex, risky, uncertain, involve a considerable number of stakeholders, are technologically difficult and must adhere to tight budgets and schedules (Akinremi et al., 2015; Briel, Luan, & Westney, 2013; Deloitte, 2015; EY, 2014, 2015). According to Badiru and Osisanya (2013), the managerial aspects of oil and gas projects remain a challenge, which might be due to the nature of oil and gas projects, as they involve a large number of stakeholders. Hence, the effective application of project management practices can assist in overcoming these challenges.

Among the various project management practices, project risk management is considered essential. As oil and gas projects involve several risks that can affect their deliveries, the management of risks is important to ensure successful project performance (Aven, Vinnem, & Wiencke, 2007; Cooper et al., 2014). The benefit of project risk management is acknowledged by numerous organisations in the industry, mainly because they believe that risks cannot be completely eliminated but can be managed (Tummala & Burchett, 1999).

With many oil and gas projects failing to meet their predetermined goals in terms of time, cost and quality (EY, 2014; Suda, Rani, Rahman, & Chen, 2015), project risk management is an important area to investigate all threats that jeopardise their performance. This is because project risk management practices offer rapid strategies for identifying, assessing, monitoring and controlling negative events, and they also identify opportunities.

## 1.2 Justification of the study

Due to the importance of oil and gas projects to the economy and to different industries, their failures are significant. In a recent universal study conducted by one of the four well-known audit firms, Ernst & Young (EY) (EY, 2014), on the performance of 365 oil and gas projects, the study showed that a high percentage of projects failed to meet their approved time and budget. The study also revealed that project delivery success is declining when compared with the long-term industry forecasts. The same study identified that management processes contribute to these schedule delays and cost overruns, *more specifically referring to improper project risk management practices*. The study concluded with the recommendation that applying project management practices, including project risk management, could improve project performance and reduce the risks of schedule delays and cost overruns. Aligned with these findings, according to Merrow (2012), who is the founder of Independent Project Analysis (IPA) Inc. (IPA is widely known for being a respected research organisation that conducts project analyses, including analysing projects within the oil and gas industry), 78% of oil and gas projects experience significant issues in terms of cost overruns and schedule delays. Long (2015), Victor, Hults, and Thurber (2011), Nolan and Thurber (2010) also identified the same problem regarding projects failing to meet their preapproved timescales and budgets, and the authors concluded that improper project risk management practices contribute to this issue.

Therefore, the continued need to ensure that projects are managed properly and efficiently across the oil and gas sector has led to increased attention in both industry and academia to develop reliable and systematic project risk management strategies to reduce project failure. Hence, project risk management has been identified as an important factor that should be carefully assessed to ensure project failures are minimised (Al Subaih, 2015; Carvalho & Rabechini Junior, 2015; PMI, 2013; Rabechini Junior & Monteiro de Carvalho, 2013; Rogers & Ethridge, 2013; Salazar-Aramayo, Rodrigues-da-Silveira, Rodrigues-de-Almeida, & de Castro-Dantas, 2013; Zwikael & Ahn, 2011). Briel et al. (2013) suggested that in these challenging environments, the available project management best practices and experienced project managers alone are not sufficient; instead, project managers who follow a coherent risk management framework that consists of monitoring and reviewing project risks is needed.

Accordingly, in an attempt to increase project performance, companies have increased their commitment to implementing project risk management to help them remain competitive as well as to induce value creation among the company deliverables (Denney, 2006). An important part of project risk management practices is analysing all project challenges and multicultural environments by implementing effective monitoring procedures for the different processes of all combined projects that are associated with global and complex demands (Thamhain, 2013); however, due to improper project performance in the past, the oil and gas industry has been subject to recent fluctuations in oil prices. In 2015, the price of oil fell to the lowest rate in almost four decades (Baumeister & Kilian, 2016; Cagianelli, Michelez, & Nava, 2015; Zhao, Hwang, & Gao, 2016), leading to project performance uncertainties, especially in regions affected by other risks, such as the uprisings and wars affecting the MENA region (Khatib, 2014). With reference to Libya, a country that is located within the MENA region and suffers from significant political and security unrest, the oil and gas sector is considered the economic backbone of the country, contributing significantly to the nation’s income. For example, according to the International Monetary Fund (IMF) (IMF, 2013), hydrocarbon production contributes to approximately 96% of total government revenue. Thus, despite the current risky and unsecured circumstances in Libya, the study of issues related to project risk management in the oil and gas sector should be prioritised.

The detailed literature review also revealed that a gap in knowledge exists, as there is a lack of studies within the Libyan context to address this issue (project risk management); however, a number of studies have been carried out that focused on the economic state of the sector (see El-Mnawi, 2005; El-Sharif, 2005; Eldanfour, 2011; Mahmud, 1997; Moussa, 2009). Other studies have focused on the role of Total Quality Management (TQM) with the aim to improve the performance of oil and gas projects (Saleh & Salem, 2013; Youssef, 2006). While TQM aim is to increase customer satisfaction in enhancing project performance by improving processes and management systems, it does not necessarily focus on project risks that might lead to poor projects’ performance. Hence, project risk management is not essentially part of TQM. On the other hand, a recent study conducted in 2013 explored the effect of senior managers on the strategic management of the National Oil Corporation (NOC) of Libya (Atamna, 2013); however, no previous studies have been carried out on project risk management in the Libyan oil and gas industry despite the significance of the area. Therefore, this has been identified as a knowledge gap that is addressed by this study, which further justifies the importance of conducting the study. Given the importance of the Libyan oil sector as a main driver of the country's economy and due to the continued failure of oil and gas projects to meet their approved budgets and schedules, it is crucial to investigate the current risk management practices in the industry to increase the awareness of this topic and to enhance project risk management practices, hence increase project success rate.

## 1.3 Aim and objectives

The aim of this research was to investigate the current project risk management practices in the oil and gas industry in Libya to provide general recommendations for an effective project risk management process. Accordingly, to accomplish the aim, the following objectives were developed.

Objectives:

- To critically review the concept and importance of effective project risk management practices with particular reference to the oil and gas industry;
- To investigate the awareness of risk and project risk management in the Libyan oil and gas industry;
- To examine the current practices of project risk management in the Libyan oil and gas industry;
- To evaluate the challenges that influence the development of effective project risk management practices in the Libyan oil and gas industry;
- To develop recommendations for enhancing project risk management practices in the Libyan oil and gas industry.

To achieve the aim and objectives of this research, the research methodology discussed in the next section was adopted.

## 1.4 Research methodology

Identifying a research problem is the most important step in the research process (Creswell, 2009; Kerlinger & Lee, 2000; Sekaran & Bougie, 2016); however, Ellis and Levy (2008) stated that the process of identifying a research problem is the most challenging task of the entire research process. Therefore, to identify a clear and solid research problem, which ultimately assisted in defining the aim and objectives of this study, three sources of information were used, as shown in figure 1-1.

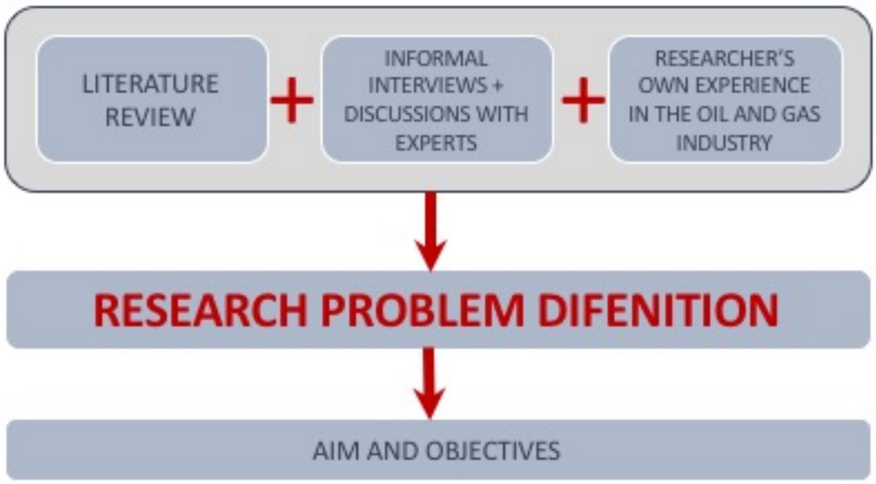



Figure 1-1 Definition of the research problem

The three sources of information included a literature review, a discussion with experts and the researcher's experience related to the Libyan oil and gas industry. These sources supported the researcher in creating a research problem. The extensive literature review assisted in framing the problem in an academic context, while consultation with experts within the Libyan oil and gas sector allowed for a practical perspective of the proposed problem. Finally, the researcher's experience related to the Libyan oil and gas sector affirmed the need to address the issue of project risk management practices, especially during this critical time for the country due to high-risk conditions resulting from the unstable political and security situation.

Following the identification of the research problem, the research onion model developed by Saunders, Lewis, and Thornhill (2016) was selected for this study because it is a simplified model that provides a clear understanding of the research process to be followed. Therefore, each of the model's layers was taken into consideration. This assisted in making a systematic and analytical decision regarding which research design would be more applicable to this research and would support the research aim and objectives. Interpretivism is considered the philosophical stance for this study, which indicates that knowledge is socially constructed through the understanding of participants in the practices of project risk management. In addition, a single case study has been adopted for this research; this has allowed the researcher to study the phenomena of project risk management in greater detail. The project risk management practices in the oil and gas industry in the Libyan NOC were used as the units of analysis. Accordingly, primary data was collected from experts working within the Libyan oil and gas industry. Semi-structured interviews were conducted to gather experts' opinions on the phenomena under investigation. The interview questions were designed to obtain knowledge of the current practices of project risk management as well as to identify challenges that limit the successful implementation of an effective project risk management process. In addition, documents were reviewed to support the findings from the interviews. In terms of the data analysis, to fulfil the aim and objectives of this research and to arrive at a valid conclusion, a content analysis was used for the analysis of the semi-structured interviews. The data analysis process was conducted with the support of NVivo 11 software. Table 1-1 below summaries how each objective outlined in section 1.3 were addressed within the different data collection techniques used for this research.

Table 1-1 Objectives of the research and the different methods of investigation

| **Objective** | **Methods of Investigation** | | |
|---|---|---|---|
| | | **Case study** | |
| | **Literature Review** | **Semi-Structured interviews** | **Document Review** |
| To critically review the concept and importance of effective project risk management practices with particular reference to the oil and gas industry. | X | | |

| | | | |
|---|---|---|---|
| To investigate the awareness of risk and project risk management in the Libyan oil and gas industry. | X | X | X |
| To examine the current practices of project risk management in the Libyan oil and gas industry. | X | X | X |
| To evaluate the challenges that influence the development of effective project risk management practices in the Libyan oil and gas industry. | X | X | X |
| To develop recommendations for enhancing project risk management practices in the Libyan oil and gas industry. | X | X | X |

## 1.5 Scope of the study

The scope of this study includes project risk management practices within the Libyan oil and gas industry. The NOC of Libya is the only body that is responsible for managing and regulating all oil and gas industry activities in Libya. These include all upstream and downstream activities of the industry. Accordingly, this research focuses on the NOC of Libya as a case study in order to investigate the current project risk management practices.

## 1.6 Contribution to knowledge

This research contributes to theory by establishing a set of recommendations for the effective implementation of project risk management practices within the Libyan oil and gas industry. This study also contributed to the academic literature by filling the knowledge gap that exists within the Libyan oil and gas industry context. The research also contributes to practice through the established recommendations which were categorised and targeted specifically towards three managerial levels in the NOC, thereby increasing the chances of the successful and effective implementation of project risk management. Hence, enhancing the performance of

Libyan oil and gas projects. Such performance can be achieved with the implementation of the recommendations in practice. Further details are provided in chapter 7.

## 1.7 Organisation of the thesis

The structure of the thesis is shown in figure 1-2. The thesis is organised into seven chapters.

**Chapter 1:** The **Introduction** section provides an overview of the background of the study. It also provides a justification for conducting this study, its aim and objectives, an overview of the research methodology, scope of the study and the contribution to knowledge.

**Chapter 2:** The **Overview of the oil and gas industry** section presents an overview of the oil and gas sector and how it operates, including the different roles of International Oil Companies (IOCs), National Oil Companies (NOCs), OPEC members and non-OPEC countries. It also includes a specific section on the oil and gas industry in Libya, its importance and the role of the NOC of Libya. Finally, it outlines the challenges the Libyan oil and gas sector faces.

**Chapter 3:** The **Project risk management** section classifies key research areas related to this study, which is achieved through a comprehensive literature synthesis on the topics of project management and project risk management.

**Chapter 4:** The **Research methodology** section describes the research process and the methodological design used to fulfil the aim and objectives of this study. Detailed justifications of the research philosophy, approach, methodological choice, strategies, time horizons and data collection and analysis procedures are provided.

**Chapter 5:** The **Data analysis and research findings** section analyses and presents the findings of the qualitative data collected during the case study. The data analysed and presented as part of this chapter include the two different sources of evidence, namely semi-structured interviews and a review of relevant documents.

**Chapter 6:** The **Discussion** section provides a detailed discussion of the results from the qualitative data presented in chapter 5. The formation of the set of recommendations is also presented in this chapter.

**Chapter 7:** The **Conclusion** section presents the conclusion regarding the aim and objectives of this research study. Furthermore, the contributions of this study to theory and practice are also discussed, followed by the research limitations and suggestions for future research studies.

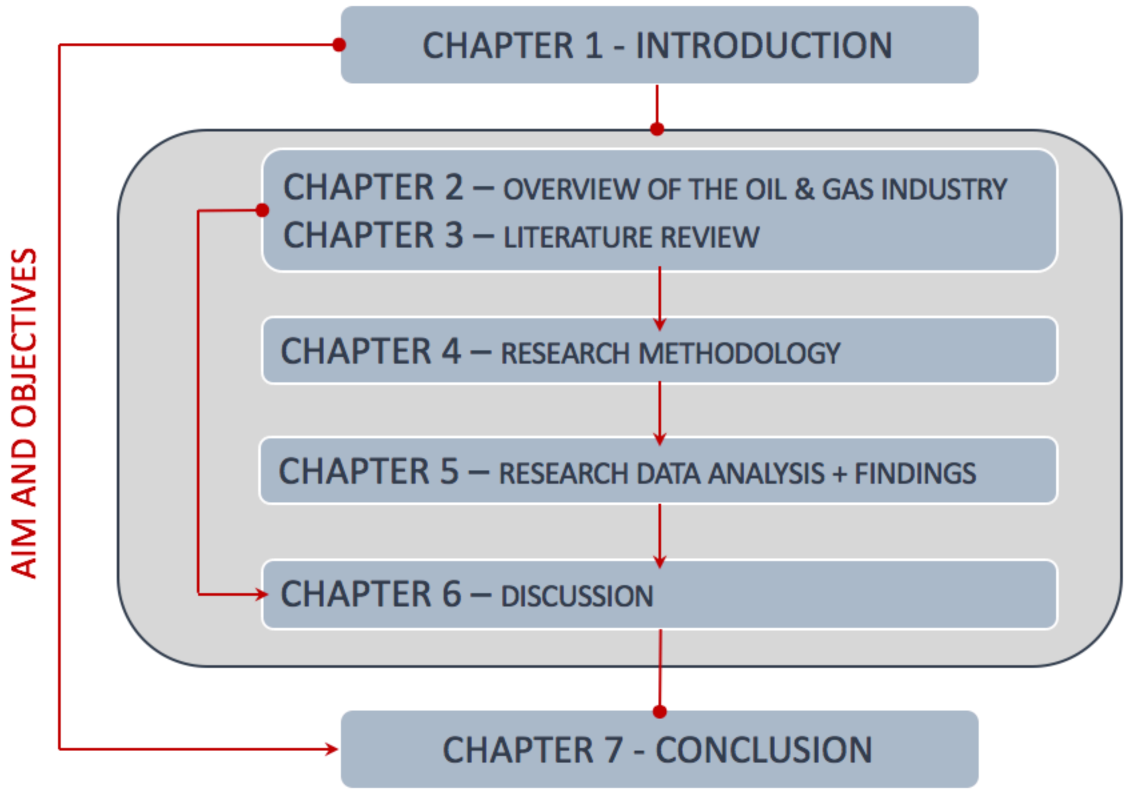



Figure 1-2 Structure of the thesis

# Chapter 2 Overview of the oil and gas industry

## 2.1 Introduction

The previous chapter provided an introduction into the current research study. Since this study deploys the concept of project risk management in the context of the oil and gas industry, the aim of this chapter is therefore to provide an overview of this industry, according to the following structure:

- First, it will provide an overview of the importance of the oil and gas industry and how the industry operates, including the role IOCs, NOCs, OPEC members and non-OPEC countries in the sector.
- Second, it will specifically outline key aspects of the Libyan oil and gas industry, including Libya's hydrocarbon reserves, its production history and the role that the oil and gas industry plays in the Libyan economy.
- Third, it will describe the role of the NOC of Libya in the Libyan oil and gas sector.
- Finally, it will outline the challenges that the Libyan oil and gas industry currently faces.

## 2.2 The oil and gas industry: overview and importance

The oil industry is like no other industry in the world, and demands a different set of skills and technical, political and financial capacities (Herkenhoff, 2014). This industry is of strategic importance to the global economy. Every country is actively affected by the oil and gas industry, in one way or another (Schwab, 2016). Many scholars argue that the industry will remain the most important source of energy for decades to come, even as various alternatives emerge (BP, 2016; England, 2016; Herkenhoff, 2014). It is estimated that hydrocarbons will still be responsible for nearly 80% of total energy sources in 2035, with the MENA region as the main supplier (BP, 2016; IEA, 2015).

The oil and gas sector directly or indirectly supports numerous industries across the globe such as engineering, hospitality, construction and finance. These industries are so dependent on the oil and gas sector that any changes in the business environment for oil and gas production or exploration directly affects the outlook for these related industries (Devold, 2013).

Moreover, oil and gas companies do not develop resources and implement projects on their own. They rely on the expertise of thousands of professionals who have specialised in relevant fields. Therefore, throughout the product life cycle, this industry provides innumerable opportunities for different types of businesses, providing employment opportunities for thousands and support the economies of towns and cities around the globe.

In addition, oil (or, as many refer to it, ‘black gold’) is flexible and can be transported in small or large quantities which then can be converted into useful products, such as the gasoline used to support individual mobility around the globe (Herkenhoff, 2014). Refining continues to produce additional, useful by-products such as those used in printing inks, paints, skin care products, make up, clothes, synthetic rubber, shoes, medical supplies and many other products (Herkenhoff, 2014).

Oil and gas operations are typically divided into three distinct activities – upstream, midstream and downstream –as shown in Figure 2-1 (Herkenhoff, 2014; Suda et al., 2015). Details of each activity will be provided below.

The upstream sector refers to activities that happen before the refinery of hydrocarbons, and is therefore mainly related to exploration and production phases (E&P) as well as prior conceptual development (Herkenhoff, 2014; Razalli, 2005). This sector requires the highest investment for new product development because of the large uncertainty involved, especially during the exploration phase (Barata et al., 2014).

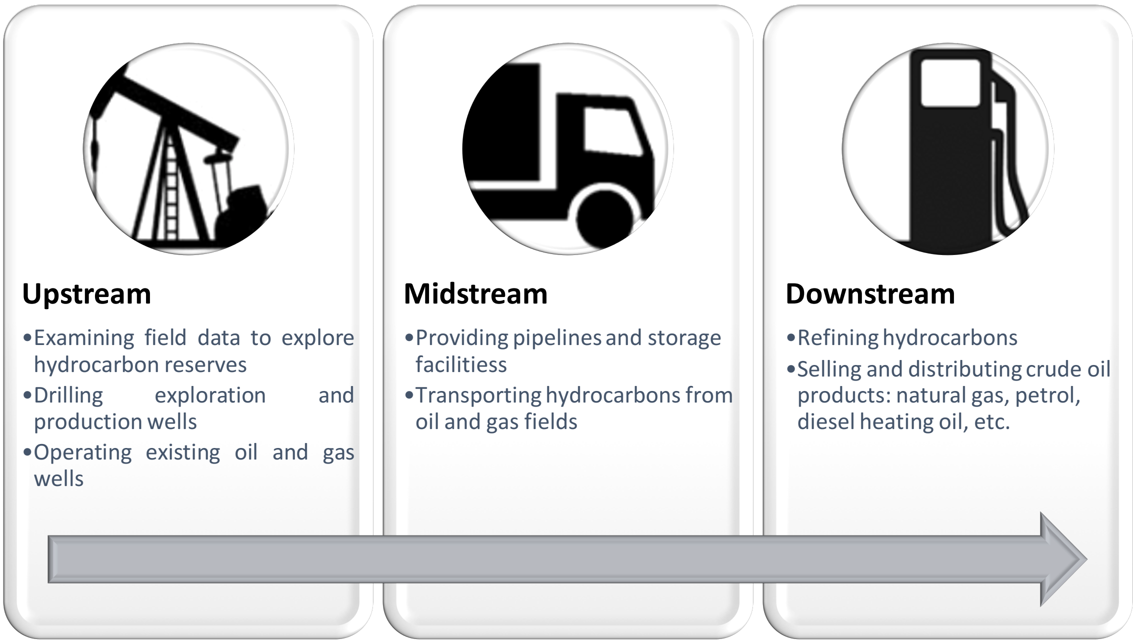



Figure 2-1 Classification of oil and gas industry activities.

Midstream activities happen after the initial production of hydrocarbons and involves the pipeline network, storage facilities and the distribution of hydrocarbon already extracted; the midstream is therefore the link between upstream and downstream activities (Herkenhoff, 2014).

The downstream sector consists of all refining and processing of hydrocarbons produced including crude oil; the term also describes the sale, storage and distribution of natural gas and of products derived from crude oil (Herkenhoff, 2014; Suda et al., 2015). Downstream activities therefore require industrial plants as well as storage facilities (Barata et al., 2014). Products of this downstream industry (but are not limited to) heating oil, gasoline, jet fuel, asphalt, diesel, natural gas and lubricants, all of which can be then sold to consumers (Herkenhoff, 2014).

The oil and gas industry is a very challenging and difficult sector; one aspect of this situation is the reality that most of the world’s oil and gas reserves are controlled by state-owned organisations; more than half of the total world oil reserves are controlled by state companies in the Middle East (Petroleum.co.uk, 2015). According to Herkenhoff (2014), the oil and gas industry can be seen to have two major participants in its activities, these include IOCs and NOCs.

### 2.2.1 International Oil Companies

The owners of IOCs predominantly make their investment decisions on the basis of financial factors (to increase shareholder value); therefore, although these companies operate in different parts of the world and are affected by the laws of their host countries, they make decisions to maximise profits for their investors and not based on the policy objectives of governments (Herkenhoff, 2014). The expression IOC is usually linked with other terms; for example, 'Supermajor' is the most common term used to refer to the six largest oil companies globally. Table 2-1 shows some of the largest upstream oil companies in the world.

Table 2-1 Largest upstream oil and gas companies (Adopted from Herkenhoff, 2014; Petroleum.co.uk, 2015)

| Company name | Location |
|---|---|
| ExxonMobil | U.S. |
| Royal Dutch Shell | Netherlands |
| BP | UK |
| Total | France |
| Chevron | U.S. |
| Lukoil | Russia |
| ConocoPhilips | U.S. |
| Occidental | U.S. |
| Gazprom | Russia |
| Repsol-YPF | Spain |

IOCs have been in the oil and gas sector the longest, and hence have developed extensive experience, knowledge and specialised technology in the search for hydrocarbons. Their history dates back to the 19th century (1870) when John D. Rockefeller founded the largest oil company at the time called 'Standard Oil'; in 1911, Standard Oil was broken up by antitrust legislation, of which three of the successor companies : Standard Oil of New Jersey (Exxon), Standard Oil of New York (Mobil), and Standard Oil of California (Chevron) joined Texaco and Gulf Oil, as well as European companies Royal Dutch Shell, and the Anglo-Iranian Oil Company (now BP) to form a group referred to as the “seven sisters” of the industry (Davis, 2006; Herkenhoff, 2014; Petroleum.co.uk, 2015).

In the 1970s, IOCs held approximately 85% of the world’s proven hydrocarbon reserves (PFC energy as cited in Beyazay-Odemis, 2016); now, however, they hold less than 10% (ranging from 6% to 8%) of reserves (Beyazay-Odemis, 2016). This change came about because of moves by national governments, especially during the Arab embargo in 1973, to gain more control over their hydrocarbon production and distribution, leading to the creation of NOCs (Herkenhoff, 2014).

### 2.2.2 National Oil Companies

NOCs are organisations that have a full or majority of their share value held by the parent government of the country in which they are based. Until recently, the operations of NOCs were centred in domestic markets, but now they also extend to international markets (Cheon, Lackner, & Urpelainen, 2015). Table 2-2 provides examples of the top ten largest NOCs worldwide. At present, approximately 94% of proven oil reserves across the globe are held by NOCs (PFC energy as cited in Beyazay-Odemis, 2016). NOCs have full and exclusive control over their hydrocarbon reserves with the rights to explore and develop oil and gas fields within their home countries and the option to enter into joint ventures with IOCs (Herkenhoff, 2014).

Table 2-2 Top 10 largest NOCs (Adopted from Herkenhoff, 2014; Petroleum.co.uk, 2015)

| Name | Location |
|---|---|
| Saudi Aramco | Saudi Arabia |
| National Iranian Oil Company (NIOC) | Iran |
| Qatar Petroleum | Qatar |
| Iraq National Oil Company | Iraq |
| Petroleos de Venzuaela, S.A. (PDVSA) | Venezuela |
| Kuwait Petroleum Corporation (KPC) | Kuwait |
| Abu Dhabi National Oil Company (ADNOC) | UAE |

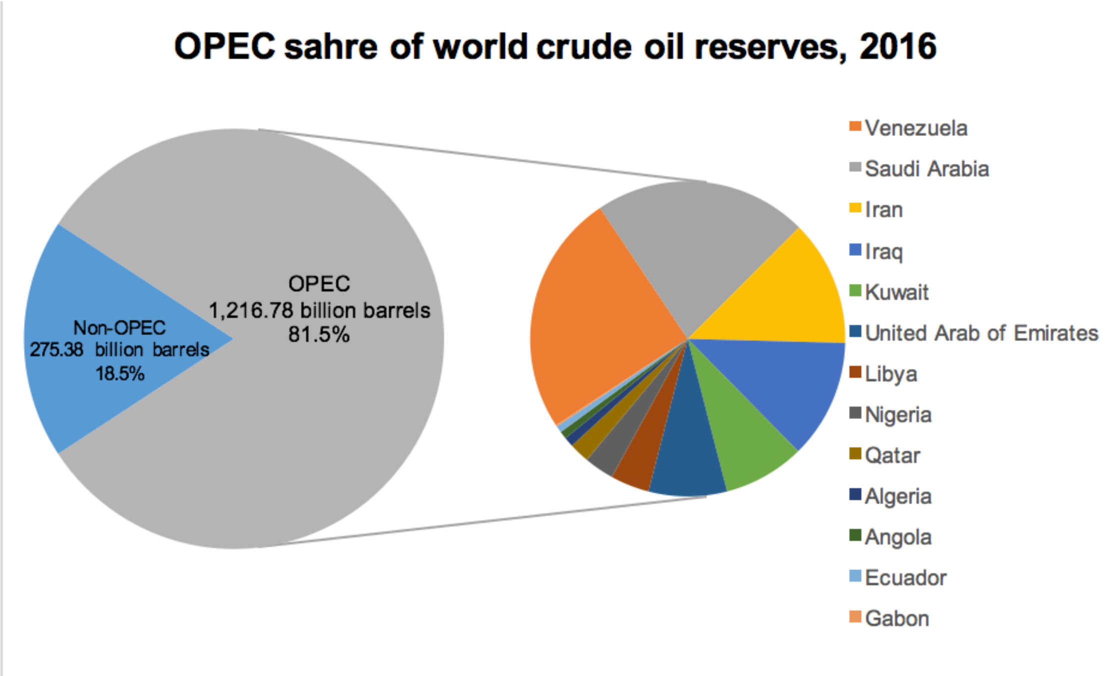
| | |
|---|---|
| National Oil Corporation – Libya (NOC) | Libya |
| Nigerian National Petroleum Corporation (NNPC) | Nigeria |
| Sonatrach | Algeria |

NOCs and their parent governments have a huge implicit influence on the upstream exploration and development of oil and gas resources. NOCs play a major role in determining the economic direction of oil producing countries, but the operation of national oil companies is not based entirely on market principles. The close connections between NOCs and their national governments imply that NOC objectives are likely to reflect the goals of governments (Luciani, 2016), including employment creation, enhancing economic development, provision of domestic energy security and the fair distribution of resources (Herkenhoff, 2014).

### 2.2.3 Organisation of Petroleum Exporting Countries

OPEC was formed in 1960 by Iraq, Venezuela, Saudi Arabia, Kuwait and Iran as the founder members. Over the years, other oil producing countries joined OPEC, including the UAE, Ecuador, Libya, Qatar, Nigeria, and Gabon, among others. As of May 2017, the organisation has 14-member countries including the newest member, Equatorial Guinea (Opec.org, 2017a). This organisation was created to facilitate coordination and help establish common policies in the petroleum industry, to enable efficiency in the production and supply of oil.

OPEC is one of the most important and influential supply-side determinants in the global oil and gas industry, accounting for approximately 40% of the total oil produced and close to 60% of the total oil traded globally (EIA, 2017). This statistic outlines the huge influence OPEC countries have in the global industry, especially their potential to determine oil prices through supply-side interventions. Moreover, OPEC countries account for approximately 81.5% of the world's proven oil reserves (Opec.org, 2017b) as shown in Figure 2-2.




OPEC proven crude oil reserves at end 2016 (*billion barrels, OPEC share*)

| | | | | | |
|---|---|---|---|---|---|
| Venezuela | 302.25 | 24.8% | Nigeria | 37.45 | 3.1% |
| Saudi Arabia | 266.21 | 21.9% | Qatar | 25.24 | 2.1% |
| Iran | 157.20 | 12.9% | Algeria | 12.20 | 1.0% |
| Iraq | 148.77 | 12.2% | Angola | 9.52 | 0.8% |
| Kuwait | 101.50 | 8.3% | Ecuador | 8.27 | 0.7% |
| United Arab of Emirates | 97.80 | 8.0% | Gabon | 2.00 | 0.2% |
| Libya | 48.36 | 4.0% | | | |

Figure 2-2 OPEC and non-OPEC share of world crude oil reserves (Opec.org, 2017b)

The above figure provides details on how OPEC countries control the majority of oil reserves while non-OPEC countries share about 18.5% of the total proven crude oil reserves. The figure classifies each country by its total reserves and the percentage it contributes to the world's crude oil reserves. It can be noted that about 70.4% of OPEC reserves are located in the MENA region, so that this region will remain influential for the foreseeable future.

### 2.2.4 Non-OPEC countries

While non-OPEC countries account for 18.5% of the total share of the world's oil reserves (as shown in Figure 2-2; Opec.org, 2017b), their oil production accounts for about 60% of global levels (EIA, 2017). Regions of the former Soviet Union (e.g. Kazakhstan and Russia), North America and the North Sea are considered to be key production regions outside of OPEC (EIA, 2017). Non-OPEC countries make autonomous decisions concerning their oil production. In contrast to OPEC, where most of the production is in the hands of NOCs, IOCs perform most of the production in non-OPEC countries (EIA, 2017). Non-OPEC countries are often seen as price takers because they respond to market prices, instead of influencing prices through production. Consequently, many non-OPEC countries produce near or at their full capacity, with little capacity to spare (EIA, 2017).

The above section has given an overview of the importance of the oil and gas sector, and discussed how the industry operates. The next section will provide specific information about the Libyan context and the importance of this sector to the national economy.

## 2.3 Libya as a country

Libya is located in North Africa and is the second-largest country in Africa by land area, with a total of approximately 1.8 million square kilometres. The country borders the Mediterranean Sea to the north, Tunisia and Algeria to the west, Niger, Chad and Sudan to the south and Egypt to the east, and as of July 2015 was estimated to have a population of 6.4 million (CIA, 2017). Figure 2-3 shows a map of Libya.


Figure 2-3 Map of Libya (CIA, 2017)

## 2.4 Libya’s oil and gas sector

Libya possesses the largest established proven oil reserves (Figure 2-4) and the fifth-largest natural gas reserves (Figure 2-5) in Africa, and has been a member of OPEC since 1962 (EIA, 2015). Oil exploration in Libya began in 1955, and the petroleum law, No. 25, was enacted in April of the same year. The first oil fields were discovered in 1959 at Nasser and Libya began oil exports in 1961 (EIA, 2015; Inkpen & Moffett, 2011).

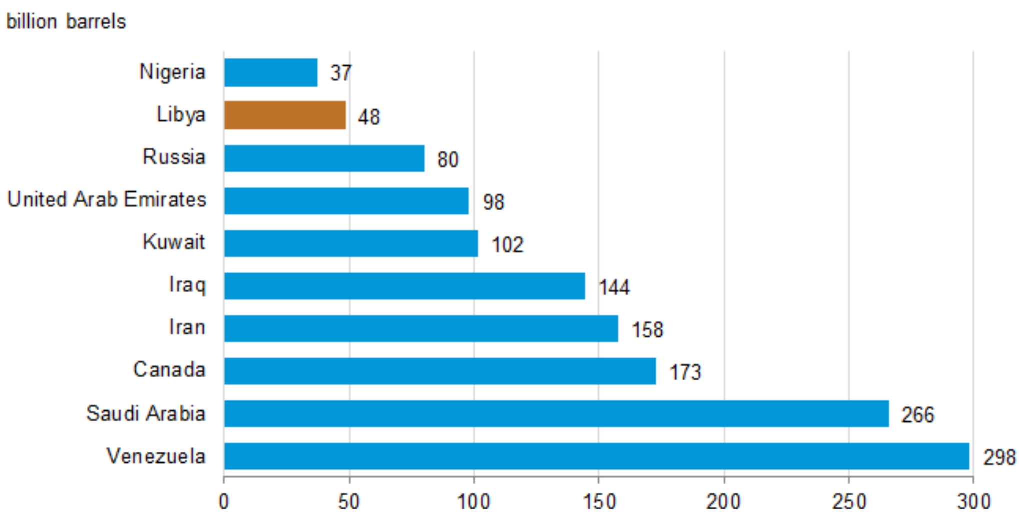



Figure 2-4 The world's largest oil reserves (EIA, 2015).

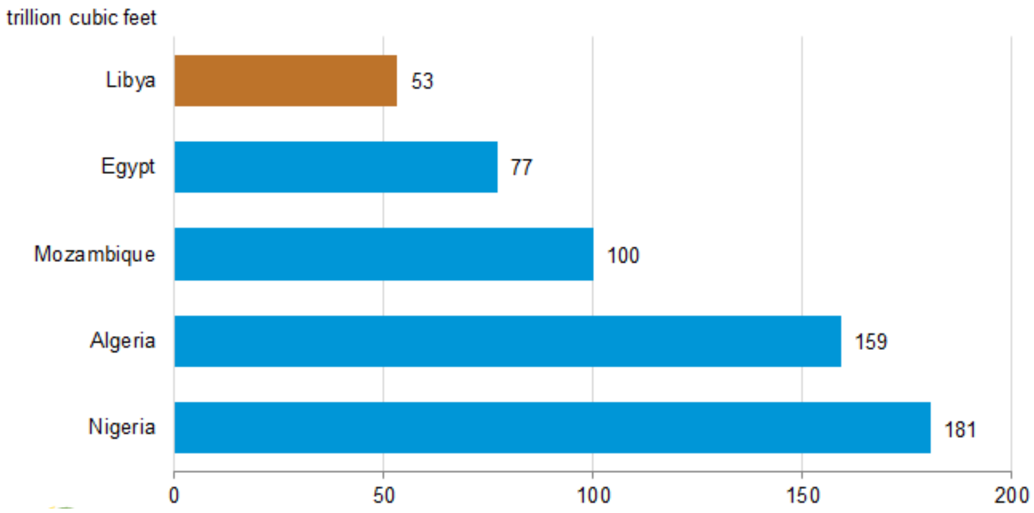



Figure 2-5 Africa's largest natural gas reserves (EIA, 2015).

Apart from being the largest oil producer in Africa, Libya is also among the largest North African suppliers of oil to Europe. The country's vast oil reserves allow it to produce a large quantity of oil for domestic and export purposes (Miyoshi, 1999). Libya's economy has been built on oil since the 1960s, and exports contribute greatly to the nation's overall revenues (Otman & Karlberg, 2007). However, Libya's access to technology and equipment was severely affected by the sanctions and restrictions placed on Libya from 1992 to 1999 (Brown, 2014). Access to up-to-date oil industry methods of exploration and production was highly restricted, making Libya reliant on direct foreign investment to ensure that the industry continued to develop. Libya is known as a location with low production costs, and its oil fields are close to the refineries and markets of Europe. Although extensive exploration has been carried out for about half a century, unexplored regions of Libya continue to possess great oil and gas potential.

## 2.5 Libya's oil and gas production

According to the EIA (2015), Libya's oil and gas production and exports both decreased sharply as a result of civil unrest in the last few years. Before the civil war began in February 2011, Libya was producing about 1.6 million barrels of oil per day, and while production recovered initially in 2012, it was still lower than the levels achieved prior to February 2011. Figures 2-6 and 2-7 below summarise oil and gas shipments and the effect of the civil war on production.

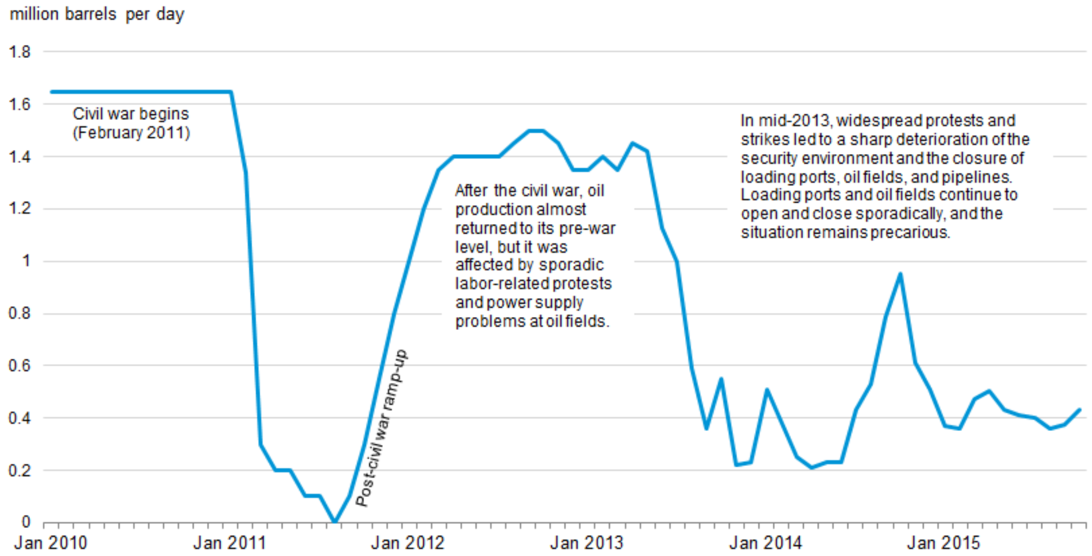



Figure 2-6 Libya's oil production from January 2010 to October 2015 (EIA, 2015).

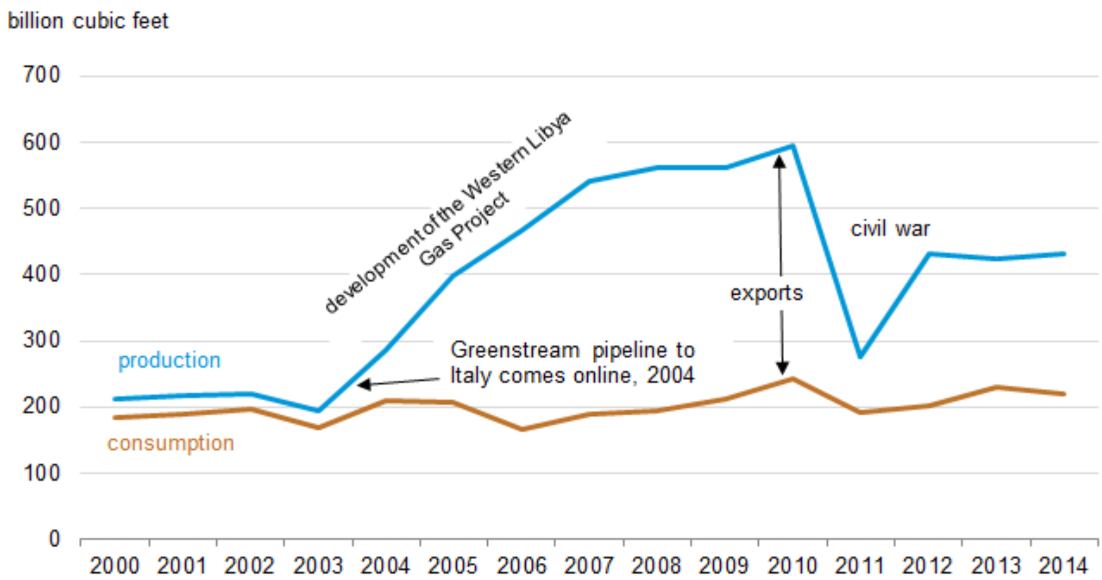



Figure 2-7 Libya's natural gas production, exports and domestic consumption (EIA, 2015).

From the above figures it can be noted that the country experienced serious exportation problems in mid-2013 as a result of the closure of the country's main eastern ports by militias; when the ports were opened again, production recovered somewhat in the second quarter of 2014. However, the country experienced serious disruption again, and from January 2015 to October 2015 oil production decreased to about 400,000 barrels per day (EIA, 2015). Today, this situation continues and the country continues to struggle to achieve stable production like that seen prior to 2011. In recent months, after the NOC seized control of its export ports, crude oil production has reached daily production rate of close to one million barrels a day under the most favourable conditions. It is therefore evident that these fluctuations have a strong effect on the Libyan economy, as the country depends heavily on hydrocarbon exports as its main source of income. The next section provides a discussion of the role of the oil and gas industry in the Libyan economy as a whole.

## 2.6 The role of oil and gas in the Libyan economy

Oil and gas plays a very important role in Libya, not only for prestige as the leading oil producer in Africa, but also in boosting the national economy. Oil and gas has helped Libya to develop its economy despite the sanctions imposed upon the country in the 1990s (Brown, 2014). The Libyan economy is hugely dependent on earnings from the oil and gas sector; the (IMF, 2013) estimated that hydrocarbon sales contribute about 96% of total government revenues. Since all export earnings are from the oil and gas industry, the country is dangerously susceptible to commodity price shocks.

Although we are witnessing a period of low oil prices, the oil and gas sector has nevertheless offered many benefits to the country, including reducing unemployment rates and attracting foreign investment (Etelawi, Blatner, & McCluskey, 2017; Ibrahim, Mutalib, & M.Abdulaziz, 2013). Three-quarters of paid employment in Libya is in the public sector (Abuhadra & Ajaali, 2014), which highlights the influence of the oil sector on the economy. It has been argued that the expansion of oil and gas production between 2007 and 2011 has led to the reduction of the unemployment rate by up to 30% (Ibrahim et al., 2013). The oil and gas industry in Libya has also encouraged many countries to do business and invest in the sector; the NOC offered financial incentives, which attracted many investors, promoting the economic development of the country (Otman & Karlberg, 2007). Direct foreign investment is vital to the country as Libya cannot develop its massive reserves on its own; foreign capital leads to further development in the sector and the creation of more jobs as well as the construction of needed infrastructure (Ibrahim et al., 2013).

## 2.7 NOC of Libya: Overview and importance

The NOC of Libya is recognised as the country's governing body for the oil sector. The corporation represents the state of Libya in contracts involving oil exploration, and is charged with controlling government-owned oil companies and joint ventures. It also oversees joint ventures in petroleum exploration and production. The NOC manages various downstream and upstream activities in the industry, in terms of project implementation, licensing processes, oil policy formulation and contract negotiations on behalf of the Libyan government. The NOC is directly responsible for advancing the government's policy objectives by increasing oil production through the development and exploitation of gas and oil reserves (Noc.ly, 2017a). To this end, Eauinat (2006; cited in Atamna, 2013) summarised the main activities of NOC of Libya:

- To suggest, prepare and apply plans for oil and gas projects in the Libyan oil and gas sector.
- To approve and monitor progress as different projects within the industry are implemented.
- To support national revenue by recommending improvements in current management methods.
- To monitor and follow up on the activities of all Libyan and foreign companies connected with the NOC.
- To make sure that oil companies follow all the NOC and government standards and policies.
- To provide all national employees with the training and development programmes required to ensure that they will be qualified to contribute to the Libyan oil and gas sector.
- To arrange for international oil and gas-related symposiums and conferences.

Therefore, the NOC has full responsibility for all activities of the oil and gas industry in Libya, upstream and downstream. This means that the NOC should ensure the up-to-date development of the sector to fulfil its duty as the main contributor to the Libyan economy (see section 2.6). To accomplish this aim, the NOC has a number of fully-owned Libyan oil companies that operate both upstream and downstream activities. In addition to other joint ventures, the NOC can also work with IOCs as part of Exploration and Production Sharing Agreements (EPSA). It is worth mentioning that in an EPSA contract, IOCs are still subject to the national laws and regulations of the host country (Libya in this case), as discussed in section 2.2.1. Table 2-3 shows the fully owned operations, joint ventures and EPSA companies that operate within the Libyan oil and gas industry.

Table 2-3 NOC of Libya companies (Noc.ly, 2017b)

| Fully owned | Joint Ventures | EPSA |
|---|---|---|
| Sirte Oil Company | Zueitina Oil Company | Eni North Africa Company |
| Arabian Gulf Oil Company | Mellita Oil & Gas Company | Amerada Hess Company |
| Ras Lanuf Oil and Gas Processing Company | WAHA Oil Company | India Oil Company |
| Zawia Oil Refining Company | Mabruk Oil Operation Company | Total E&P Company |
| Brega Petroleum Marketing Company | Harouge Oil Operation Company | Petro Canada Company |
| National Oil Wells Drilling and Work over Company | Akakus Oil Operation Company | Polish Oil & Gas Company |
| Jowfe Oil Technology Company | Nafusah Oil Operation Company | OMV Company |
| National Oil Fields and Terminals Catering Company | | OXY Company |
| North Africa Geophysical Exploration Company | | BP Exploration Libya Limited Company |
| Taknia Libya Engineering Company | | STATOIL Company |
| Petro Air Company | | Gazprom Company |
| | | Repsol Murzuq Company |

| | | |
|---|---|---|
| | | Petrobras Company |
| | | Chevron Libya LTD Company |
| | | Shell Company |
| | | RWE Company |
| | | Sonatrach Company |
| | | Turkish Petroleum Corporation |
| | | Medco Energy Company |
| | | Exxon Mobil Company |
| | | ONGC Limited Company |
| | | Tatneft Company |
| | | Wintershall AG Company |

## 2.8 The NOC before and after the civil war

The Libyan Parliament issued its first hydrocarbon law in 1955, to provide a legal framework for international oil companies wishing to do business with Libya; to the government issued exploration licences and exercised control over the production activities (Sawalim, 2015). However, this law was seldom updated, although before the Libyan civil war in 2011, policy makers were trying to update the legal framework to include information of the natural gas development and Enhanced Oil Recovery (EOR) projects. Discussions continued after the civil war, but any resolution has been delayed as a result of the country's security instability (EIA, 2015).

This delay in updating or issuing a new hydrocarbon law is believed to be the main barrier in developing the sector. Only 25% of the country has been explored, and there are many more future exploration opportunities particularly in the area of shale oil reserves, in which Libya is ranked fifth in the world (Sawalim, 2015).

Meanwhile, according to Sawalim (2015), Libya lags behind the current international practices in project management. As a project manager for the NOC, he argues that the management situation is the same as it was before the civil war. In addition, Sawalim argues that the up-to-date practices have not been developed while managers still follow the management style of previous operators of Libyan oil fields, e.g. British and American operators. He believes that one of factors contributing to this could be politicians' involvement in the decision-making at the senior management level of oil and gas companies in Libya.

## 2.9 Challenges within the Libyan oil and gas industry

The Libyan oil and gas industry faces numerous challenges, most which are linked to the Libyan uprising that led to the ousting of Gaddafi. The primary problem in the country is the failure of the Tobruk and Tripoli government to arrive at a political accommodation to end the political turmoil that has affected the economy. In essence, no faction of the government is willing to give up control of the highly valued oil-rich regions. This has led to a persistent political stalemate, with each warring party willing to defend their interests to the last man. This fragile security situation is further aggravated by the presence of outlawed armed groups who have taken advantage of the political confusion in the country.

Post-Gaddafi Libya has been characterised by constant protests, government strikes and an unending dispute between two governing factions. Attacks by the outlawed armed groups have made it impossible for either government to initiate measures to ensure economic stability. In 2015, an armed group acquired expansive territories in the northern part of the country and launched attacks on crucial oil and gas installations such as pipelines and oil and gas ports. This unpredictable political environment coupled with the threat of domestic uncertainty has reduced buyer confidence in Libyan oil despite the country having some of the highest quality crude oil in the world. By failing to address these governance challenges, the country has exposed the oil and gas industry to corruption and loss of market share.

## 2.10 Link to the current research

This chapter began by providing an overview of the oil and gas industry in general. Section 2.2 establishes the importance of the industry in not only meeting worldwide energy demands but also in driving the global economy. For some countries, like Libya, the industry acts as the backbone of the economy (see section 2.6). However, Libya is currently going through several challenges affecting the performance of its development projects. Many new projects (i.e., EOR projects) were delayed due to the country's security instability (see section 2.8). Therefore, with the current unsecured situation in Libya, priority should be placed on the study of issues related to project risk management in the oil and gas sector. Given the significance of risk management as a factor in improving the performance of oil and gas projects (see section 1.2 and 3.5.8), this research aims to investigate current project risk management within the Libyan oil and gas industry to enhance the process.

## 2.11 Summary

This chapter presented an overview of the oil and gas industry, showing that industry can be divided into upstream, midstream and downstream operations. The chapter also showed the strategic importance of the OPEC counties that control the great majority of hydrocarbon reserves around the globe. Moreover, the role of IOCs and NOCs was presented to illustrate how the sector operates. Further, with specific reference to Libya, this chapter also showed the importance of the oil and gas industry as the main country's source of income and its impact on the whole national economy. The role of the NOC of Libya, as the only body responsible for oil and gas activities in Libya' was also presented. Finally, this chapter provided an overview of the challenges that the oil and gas industry in Libya currently faces. The next chapter will focus on presenting a review of the literature related to project risk management.

# Chapter 3 Project risk management

## 3.1 Introduction

The previous chapter provided an overview of the oil and gas industry in Libya as well as demonstrating the importance of the sector. It also provided information about how the industry operates and the role of NOCs and IOCs in the process. The aim of this chapter is to identify and thematise the key research areas related to this study, through a comprehensive synthesis of the existing literature. This chapter therefore includes the following elements:

- First, a definition of the term “risk”.
- Second, an overview of the definition and the concept of risk management.
- Third, an overview and definitions of the concepts of project and project management.
- Fourth, an overview and definitions of the concepts of project risk management, its benefits, project risk management practices, different project risk management approaches, its supporting tools and techniques and their limitations, the link between project risk management and project performance, the challenges in developing an effective project risk management process and the critical success factors needed to develop a successful process.
- Finally, an outline of project performance within the oil and gas industry as well as highlights of studies of project risk management within the oil and gas industry.

## 3.2 Definition of risk

According to the Cambridge English Dictionary, the term ‘Risk’ is defined as ‘*the possibility of something bad happening’,* and *‘something bad that might happen.’* Similarly, the Oxford English Dictionary defines risk as: ‘*A situation involving exposure to danger’*, and *‘The possibility that something unpleasant or unwelcome* *will happen.'* Definitions of this term vary among individuals, organisations, professional bodies, national and international standards and governmental statutes. Some of the national and international standards bodies include the International Organization for Standardization (ISO) and the British Standards Institution (BSI). Governmental or national statutes have been published by the National Audit Office, UK and the HM Treasury, UK, while other organisations taking positions on these issues include: The United Nations Economic Commission for Europe (UNECE) and the International Risk Governance Council (IRGC). Meanwhile, the Project Management Institute (PMI), the Association for Project Management (APM) and the Institute of Electrical and Electronics Engineers (IEEE) are three relevant professional bodies. Table 3-1 shows how risk is defined in each of these cases.

Table 3-1 Definitions of risk.

| **Standard/Organisation /Government unit** | **Definition** | **Key words** |
|---|---|---|
| ISO | *'combination of the probability of an event and its consequence'* (ISO-IEC-73, 2002; ISO-IEC-16085, 2006)<br><br>*'effect of uncertainty on objectives'* (ISO-31000, 2009) | Probability<br>Consequence<br>Uncertainty<br>Objectives |
| BSI | *'effect of uncertainty on objectives'* (PAS99, 2012)<br><br>*'likelihood of an event occurring that will have an impact on objectives'* (PAS99, 2006)<br><br>*'uncertainty inherent in plans and the possibility of something happening'* (BS-6079-3, 2000) | Uncertainty<br>Objectives<br>Likelihood<br>Impact |
| National Audit Office, UK | *'A hazard, or factor likely to cause loss or danger (such as a chance of loss or injury; the degree of probability of loss) that may occur in the future.'* (NAO, 2008) | Hazard<br>Loss<br>Injury<br>Chance<br>Probability<br>Future |
| HM Treasury, UK | *'The likelihood, measured by its probability, that a particular event will occur'* (HM-TREASURY, 2005)<br><br>*'uncertainty of outcome, whether positive* | Likelihood<br>Probability<br>Event<br>Uncertainty<br>Positive<br>Opportunity |

| | | |
|---|---|---|
| | *opportunity or negative threat, of actions and events. It is the combination of likelihood and impact, including perceived importance'* (HM-TREASURY, 2004) | Negative<br>Threat<br>Impact |
| UNECE | *'An event which can change the expected cash flow forecast for a project'* (UN-ECE/CECI/4, 2008) | Event<br>Change<br>Forecast |
| IRGC | *'a combination of two components: the likelihood or chance of potential consequences and the severity of consequences of human activities, natural events or a combination of both'* (IRGC, 2005)<br><br>*'an uncertain (generally adverse) consequence of an event or activity with respect to something that humans value. Risks are often accompanied by opportunities'* (IRGC, 2008) | Likelihood<br>Chance<br>Consequences<br>Severity<br>Events<br>Opportunities |
| PMI | *Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives … A risk may have one or more causes and, if it occurs, it may have one or more impacts'* (PMI, 2009, 2013) | Uncertainty<br>Positive<br>Negative<br>Effect<br>Objectives<br>Impact |
| APM | *'an uncertain event or set of circumstances that should it or they occur have an effect on the achievement of one or more of the project objectives'* (APM, 2004) | Uncertainty<br>Event<br>Effect<br>Objectives |
| IEEE | *'The likelihood of an event, hazard, threat, or situation occurring and its undesirable consequences; a potential problem'* (IEEE, 2001) | Likelihood<br>Event<br>Hazard<br>Problem<br>Threat<br>Situation<br>Consequence<br>Undesirable |

The above table shows that the term risk is defined using varying terminology, and while some definitions demonstrate that risk can include positive as well as negative connotations, most definitions focus on the negative aspects of risk. This fact is apparent in the key words common to several definitions (e.g. hazard, problem, threat and injury). It can also be seen that the definitions lack consistency; for instance, HM Treasury provided two disputing definitions in their two published guidelines (2004 and 2005): one including optimistic terms (positive and opportunity); the alternative with negative connotations (e.g. negative and threat). This inconsistency indicates that the term risk does not have a generally-understood common meaning (Dix, 2013), which adds to the potential for misunderstanding.

Along similar lines, the academic literature does not provide an agreed-upon definition of risk, either (Aven & Renn, 2009). For example: Chapman and Ward (2011) state that: *'Risk means possible unfavourable outcomes'* (p.3), Loosemore, Raftery, Reilly, and Higgon (2006) offer this definition: *'A risk is concerned with unpredictable events that might occur in the future whose exact likelihood and outcome is uncertain but could potentially affect their interests/objectives in some way'* (p.8). Interestingly, Massingham (2010) believes that the word 'risk' originated from the Italian word *risicare*; a literal translation for this word would be 'to dare', and therefore he sees risk as offering options rather than a destiny. Scholars over the years have clarified how decisions can be made under conditions of risk; however, this has produced an ambiguous and even contradictory body of literature on the topic. For example, Cervone (2006) refers to risk as a problem that has not yet occurred, while Eaton and Little (2012) defined risk as a possible loss, relating this loss to the effect and the probability of a particular event.

No specific definition of the term risk arises from the literature. Both the organisational definitions provided in Table 3-1, as well as this review of the academic literature, indicate that the term remains ambiguous. Despite this difficulty in agreeing on a certain term, there is an agreement that risk should be managed. For this research, the PMI's (2009, 2013) definition of risk is adopted, this is because it is more comprehensive and is specifically linked to projects, the definition does not see risk solely as a threat but also consider opportunities.

The following sections will provide an overview of the concepts of risk management and project risk management.

## 3.3 Risk management

The topic of risk and risk management has been studied by different disciplines; the literature has not produced a clear or standardised definition, while the fields of economics, management, strategic management, project management and others each offer distinct perspectives (Ehsan, 2013). However, despite these differences, risk management has become an increasingly vital issue because the uncertainty surrounding many business activities continues to increase (Becker & Smidt, 2016).

On the other hand, Dionne (2013) argues that it was not until after the Second World War that the study of risk management began, and that modern risk management developed from the mid-1950s through the 1960s. The use of risk management has been linked to the offering of market insurance to safeguard individuals and organisations from damages related to accidents (Dionne, 2013). According to Snider (1956), before the mid-1950s, there were no established publications on risk management, and there were no training courses offered on the subject. In fact, Dionne (2013) argues that the first two publications related to pure risk management were those of Mehr and Hedges (1963) and Willaims and Heins (1964), at the same time that many engineers developed risk management models to cope with operational and political risks; from that time, risk management has developed in many disciplines to what we see today (Dionne, 2013). To this end, the next section will provide a definition of the concept of risk management.

### 3.3.1 Definition of risk management

Similar to the varying definitions of the term risk discussed in section 3.2, the concept of risk management is viewed differently by individuals, originations, professional bodies, national and international standards organisations and in governmental statutes. These dissimilar definitions of the concept of risk management are shown in Table 3-2 below.

Table 3-2 Definitions of risk management.

| **Standard/Organisation /Government unit** | **Definition** |
|---|---|
| ISO | *'coordinated activities to direct and control an organisation with regard to risk'* (ISO-31000, 2009)<br><br>*'systematic application of management policies, procedures and practices to the activities of communicating, consulting, establishing the context, and identifying, analysing, evaluating, treating, monitoring and* |

| | |
|---|---|
| | *reviewing risk'* (ISO-31000, 2009) |
| BSI | *'systematic application of policies, procedures, methods and practices to the tasks of identifying, analysing, evaluating, treating and monitoring risk'* (BS-6079-3, 2000) |
| National Audit Office, UK | *'The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, evaluating, treating and monitoring risk. The culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects'* (NAO, 2008) |
| HM Treasury, UK | *'all the processes involved in identifying, assessing and judging risks, assigning ownership, taking actions to mitigate or anticipate them, and monitoring and reviewing progress'* (HM-TREASURY, 2004) |
| IRGC | *[Risk management] 'involves the design and implementation of the actions and remedies required to avoid, reduce, transfer or retain the risks'* (IRGC, 2008)<br><br>*'The creation and evaluation of options for initiating or changing human activities or (natural and artificial) structures with the objective of increasing the net benefit to human society and preventing harm to humans and what they value; and the implementation of chosen options and the monitoring of their effectiveness'* (IRGC, 2005) |
| PMI | *'the process concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project...'* (PMI, 2004) |
| APM | *'a structured process that allows individual risk events and overall (project) risk to be understood and managed proactively, optimising project success by minimising threats and maximising opportunities'* (APM, 2006) |
| IEEE | *'A continuous process for systematically identifying, analysing, treating, and monitoring risk throughout the life cycle of a product or service'* (IEEE, 2001) |

In addition, when reviewing the academic literature linked to risk management in particular, the researcher identified that most of these studies make reference to definitions defined by ISO-31000:2009. However, Edwards and Bowen (1998) and

Cooper, Grey, Raymond, and Walker (2005) developed their own definitions based on their own studies. For example, Cooper et al. (2005) defined risk management as *‘the culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects’* (p.3). On the other hand, Edwards and Bowen (1998) defined risk management as *‘a systematic approach to dealing with risk’,* while *‘A risk management system should: establish an appropriate context; set goals and objectives; identify and analyse risks; influence risk decision-making; and monitor and review risk responses.’*

Based on the definitions of risk management provided in Table 3-2 as well as those offered in academic literature, there is no agreed-upon definition for this concept, either, similar to the previous findings on the definition of the term risk discussed in section 3.2. However, there were some commonalities evident among these different views, in that risk management consists in a systematic procedure or policies establishing a co-ordinated and structured process for planning, identifying, analysing, assessing, monitoring and controlling risks. To this end, risk management is seen as a vital method to manage risks; there is a wide acceptance in the literature and among organisations that risks cannot be eliminated completely but rather can be managed. Therefore, this research agrees with the five risk management steps (e.g. planning, identification, analysis, response and control) of risk management proposed by PMI (2004).

The above section has reviewed the literature, showing some of the definitions on the concept of risk management that have been proposed by organisations and by academics. The next section will provide detailed information of the concepts of project, project management and project risk management.

## 3.4 Project and Project Management

The aim of this section is to provide the reader with an overview and definitions of the concepts of project and project management. Section 3.4.1 will provide a definition on the term project, while in section 3.4.2 the researcher will provide an overview as well as a definition of the concept of project management.

### 3.4.1 What is a project?

A project can be defined as '*A temporary endeavour involving a connected sequence of activities and range of resources, which is designed to achieve a specific and unique outcome, which operates within time, cost and quality constraints and which is often used to introduce change'* (Elearn, 2007). It is argued that a project is usually a reaction to a need or a solution for a problem; the idea of a project is generally either to save money or make money (Heerkens, 2002). In addition, the PMI also defines projects as '*a temporary endeavour undertaken to create a unique product or service*' (2013, p.3). Although several definitions have been offered for projects, one of their common characteristics is their *unique and temporary nature*. This means that they have a timeline – a specific start and a finish time –and focus on delivering a business product as defined in the business case (Murray, 2009).

However, projects do not have universally shared characteristics, since they cannot necessarily be undertaken by following the same approach, use similar resources or even rely on the same environment (Heerkens, 2002). It is also important to note that projects are different from operations. Whereas the former end when they achieve their goals, the latter consist in work done in organisations on a continuing basis to maintain their business. Lock (2013), observed four different types of projects: type 1, civil engineering, construction, petrochemical, oil and gas, mining and quarrying; type 2, manufacturing; type 3, IT projects and projects associated with business change; and type 4, projects for pure scientific research. Projects can involve several people or one person; they can sometimes take only one day or, more frequently, last for several years (Schwalbe, 2009). Examples of projects include the following:

- The creation or development of a new outcome or service.
- The construction of new facilities or infrastructure.
- The execution of a new business procedure or process.
- A young couple employs a company to design and build a new house.
- A university upgrades its technology facilities to provide wireless Internet access. (PMI, 2013; Schwalbe, 2009)

In each case, the aim of a specific project is to achieve its intended goal. Each project is constrained in a distinctive way, although it has been argued that project managers tend to focus on time, scope and cost constraints. However, others claim to add quality as a fourth constraint, and the Project Management Body of Knowledge (PMBOK) guide adds risk to the previous five constraints. A set of project constraints is summarised in Figure 3-1.

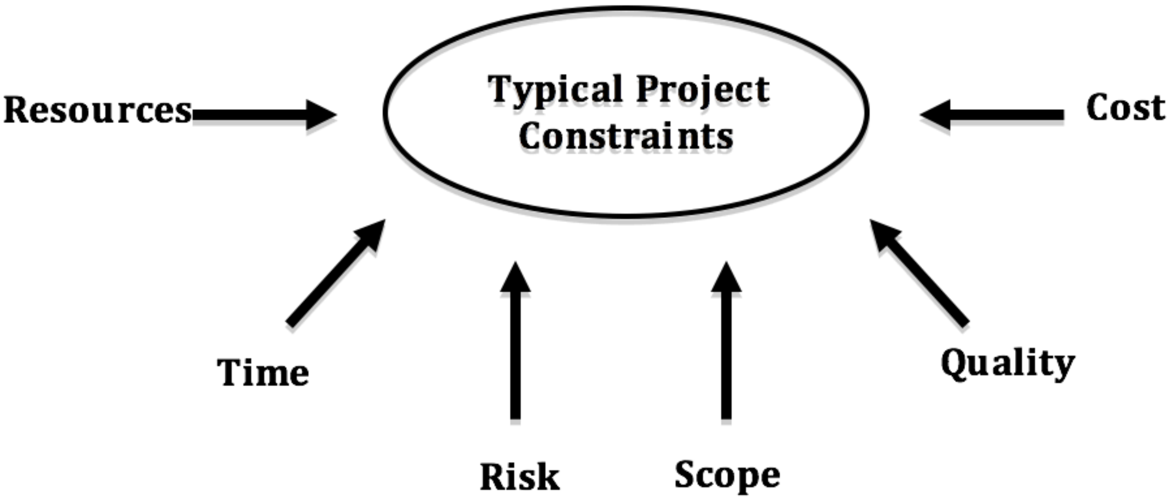



Figure 3-1 Typical Project Constraints (PMI, 2013 p. 13).

On the other hand, Schwalbe (2009) argues that in a number of projects, other constraints may be more significant than time, scope, cost, quality or risks, pointing to the role of experienced project managers as best able to decide which constraint is more critical in a given case. For example, if time is most important, then the initial scope or/and cost could be changed to meet the schedule.

To this end, the next section will provide details on the concept of project management and its benefits as a method to support project aims and objectives.

### 3.4.2 The Concept of Project management

The concept of project management is not new; while the concept evolved over many years, it was not until the 1950s that the academic literature started to reflect the developing theory and practice of the discipline (Cleland & Gareis, 2006). Such varying fields as engineering, defence and construction contributed to the development of these concepts (Cleland & Gareis, 2006). Of course, this process was encouraged by technological innovation as well as business logics (Lientz & Rea, 2007). Prior to the 1950s, project management lacked a formal definition and acceptance within the management field (Cleland & Gareis, 2006). The historical development of the concept of project management concept is presented in Figure 3-2.

| Era | Characteristics |
|---|---|
| Pre – 1950s | No generally accepted methods or recognised processes. |
| 1950s | 'One best way' approach, based on numerical methods established in the USA to manage large-scale projects. Development of planning processes. Development of Critical Path Analysis (CPA) and Programme Evaluation and Review Techniques (PERT). |
| 1960s | More development of techniques and further acceptance of their applications. Founded of IPMA in 1965 and PMI in 1969. |
| 1970s | Formation of UK's APM and the recognition of the role of project manager in large-scale projects. |
| 1980s | Continued interest in the project management subject as appose to manage large-scale and construction projects. |
| 1990s | Contingent approach based on strategy. More work undertaken on projects beyond just construction and engineering. The publication PMI's and APM's Bodies of Knowledge. |
| 2000s | Widespread acceptance of need for developing project manager. Programme management becoming standard in organisations. Development of ideas beyond traditional techniques and tools. |

Figure 3-2 Historical development of project management (source: Maylor, 2010)

The current widespread acceptance and increased use of project management concepts and methods could be linked with the growing difficulty and complexity of projects. Project management tools and methods now play an important role in the administration and management of projects as well as the success of the project (Albert, Balve, & Spang, 2017). To this end, the ultimate goal of project management is to support the successful delivery of projects towards achieving its objectives, within time and cost constraints (PMI, 2013).

### 3.4.2.1 Definition of project management

According to Morris, Pinto, and Söderlund (2011) defining the concept of project management is very challenging. This might be because the concept is progressively advancing, making it difficult to stick with a definite definition of the concept. As a result, different definitions are available. According to Söderlund (2004), since the 1990s, project management has witnessed rapid development in its certified documentation, leading to publications of different Bodies of Knowledge (BoKs) by different institutions. These institutions include the two previously mentioned (PMI and APM), as well as the International Project Management Association (IPMA) and the Australian Institute of Project Management (AIPM). All guides are similar in that they are used to offer guidelines and best practices in the field. The different definitions of project management are summarised in Table 3-3 below.

Table 3-3 Definitions of project management.

| **Professional body** | **Definition of Project Management** |
|---|---|
| PMI | *'Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. This application of knowledge requires the effective management of the project management processes'* (PMI, 2013) |
| APM | *'the process by which projects are defined, planned, monitored, controlled and delivered such that the agreed benefits are realised.'* (APM, 2006) |
| IPMA | *'the planning, organising, monitoring and controlling of all aspects of a project and the management and leadership of all involved to achieve the project objectives safely and within agreed criteria for time, cost, scope and performance/quality'* (IPMA, 2006) |
| AIPM | *'formalised and structured methods of managing change in a rigorous manner. It requires the application of knowledge, skills, tools and techniques to project activities to achieve the required project outcome'* (AIPM, 2008) |

The above table provides definitions of project management from different well-known professional bodies within the field of project management. It can be seen that while project management is defined in various ways, there is also a general understanding of the importance of project management as a method to help in achieving project aims and objectives. From the definitions in Table 3-3, it is clear that project management involves the systematic application of knowledge, skills as well as the activities of planning, organising, monitoring and controlling all aspects related to the management of the project. However, these activities may also be seen as imbued with a significant degree of ambiguity, uncertainty, presumption and risk, especially at the project level; to this end, the next section will discuss the concept of project risk management.

## 3.5 Project Risk Management

The aim of this section is to provide an overview that includes definitions of the concepts of project risk management while discussing its benefits, project risk management practices, different approaches, supporting tools and techniques and their limitations, the link between project risk management and project performance, the challenges in developing an effective process as well as critical success factors needed to develop a successful process of project risk management.

### 3.5.1 The concept of project risk management

The concept of project risk management is now an important subject for many organisations (Cooper et al., 2005). This is not a discrete or stand-alone process, but rather integral to the broader project management process (Cooper et al., 2005; PMI, 2013). The PMI’s PMBOK guide considers project risk management to be one of ten areas of knowledge within project management; the operating assumption of the guide is that if the project manager achieves mastery of all ten areas, the success of the project will be assured (PMI, 2013). Although in 1985 the Ministry of Defence (MoD) in the UK was one of the first organisations to implement an official approach to risk management for its projects (Hillson, 2012), according to Grimaldi, Rafele, and Cagliano (2012), the widespread development and adoption of this concept began in the 1990s, and has accelerated since then. The general trends and practices in project risk management will be discussed chronologically, below.

1950s:

Project risk management is not modern; it has its roots in the development of the Program Evaluation and Review Technique (PERT) in the 1950s for dealing with uncertainty in project duration (Taroun, 2014), although it was seen mainly as a planning tool, aiming to take into account and predict future activities. However, planning and control tools are both understood as part of a risk management perspective, because planning often tries to predict or estimate the risk posed by future events (Besner & Hobbs, 2012).

1960s:

The topic of risk analysis and assessment did not appear in academic literature until the 1960s (Edwards & Bowen, 1998). According to Baker and Ponniah (1999) the term 'risk analysis' was first introduced by Hertz (1964), who used a computer to generate probability distributions of investment projects' rates of return. Gradually, since then, others have developed additional tools and techniques for assessing and analysing project risks.

1970s:

One such project risk analysis technique, a statistical method referred to as Probability Theory (PT), was adopted even before the use of Monte-Carlo Simulation (MCS) during the 1970s, according to Edwards and Bowen (1998). Nonetheless, despite widespread usage of these methods and MCS, risk analysis and assessment publications were still remarkably rare during that era. According to Edwards and Bowen (1998), the few articles related to risk analysis and assessment were written by a small number of researchers, such as Carr (1977), Friedman (1956), Gates (1967), Gates and Scarpa (1974), Morin and Clough (1969), and Spooner (1974). It was not until the end of the 1970s that risk management became a significant part of project management literature, overall (Merna & Al-Thani, 2011).

1980s

According to Taroun (2014), risk management began to be perceived as an area of research in independent project management development at the beginning of the 1980s. Although the application and dominance of the MCS and PT-based tools continued to grow in the project management world during the 1980s, new tools and theories were introduced as well, including Fuzzy Sets Theory (FST). In addition, during the same decade, Chapman and Cooper (1983) worked towards establishing a systematic, structured project risk management system. They introduced the ‘risk engineering’ approach, in which they integrated the various tools and techniques (e.g. PERT and decision trees) that combined risk events and produced probability distributions of activities and project periods.

1990s

In the 1990s, project risk assessment and modelling received much greater attention than in the previous decade, becoming an active topic of extensive research. Along with the two largely used risk management theories, the PT and FST, researchers developed other tools and techniques such as the Analytical Hierarchy Process (AHP). Another scholar, Hull (1990), introduced new models based on MCS and PERT, with the goal of assessing proposal risks from the standpoints of cost and duration. At the same time, Yeo (1990) offered a ‘contingency engineering’ method, which aimed to assess project cost risk and estimate contingency calculations. This was one of the initial attempts to estimate risk contingency in a systematic manner.

2000s

Since the beginning of the new millennium, PT-based techniques still appear in academic literature, but less frequently than in previous years. Research reveals an increasingly widespread use of the Probability-Impact Grid (PIG) as a risk assessment technique; however this method also has received significant criticism (Taroun, 2014) Chapman and Ward (2000), based on the argument that it generates needless uncertainty by oversimplifying the evaluations of risk probability and its impact. More recently, efforts have been made to improve project risk tool assessment and modelling, aided by the increasing computing power available.

Since 2010:

During the last few years, there has been a striking increase in the number of published papers discussing risk assessment and modelling in general. Risk is now generally treated as a project attribute, rather than as an estimated degree of variance as it was during the 1980s and 1990s. This change has resulted in the integration of risk assessment into comprehensive decision-making frameworks

(Taroun, 2014). However, Marle and Vidal (2011) argue that the existing techniques are limited in the ways they reflect the connections between risks while assessing them. The authors further argue that the current tools, for the most part, can only deal with mutually dependent risks, by treating them as though they were independent.

### 3.5.2 Definitions of project risk management

Similar to the definitions of project management discussed in section 3.4.2.1, the literature shows that there is no standardised definition of project risk management. For example: Ghosh and Jintanapakanont (2004) define risk management as a *'tool for managing projects effectively through their life cycles'*. Definitions of project risk management will be provided in Table 3-4 below, showing different terminologies established by various professional bodies.

Table 3-4 Definitions of project risk management.

| **Professional body** | **Definition of Project Risk Management** |
|---|---|
| PMI | *'Project Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, and controlling risk on a project. The objectives of project risk management are to increase the likelihood and impact of positive events, and decrease the likelihood and impact of negative events in the project.'* (PMI, 2013) |
| APM | *'Risk management is a process that allows individual risk events and overall risk to be understood and managed proactively, optimising success by minimising threats and maximising opportunities.'* (APM, 2004) |
| OGC | *'Risk Management is about the steps you take in a systematic way that will enable you to identify, assess and control risk. This Risk Theme provides an approach to manage Risk in a project.'* (OGC, 2009) |

From this table, while differences are evident in the ways various professional bodies view the definition of project risk management, some similarities are also clear: these professional bodies view project risk management as a systematic processes and emphasise the steps required to minimise the impact of negative events on the project. The last definition provided in the table was created by the Office of Government Commerce (OGC), the body responsible for developing the PRojects IN Controlled Environments (PRINCE2) guideline for project management; it differs slightly from the definitions provided by the PMI and APM. While the other two definitions provide detailed information on the assumption that risk management is used to minimise threats and to maximise opportunities, this aspect is absent in the OGC's definition. Therefore, this research follows the PMI (2013) definition of project risk management as it follows clear steps of the process, in addition to the fact that it is used to identify and assess threats as well as opportunities.

However, from the above definitions it is clear that project risk management is an important topic that can contribute to the successful delivery of projects. To this end, the benefits of these practices will be covered in the next subsection.

### 3.5.3 The benefits of project risk management

Project risk management is becoming widely implemented in many industrial and social contexts. This is because of the growing recognition that risk cannot be eliminated, but can be managed. It is believed that risk management provides a framework to achieve a balance between avoiding accidents and catastrophes and providing opportunities (Aven et al., 2007). Hence, the main goal of risk management is to guarantee the rapid identification of risks and then to establish a clear assessment process, action planning and later reporting on the identified risks. It is also vital here to stress the identification of opportunities that will certainly have an effect on the decision-making process (Burtonshaw-Gunn, 2009). In addition, according to PMI (2004), risk management involves identifying and reducing the project's risk level, including risk management planning, monitoring and control processes.

### 3.5.4 Risk factors that influence project risk management

The project management literature is rich in studies that try to implement project risk management by investigating the principal risk factors that affect different projects (Cervone, 2006). According to Redmill (2002), the main purpose for identifying risk factors is to stop the events that can cause harm.

Different authors view project risk factors from different perspectives. For example, Keil, Cule, Lyytinen, and Schmidt (1998) concluded that the most popular risk factors encountered by most projects include:

- Poor top management commitment to the project
- Poor end user participation and commitment
- Unclear project requirements
- Failure to manage end user expectations
- Changes in the project scope or objectives
- Inadequate staffing
- Introduction of new technology

The authors stress the importance of the term 'commitment' rather than 'support'. It is important that stakeholders show commitment to the project. The authors argue that it is easy to throw money and resources into the project, but that commitment is more difficult to demonstrate.

In another study by Ghosh and Jintanapakanont (2004), to identify the critical risk factors in underground rail projects in Thailand, the authors identified nine risk factors, including risk of delay, financial and economic risk, subcontractor-related risks, contractual and legal risks, design risks, force majeure risks, safety and social risks, physical risks and operational risks. Below is a summary of the variables within each of these risk factors.

- Delay risks
    - Construction delay
    - Third-party delay
- Financial risks
    - Absence of funds
    - Economic disaster
    - Inflation
    - Exchange rate fluctuation
    - Financial failure of the contractor
    - Tendered price
- Subcontractor-related risks

    - Subcontractor failure
    - Subcontractor' having insufficient staff
    - Subcontractor financial failure

- Contractual and legal risks
    - Delay in solving contract problems and disputes
    - Delay in payment
    - Change in order negotiation

- Design risks
    - Change to scope of work
    - Insufficient specification
    - Design change

- Force majeure risks
    - War
    - Act of God
    - Fire and theft

- Safety and social risks
    - Accidents
    - Ecological constraints
    - Damage to persons or property
    - Pollution and safety policies

- Physical risks
    - Subsurface geological conditions
    - Unforeseen site conditions
    - Subsurface condition of ground water

- Operational risks
    - Labour productivity
    - Equipment productivity
    - Treatment of material removed from the site
    - System failure

The above discussion shows that projects face many risks, that may affect them significantly in positive or negative ways. It is therefore important to address all of these factors. Indeed, the aim of project risk management (see section 3.5.3) is to support the rapid identification of such risk factors and to manage them. The next section will provide additional detail about project risk management practices.

### 3.5.5 Project risk management practices

As discussed previously (see section 3.5.3), project risk management is an important element in project management, as it augments the effectiveness of other project management processes, especially when employed according to professional best practices and values (Benta, Podean, & Mircean, 2011; Besner & Hobbs, 2012; PMI, 2013). The current trends within project risk management aim to recognise project challenges and multicultural contexts, particularly those associated with increasingly global and complex environments (Thamhain, 2013). In the view of Besner and Hobbs (2012), project risk management is regarded as an organised practice to manage project risks effectively.

Existing project risk management practices are summarised by the PMI (PMI, 2013), and include five formal project risk management processes:

- Project risk planning
- Project risk identification
- Project risk analysis (quantitative and qualitative)
- Project risk response
- Project risk control

Similarly, Aloini, Dulmin, and Mininno (2007) describe risk management as a process that involves the following main steps:

- Context analysis
- Risk identification
- Risk analysis
- Risk evaluation
- Risk treatment
- Monitoring and review
- Communication and consulting

In a different study, Zwikael and Sadeh (2007) suggest that risk management planning involves four steps, including risk identification, quantitative and qualitative risk analysis and risk response planning. Finally, at the project execution phase, risk monitoring and control is made available as the last risk management process.

However, scholars and professional bodies (as will be discussed in detail in section 3.5.6), with slight differences in the level of detail, generally agree that the project risk management process consists of risk identification, risk analysis/assessment, risk response/mitigation and risk control. Each of these will be discussed in turn, in the following subsections.

#### 3.5.5.1 Project risk identification

Risk identification is a core practice of project risk management. This stage involves the systematic and continuous activity of identifying, classifying and assessing the importance of project risks during the initial stages of project life cycle (Aven et al., 2007; PMI, 2013). Upon identification, the risk is documented in the project charter. The project risk manager should also communicate all the potential consequences of the risk to other project administrators and stakeholders (PMI, 2013).

#### 3.5.5.2 Project risk analysis/assessment

The second stage of project risk management concerns risk analysis and evaluation (assessment). The aim of this stage is to incorporate and quantify uncertainty, for example by modelling uncertainty to determine the probability of each event (Aven et al., 2007; PMI, 2013). Evaluation and prioritisation also take place at this stage. There are two major types of risk assessment and analysis in project risk management, namely qualitative and quantitative risk analysis. In project risk analysis, Failure Mode Effect Analysis (FMEA) and Failure Mode Effect and Criticality analysis (FMECA) are used to identify the failure risks and all associated effects (Lock, 2014).

Also, project risk analysis and assessment is seen as a continuous process of risk identification, involving the constant re-evaluation and identification of project risk (Yoon, Tamer, & Hastak, 2015). Through this practice, personnel can identify and communicate potential new risks that may affect the project. Moreover, the project risk management team should analyse the potential impacts associated with the newly identified project risks (PMI, 2009).

The different tools and techniques for identifying and analysing the risks associated with projects include:

*Identification techniques*

- Brainstorming
- Fault tree analysis
- Work breakdown structure analysis
- Interviews and focus group discussions
- Event tree analysis
- Scenario analysis
- Checklists
- Surveys and questionnaires

*Risk analysis techniques*

- Qualitative analysis: Beneficial for early review or when rapid assessment is necessary. It is built on a minimal or descriptive scale relating the likelihoods and consequences of risks.
- Semi-quantitative analysis: Enhances the qualitative analysis process by adding numerical values to the descriptive scales. These numbers then provide the input for measuring quantitative risk factors.
- Quantitative analysis: In contrast to qualitative analysis, this type uses numerical ratio scales for the likelihoods and consequences of risk occurrence. (Cooper et al., 2005).

Overall, the choice of a risk analysis method is influenced by the following factors:

- The decision-maker's approach to risk
- Accessibility and scope of information
- The context in which the decision is made
- Scope of risk under discussion
- The experience and knowledge of the team or manager in the assessing of risk levels and the probability of events and impacts
- Investment conditions, as well as the economic life cycle of an investment

project

- The knowledge of risk analysis tools by practitioners and their ability to practice them in a practical context
- Time and costs associated with different applied tools and techniques (Tworek, 2012)

While each stage of the risk management process has received ample consideration from scholars, risk analysis still appears to be a controversial topic in the academic literature (Baloi & Price, 2003). According to Tah and Carr (2001), attention has occasionally concentrated on quantitative risk analysis in spite of the challenges that might be faced in gaining objective probabilities and frequencies. Winch (2000) concluded that, in practice, project managers depend on subjective probabilities. In fact, risk in many cases is subjectively dealt with through adding an approximate possibility calculation (Kangari & Riggs, 1989). Therefore, it is important to facilitate risk assessment through individual experiences, knowledge and intuitive judgment (Dikmen, Birgonul, & Han, 2007).

#### 3.5.5.3 Project risk response

Developing a risk response plan is also an important practice in project risk management. This involves defining thresholds and triggers, contingency plans and mitigation strategies. Typically, risk managers apply a risk response matrix to determine the appropriate risk response plans and actions. A risk response matrix is a table-based risk-ranking approach that allows projects to select appropriate risk response strategies that vary with the type and magnitude of the risk impact (Sage & Haimes, 2015). The four most common risk response strategies have been identified as: avoid, transfer, reduce and accept.

In addition, monitoring of risk status and associated risk response actions are an integral practice of project risk management (Rigby & Bilodeau, 2015). Current professional standards stress the need for continuous risk monitoring throughout a project's life cycle, monitoring potential changes in previously identified risks and evaluating the effectiveness of the risk response adopted. The adoption of technology in risk management has facilitated monitoring through the use of risk management logging software (PMI, 2013).

#### 3.5.5.4 Project risk control

Project risk control is another part of the paradigm of project risk management practice, and is done continuously over the project life cycle. Risk control involves re-assessing potential business risks and selecting more visible alternative risk response actions (Benta et al., 2011; Lock, 2013; PMI, 2013).

### 3.5.6 Different frameworks and guidelines for the project risk management

The same principles are applied throughout the domain of project risk management, but projects themselves are different (as discussed in section 3.4.1); different problems arise, based on the different ways they are organised and managed (Cooper et al., 2005). In response to this diversity, different approaches, guidelines and standards have been developed for project risk management. Two famous and popular approaches were developed by two established professional bodies, namely PMI's PMBOK guide and APM's Project Risk Analysis and Management (PRAM) guide. BSI also developed two important guidelines, BS 6079-3:2000 and BS 62198:2014. Additional standards, principles and guidelines for risk management exist such as ISO 31000:2009 and AS/NZS 4360; however, these offer very generic approaches to risk management rather than specifically designed for projects. In general, the aim of these guidelines is to help organisations to apply project risk management practices with the hope of ensuring project success.

#### 3.5.6.1 PMI PMBOK

The PMI's PMBOK guide offers instructions and supporting information to help practitioners apply the knowledge, tools/techniques and skills needed to enhance the likelihood of project success. These guidelines also emphasise that there is no strict way to apply all these practices to all projects; rather, the organisation should identify what is suitable for any particular project. The PMBOK offers a group of project management principles of which project risk management is fundamental. Chapter eleven (11) of the PMBOK outlines the project risk management process, identifying six (6) main steps that include: risk management planning, identifying risks, performing qualitative risk analysis, performing quantitative risk analysis, planning risk responses and controlling risks. Figure 3-3 shows the project risk management process as defined by the PMBOK.

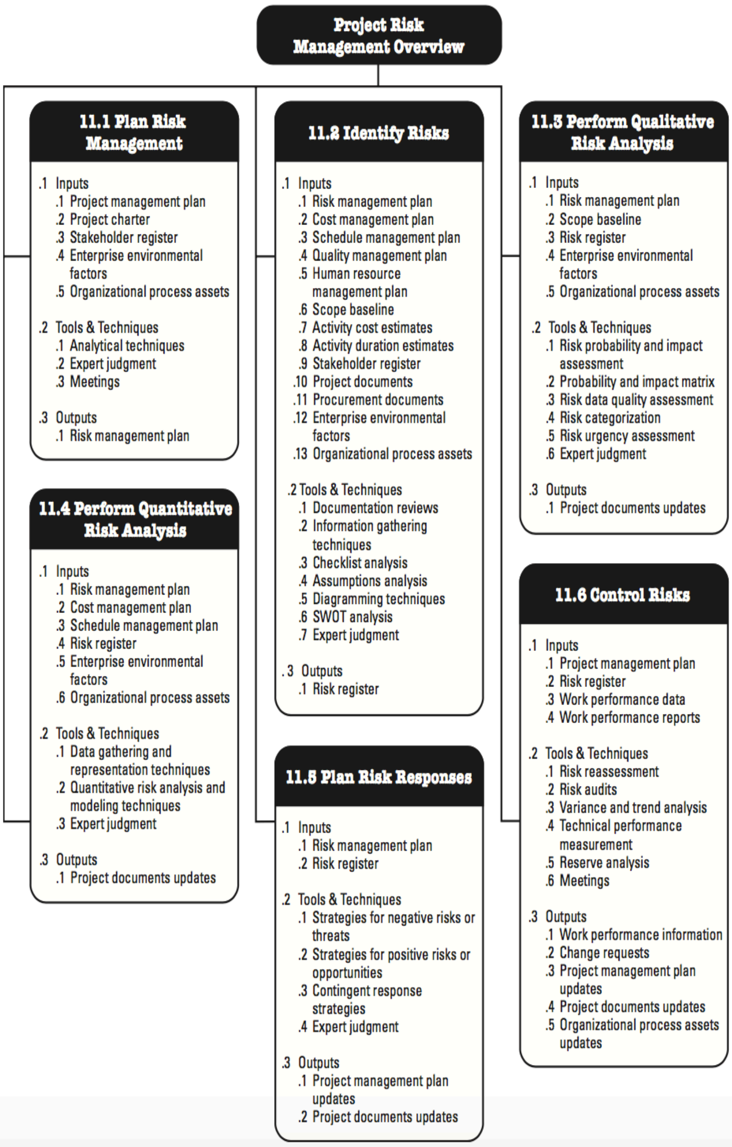



Figure 3-3 PMBOK Project risk management process (PMI, 2013).

### 3.5.6.2 PRAM guide

The PRAM guide is developed by consultants, academics and practitioners, PRAM is designed to address how corporate-level risk management is integrated with the risk management process at the project level (APM, 2004). To this end, the PRAM is well-designed and easy to follow; the project risk management guide is endorsed within the project management structure (Cooper et al., 2005). Figure 3-4 provides an outline of this project risk management process. The PRAM guide stresses that the degree of maturity of any organisation towards risk will determine the level of detail at which this guide will be implemented (APM, 2004).

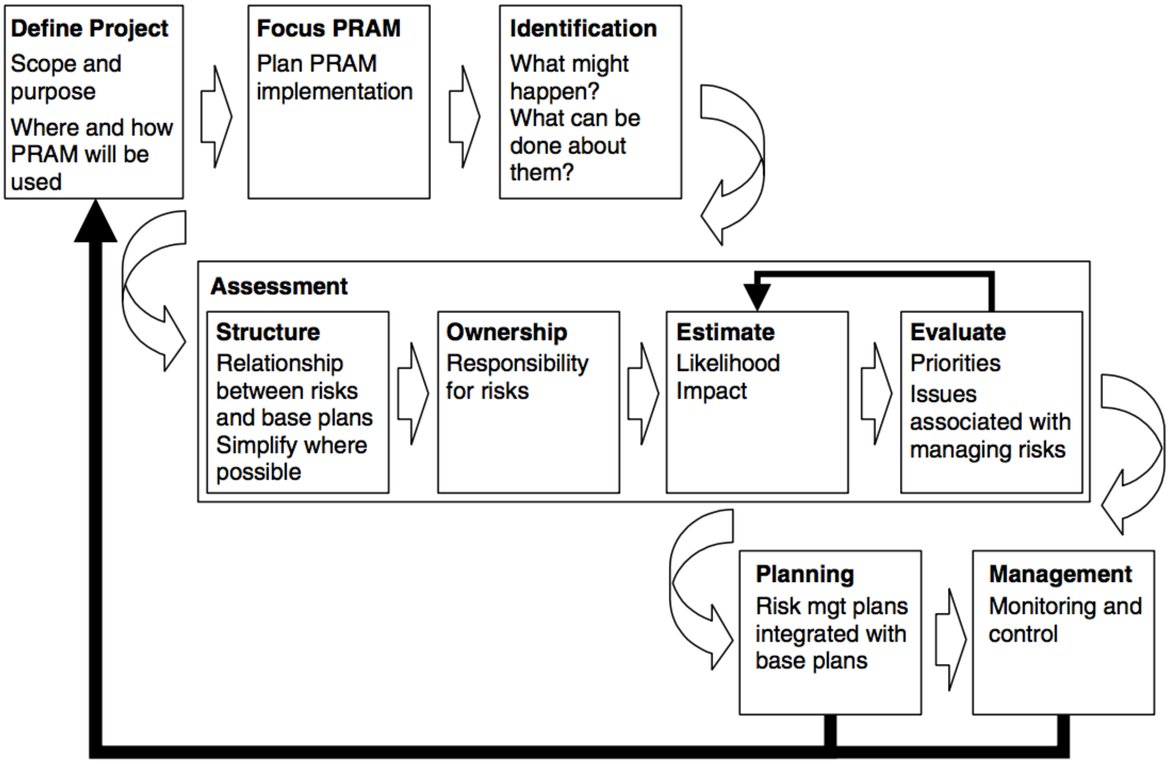



Figure 3-4 The PRAM guide (source: Cooper et al., 2005).

### 3.5.6.3 BS 6079-3:2000

The BSI standards on project management consists of three parts: A Guide to project management, Project Management Vocabulary and a Guide to the management of business-related project risk. The last guide (Part 3), identifies the steps at which the framework is used to manage project risks that relate to different business activities. This standard has six stages that can be divided into two general phases, including, first, defining the scope of risks and then problem solving: assessing and management of risks.

This standard is designed for project managers and sponsors, who are accountable to higher levels of authority and influence projects of different types and sizes. This approach also provides guidance in identifying solutions not only to respond to threats but also to grasp emerging opportunities. The standard also highlights the importance of recognising all stakeholders, especially during the early stages of the project, as part of the integrated project risk management process. Figure 3-5 provides an outline of this process as defined by the BS 6079-3:2000 guide.

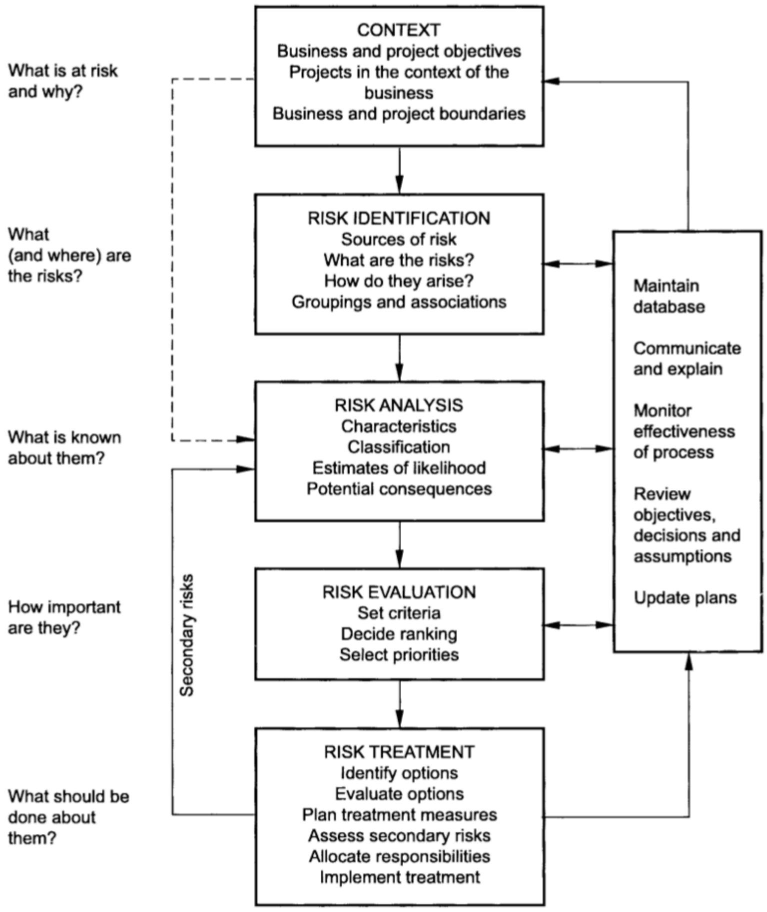



Figure 3-5 BS 6079-3:2000 guidelines.

#### 3.5.6.4 BS 62198:2014 – Managing risk in projects – Application guidelines

The BSI published this international standard to offer generic principles and guidelines on managing project uncertainty and risks. However, although the BSI have developed different standards and guidelines, many of these are based on ISO standards; the standard for risk management is based on ISO 31000 (Risk management – Principles and guidelines). This standard is designed to support organisations to increase their likelihood of achieving predetermined project objectives, while capturing opportunities and identifying and avoiding threats. The guide also places an emphasis on the importance of continuous communication and consultation between all stakeholders during the different stages of the risk management process. Figure 3-6 provides an outline of this process as defined by the BS 62198:2014 guide.

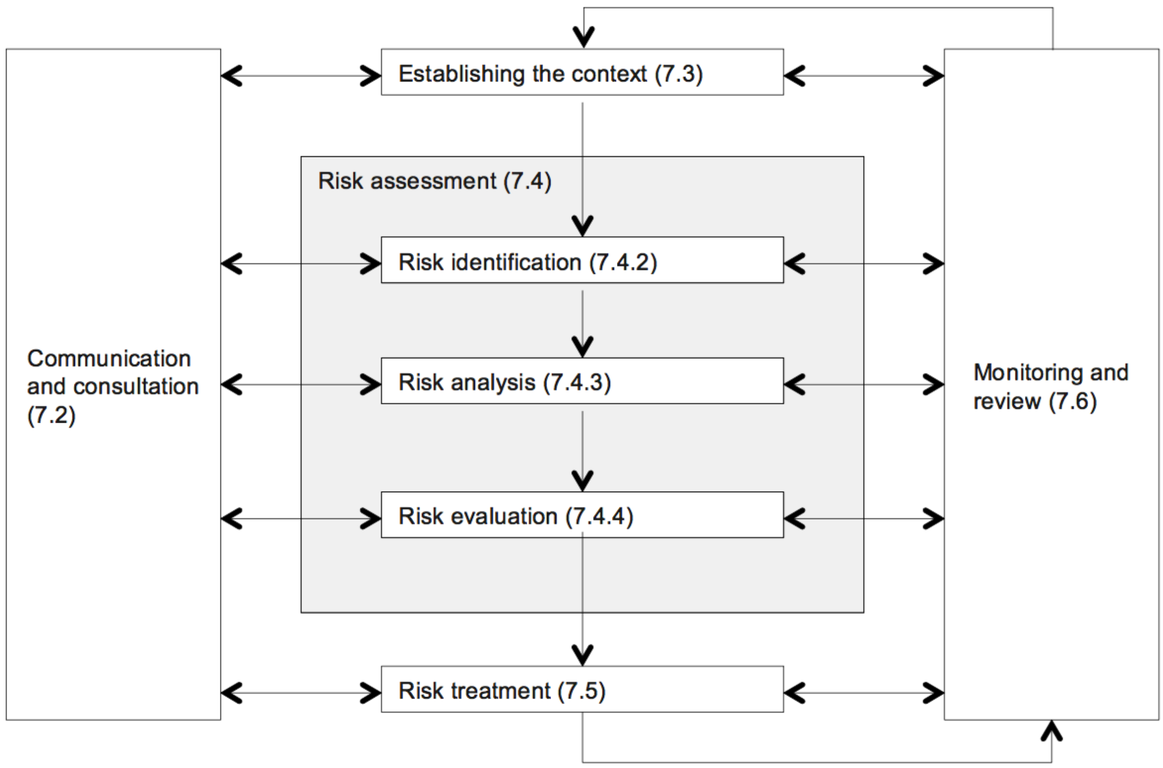



Figure 3-6 BS 62198:2014 – Managing risk in projects – Application guidelines

Having discussed these different approaches, guidelines and frameworks used to help in the management of project risks, the next section will focus on the different tools and techniques used to support the application of project risk management practices.

### 3.5.7 Tools and techniques to support project risk management

The literature to date documents at least 31 techniques to support project risk management, with the suitability of various applications depending on the nature, size and complexity of the projects undertaken (Cagliano, Grimaldi, & Rafele, 2015; Salazar-Aramayo et al., 2013). Such risk management techniques require specific tools to be utilised; some projects may therefore allow the combination of more than one set of techniques (Suslick & Schiozer, 2004). The list of these different risk management techniques is shown in Table 3-5.

The continuous pressure to enhance project performance through cost control and management of delivery times along with other eventualities, has mandated more intensive and complex forms of risk management, aiming for a more reliable decision-making process, particularly for large and costly projects (Akinremi et al., 2015; Chapman & Ward, 2004; Macmillan, 2000). Choosing a suitable project management technique has always been difficult (Virlics, 2013) and depends on a comprehensive knowledge and understanding of various, relevant parameters to choose the most viable options prescribed by particular frameworks. One such risk framework involves three basic dimensions to be considered in choosing the right risk management tool/technique. These dimensions, as suggested by (Cagliano et al., 2015), include: Phase of the risk management process; Project life cycle and Corporate maturity towards risk. These dimensions will be discussed in detail in the next subsection.

Table 3-5 Risk management techniques (Cagliano et al., 2015).

| No. | Technique |
|---|---|
| 1 | Checklist |
| 2 | Brainstorming |
| 3 | Change Analysis |
| 4 | Decision Tree Analysis |
| 5 | Cause and Effect Diagram |
| 6 | Fault Tree Analysis |
| 7 | Expert Judgement |
| 8 | FMEA |
| 9 | Fuzzy Logic |
| 10 | Failure Mode and Effect Criticality Analysis (FMECA) |

| | |
|---|---|
| 11 | Event Tree Analysis |
| 12 | Delphi |
| 13 | Expected Monetary Value |
| 14 | Hazard and Operability |
| 15 | Human Reliability Assessment |
| 16 | Hazard Review |
| 17 | Interview |
| 18 | Incident Reporting |
| 19 | Pareto Analysis |
| 20 | Monte Carlo |
| 21 | Preliminary Hazard Analysis |
| 22 | Probability Index Matrix, Risk Matrix, Risk Mapping |
| 23 | Sensitivity Analysis |
| 24 | Risk Ranking / Risk Probability and Impact |
| 25 | Swift Analysis |
| 26 | Strengths, Weaknesses, Opportunities and Threats |
| 27 | "5 whys" Technique |
| 28 | What-if Analysis |
| 29 | Risk Breakdown Matrix |
| 30 | Risk Breakdown Structure |
| 31 | Event and Causal Factor Charting |

Having discussed the different tools and techniques available to support with the project risk management process, the next section will focus on the different factors that determine the selection of the most suitable tool/technique.

#### 3.5.7.1 Selecting an effective project risk management tool or technique

The task of choosing an effective risk management technique or tool is a key step in ensuring project performance. Considering that a specific projects differ in their nature, location, size and complexity (Cagliano et al., 2015; EY, 2015; Salazar-Aramayo et al., 2013), different risk assessment tools are therefore required to ensure project performance in different contexts and in differing national and organisational cultures (Liu, Meng, & Fellows, 2015). Risk assessment tools must therefore be chosen in relation to the risk management phase, the project phase and the corporate maturity of the project team towards risk (Cagliano et al., 2015); these three dimensions will be discussed in detail in the subsections that follows.

##### 3.5.7.1.1 Phase of the risk management process

The risk management process is conditioned by the sequence of events surrounding a risk: the cause of risk, its occurrence and its consequences (Hillson & Murray-Webster, 2007). These three events have been converted into phases of the risk management process, which involves planning, identification, analysis, monitoring, response and control (Cagliano et al., 2015). The actions derived from these phases of risk assessment and management are provided in Table 3-6.

Table 3-6. Risk management phases and actions.

| Risk management phase | Action towards risk assessment |
|---|---|
| Planning | Identify objectives, resource and approaches to risk |
| Identification | Causes of risk |
| Analysis | Probability of occurrence of the risk and impact |
| Response | Actions to develop opportunities and reduce threat |

Despite the clarity of the risk phases, and the corresponding actions, identification of the objectives, causes, and even the probability of risks tends to be a challenging and complex task, due to the limitations of individual knowledge and understandings of particular risks (Cagianelli et al., 2015; Cagliano et al., 2015; Rabechini Junior & Monteiro de Carvalho, 2013). Many project failures may be attributed to the inability of the risk assessment team to understand and identify the possible sources of risk in projects (Zwikael & Ahn, 2011), as well as the challenges of risk assessment in a variety of projects (Aven et al., 2007; Liu, Meng, et al., 2015; Srivastava & Gupta, 2010). Again, although the risk management phases differ in the sequence in which they are conducted, the early part of the risk assessment, i.e. planning, has been identified as a crucial step in ensuring a project's success (Chapman & Ward, 1995; Salas, 2015).

#### 3.5.7.1.2 Project life cycle phases

A project's life cycle has been demarcated in terms of four distinct phases, including conceptualisation, planning, execution and termination (Cagliano et al., 2015; Chapman & Ward, 2004), which enable the project's schedule to be managed at each phase in relation to distinct deliverables. Among these four phases, the possible sources and causes of uncertainties are identified in the conceptual and planning phase (Cagliano et al., 2015).

#### 3.5.7.1.3 Corporate maturity regarding risk

The approach to tackling and mitigating risks differs among projects as well as among companies; however, corporate maturity towards risk requires an understanding and awareness of risk through the consideration that a scope assessment is required to ensure that measures are taken systematically to mitigate risk (Pitsis, Kornberger, & Clegg, 2004). The risks associated with some projects may be managed based on an informal risk management approach, which tends to manage risks as they occur (Cagliano et al., 2015; Chapman & Ward, 2011; Lyon & Hollcroft, 2012; Suslick & Schiozer, 2004)

### 3.5.7.2 Limitations of project risk management practices, tools and techniques

In this section, the limitations of the tools used to assess and manage risk in projects will be outlined.

The literature has identified a problem with the risk management tools available in the project management environment (Benta et al., 2011; Besner & Hobbs, 2012; Thamhain, 2013; Zwikael & Sadeh, 2007). These tools and techniques do not provide strong answers and are based instead on a number of presumptions and assumptions, which may not be accurate and which depend on the experience of practitioners for their effectiveness (Aven et al., 2007).

According to Zwikael and Ahn (2011), although risk planning tools are popular within the project management discipline, many disadvantages have been identified with them, including:

- A limited variety of tools used: despite the wide range of available risk planning tools, in practice, project managers tend to use risk event ranking as their main or only tool (Chapman & Ward, 2004; Larson & Gray, 2011; Wallace, Keil, & Rai, 2004).

- Poor quality of use: several project managers tend to perform inadequately on some of the main risk planning processes, e.g. risk identification (Chapman & Ward, 2004; Kwak & Stoddard, 2004; Larson & Gray, 2011; Wallace et al., 2004).

- High complexity of existing tools: there is a trend suggesting that the use of the current risk tools becomes more difficult as the size and complexity of projects increases (Kwak & Stoddard, 2004).

- Perceived low effectiveness: when it comes to identifying projects' critical success factors, risk management tends to be ranked as ineffective, across various studies (Fortune & White, 2006).

Although many tools are available for the assessment of risk in projects, the majority of project risk assessments are limited to using risk-ranking tools only (Cagliano et al., 2015; Mojtahedi, Mousavi, & Makui, 2010; Osabutey, Obro-Adibo, Agbodohu, & Kumi, 2013). However, effective risk assessment has gone beyond ranking projects' risk into developing an integrated and sustainable approach to risk management (Cagianelli et al., 2015).

Such models of risk assessment manifest two very obvious short-comings. First, the judgment and interpretation of data inputs are subjective, as human actors are likely to either underestimate or overestimate the frequency of adverse events or the chance of possible risks occurring. Second, there is a tendency towards incomplete analysis, which is related to a failure to identify all relevant sources of risk. The main issue here is that while the calculation of risk through probability analysis may appear to be scientific in nature, nonetheless it may still be misleading and inaccurate in evaluating the true nature of risks in a particular case (Carter & Hancock, 1994, p. 116; Harris, 2009).

Cox (2008) examined the mathematical characteristics of risk matrices and concluded that they have the following disadvantages and limitations:

- Poor resolution: risk matrices only compare limited and small number of arbitrarily selected samples of hazards, usually fewer than 10%. They also tend to give identical ratings to very different types of risks.

- Suboptimal resource allocation: to provide effective risk reduction countermeasures, the actual and accurate allocation of resources cannot be grounded on the categories derived from the risk matrices.

- Ambiguous inputs and outputs: decisions about risk severities are difficult to make objectively. Instead, inputs such as frequency and severity of risk, and consequently outputs such as risk ratings, are all based on a subjective interpretation of events. Different people may therefore arrive at contradictory evaluations of the same risks. Of course, this suggests that risk matrices should be used with care, and any decision made should have embedded explanations within it.

It has been argued that the current use of risk matrices does not notably contribute to good risk management decisions, especially the need to allocate resources in conditions of limited management attention. In fact, Cox (2008) argues that extra care should be used when employing risk matrices, while noting that risk matrices are convenient and easy to use and that many decision makers favour this tool rather than others available. Therefore, research is urgently required to understand under which conditions this tool might be helpful or too risky to adopt in risk management decision making. In addition, Cox (2008) suggests that an emphasis on grid lines in a risk matrix might be helpful to ensure that maximum harms from misclassified risks are minimised.

Apart from the approximation inherent in risk matrices, there is a widespread acknowledgement among consultants and decision makers that they are beneficial in differentiating between the risk ranking priorities (most urgent vs. less urgent risks), and some even claim that something is much better than ‘nothing’, such as random or arbitrary decision making (Cox, 2008; Thomas, Bratvold, & Bickel, 2014).

The above sections have provided an overview and established the importance of project risk management as a practice needed to avoid and minimise the occurrence of project failures and to ensure that all of the objectives of the project are met. However, despite this recognition of the benefits of project risk management, projects still fail to meet their schedules and budgets. The following section provides information about the relationship between project risk management and project performance.

### 3.5.8 Project risk management and project performance

Several scholars have discussed the relationship between performing project risk management processes and project success. Some believe that applying these practices relates strongly and positively to desirable project outcomes, while others believe the opposite. Elkington and Smallman (2002) stress the importance of earlier project risk management practices (before the project brief stage) to the success of projects and believe that the amount of project risk management used increases the level of project success. A recent comprehensive study conducted by Zwikael and Ahn (2011) examines the effectiveness of current risk management practices to reduce project risk. Their study used a multi-industry, multinational survey during the period from 2002 to 2007, covering 701 project managers in seven industries in three countries, including Japan, New Zealand and Israel. They found that the country and industry of the project had an important impact on the level of the perceived project risk and on the risk management process adopted. The authors concluded that even a reasonable or moderate quantity of risk management helps minimise project risks, increasing the project's level of success. de Bakker, Boonstra, and Wortmann (2012) agree that project risk management has a significant positive influence on project success, emphasising the risk identification stage as the most important factor in project success. Baloi and Price (2003) and Zou, Zhang, and Wang (2007) also found a strong relationship between project risk management and project success.

While many authors support the idea that project risk management has a positive impact on project performance, other scholars do not seem as optimistic. For example, Raz, Shenhar, and Dvir (2002) did not find a relationship between project success and risk management, stressing the need for more training, and better tools and techniques, while promoting the effectiveness of project risk management and the development of tools specific to various types of projects. Bannerman (2008) claims that, in practice, risk management methods lag behind the understanding and recommendations of the literature. The author insists that, even if a project is successful, it can be challenging to relate the successful result to project management practices, believing instead that success is often credited to good luck or the efforts and specific skills of individuals involved in the project.

Therefore, it is clear that many projects, including oil and gas projects, still fail because of poor project risk management, as will be discussed in detail in section 3.6. The relationship between project risk management and project performance is still ambiguous; one reason for this could be that the term 'project success' is not clearly defined. The next subsection will provide an overview of the definition of project success.

#### 3.5.8.1 Project success

The Cambridge English Dictionary defines success as '*The achieving of the results wanted or hoped for'.* The Oxford English dictionary also defines success as '*the accomplishment of an aim or purpose'*. To this end, project success can be defined as the achievement of the project's desired aims and objectives. However, defining project success is a challenging task. The concept has been extensively researched in the project management discipline, but the literature has been slow to arrive at a clear definition of the concept (Albert et al., 2017; Ika, 2009). One problem, in this case, is that many people assume they can simply recognise the difference between project success and failure (Ika, 2009).

On this issue, different scholars tried to build models and frameworks to measure project success; many of these approaches were based on the Barnes' Iron Triangle of time, cost and quality (Cao & Hoffman, 2011; Chan & Chan, 2004; Khan, 2014; Serra & Kunc, 2015; Westerveld, 2003).

One example of a defined project success framework is the model developed by Lim and Mohamed (1999). These authors realised that project success is perceived differently by different people involved in the projects (e.g. users, contractors, clients etc.); they further suggested that project success can be divided into two macro and micro viewpoints, as shown in Figure 3-7.

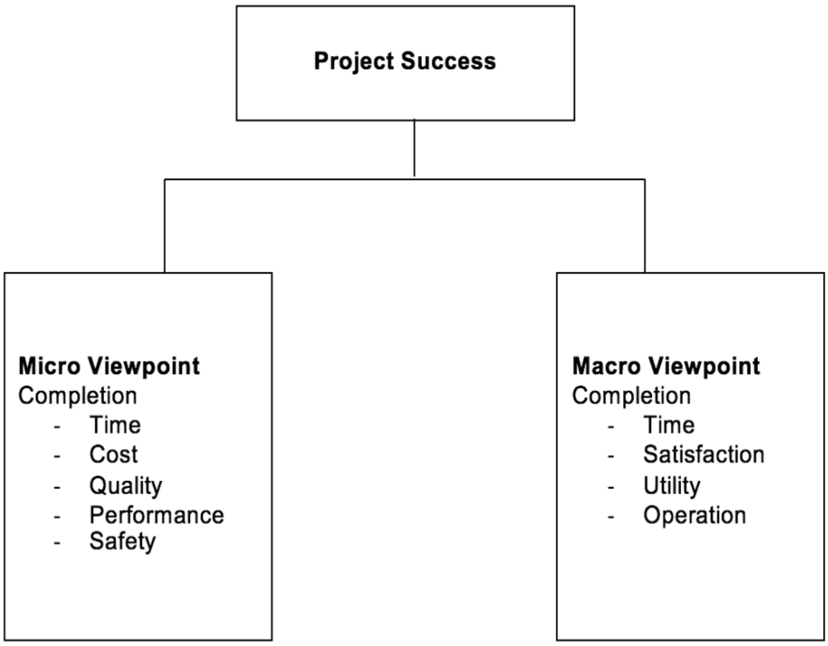



Figure 3-7 Micro and macro measures of project success, as developed by Lim and Mohamed (1999).

On the other hand, Shenhar, Levy, and Dvir (1997) identified project success as including four dimensions – project efficiency, impact on customers, business success and preparation for the future) – as shown in Figure 3-8.

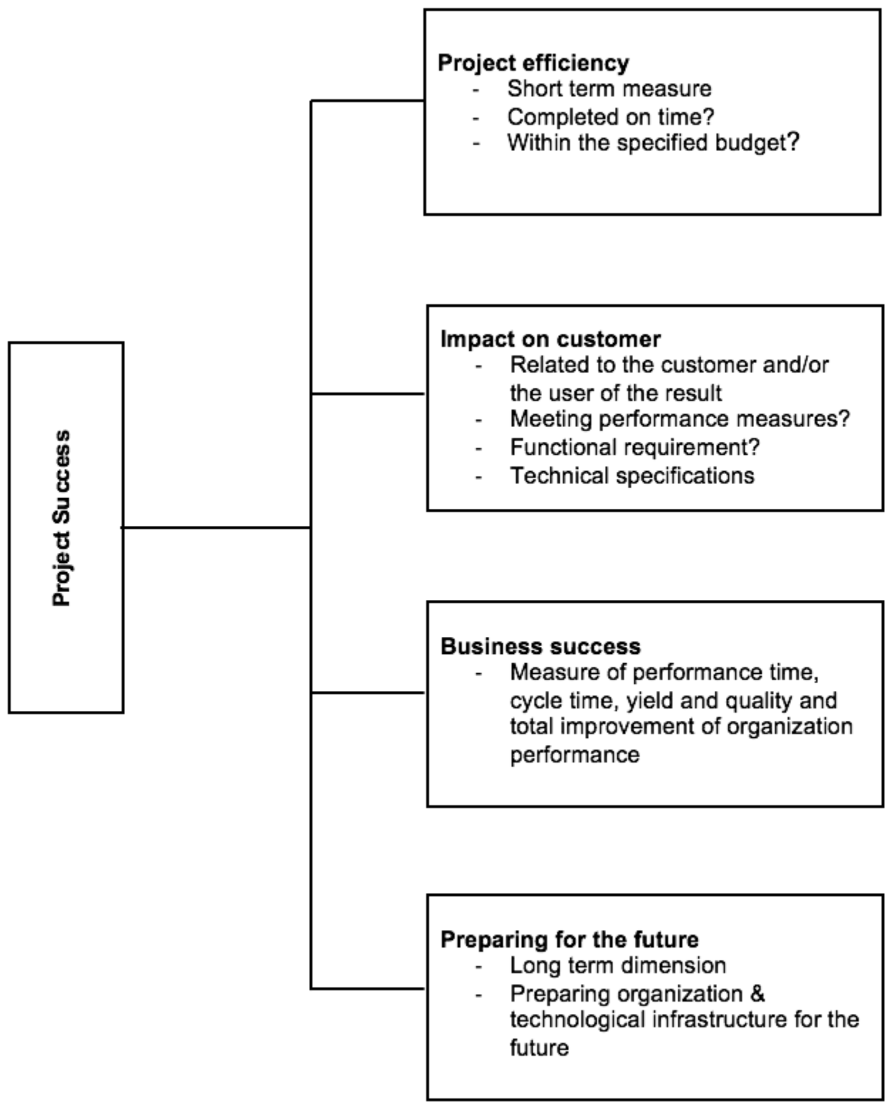



Figure 3-8 Four stages of project success (Shenhar et al.,1997)

The four dimensions suggested by Shenhar et al. (1997) relate to time: their measurements occur at various times during project development. For instance, the first dimension (project efficiency) could be assessed during project execution and again after the completion of the project. The second, third and fourth dimensions are measured over an extended period of time, including measurements of the project's impact on customers, business success and preparation for the future. Similar to the approach proposed by Shenhar et al. (1997), Atkinson (1999) classified project success into the delivery and post-delivery stages, as shown in Figure 3-9.

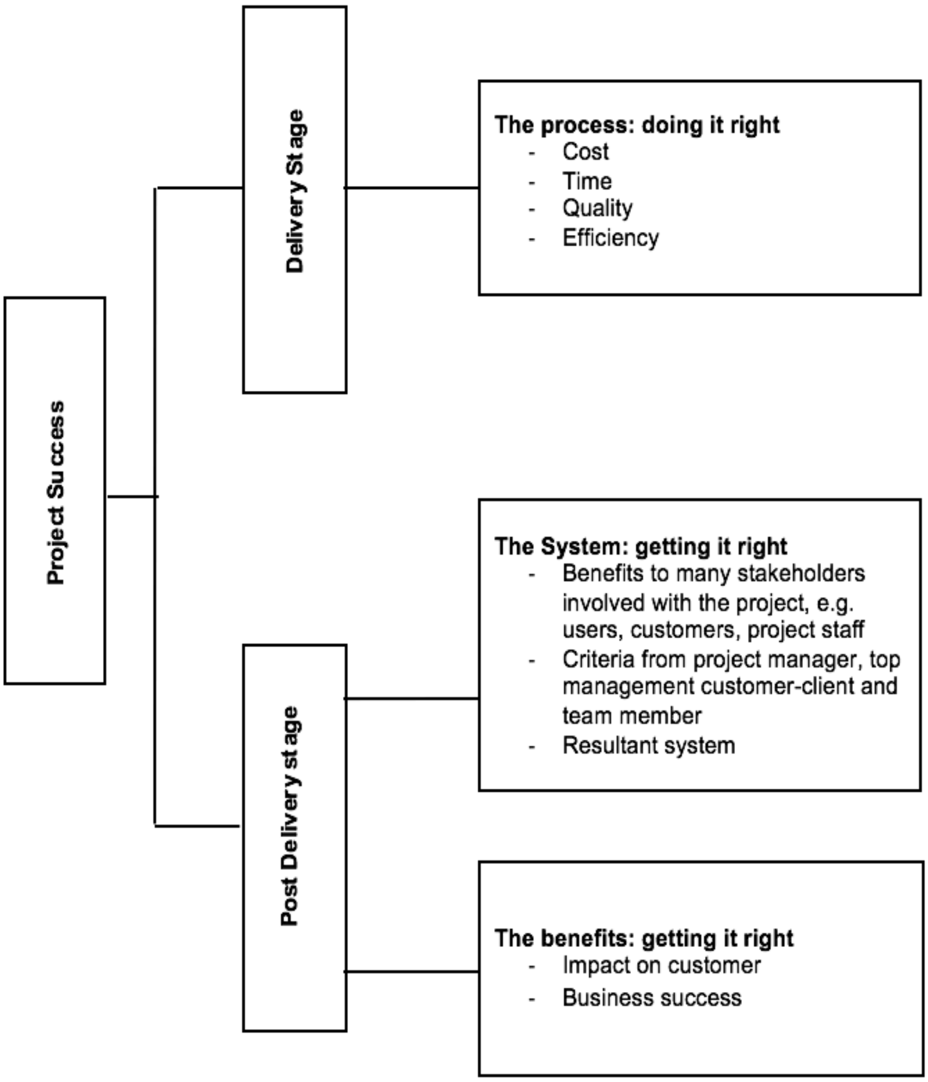



Figure 3-9 Project success stages (Atkinson,1999).

The delivery stage is linked with the measurements required to meet the project's time, cost and quality constraints, as well as to measure efficiency. Meanwhile, the post-delivery stage is divided in turn into two criteria: (1) the system measures the benefits the project brings to different stakeholders, while including criteria set by project managers, top management and team members and (2) benefits related to the measurement of the impact of the project on customers as well as on its business success.

However, to establish a more comprehensive definition of project success, Chan and Chan (2004) proposed a general combined framework, presented in Figure 3-10.

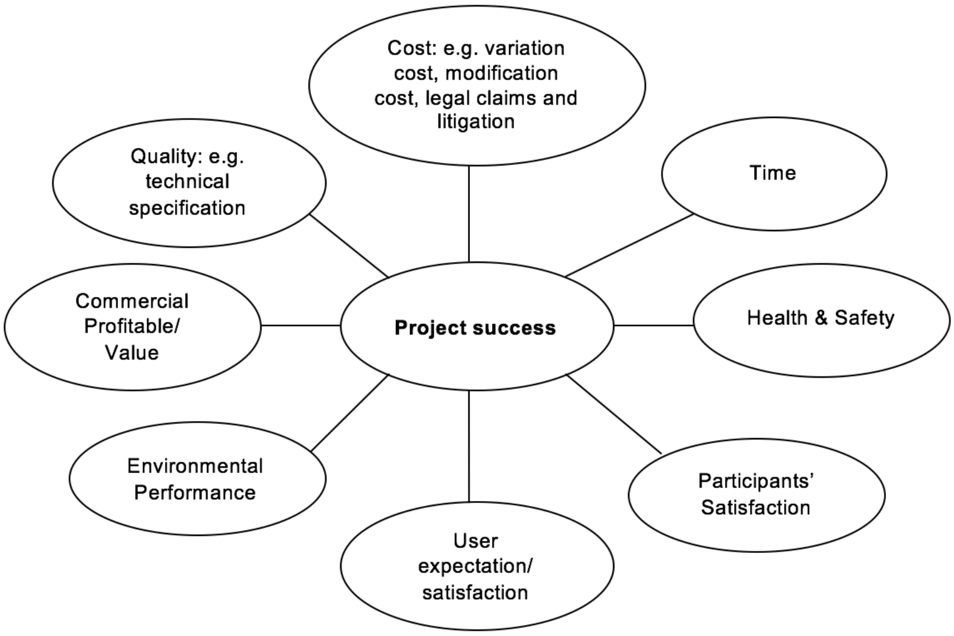



Figure 3-10 General framework for measuring project success (Chan and Chan, 2004).

These authors believed that over recent last decades, different scholars tried to improve the criteria for project success. Chan and Chan have identified eight dimensions for project success; in addition to the well-known ones of time, cost and quality, the framework also includes health and safety, participant satisfaction, user expectations and satisfaction, environmental performance and commercial value.

From the above discussion, it is clear that no definition of project success has been generally agreed on; each analyst views the concept differently. Ensuring that project success is well understood among different stakeholders is important, as this helps in avoiding or preventing any conflicts that might arise during or after the completion of the project. The next section will provide details on the challenges many organisations face in implementing effective project risk management practices.

### 3.5.9 Challenges in developing effective project risk management practices

Despite the fact that project risk management practices may look straightforward in theory, their implementation is challenging (Nocco & Stulz, 2006). Identifying and eliminating these challenges and barriers is an important step in establishing successful project risk management practices, as failure to do so will affect the process and hence lead to project failure (Dandage, Mantha, Rane, & Bhoola, 2017).

One difficulty in trying to develop an effective project risk management approach could arise from trying to make risk management the responsibility of all employees at all levels of the organisation (Ehsan, 2013). According to Goh and Abdul-Rahman (2013), another challenge organisations face is the lack of knowledge among different parties about the true benefits of project risk management, which may result in a lack of the support required to develop a successful practice. In many cases, managers tend to neglect risks, and do not keep up with recent developments in theory (Ehsan, 2013). To this end, Klakegg (2016) identified clearly the challenges involved in establishing project risk management practices. Stating that: *‘it is all about people and competence!’* (p.2), he further claimed that if project risk management science holds a focus on creating frameworks, procedures, tools and techniques, without having a balanced approach between theory and individual practitioners, the concept might be led into a dead end.

Although Kutsch and Hall (2010) found a lack of research identifying challenges and barriers that limit the effectiveness of project risk management, Dandage et al. (2017) conducted a detailed literature review and were able to identify ten challenges and barriers that limit the development of successful project risk management, including:

1) Resistance to change: a common barrier to effective project risk management practices is the resistance of employees to the concept (Lundy & Morin, 2013). According to Oreg (2003), cited in Hon, Bloom, and Crant (2014), resistance to change arises for the following reasons: fear of losing control after change, a tendency to be closed-minded and a refusal to think differently, a limited capability to manage change, a limited ability to cope with new situations, the preference to work within a given well-defined and familiar framework while failing to perform well outside this framework, and an unwillingness to give up old habits.

2) Lack of clear risk definition: As discussed in section 3.2, there is no clear definition of the term risk, which creates significant problems in establishing an effective project risk management process. Bhoola, Hiremath, and Mallik (2014) stress the importance of an adequate definition and suggest a system of project risk criteria.

3) Limited top management support: different authors believe that the lack of top management support, a lack of leadership and an absence of strategic vision can act together as a major barrier to developing effective project risk management strategies (Liu, Wang, & Chua, 2015; Papadaki et al., 2014).

4) Limited availability of resources: the successful implementation of a project risk management process requires different resources that contribute to its success, including: funds, technologies and people; Hwang, Zhao, and Toh (2014) and Farr-Wharton (2003) both indicate that lack of financial resources is an important barrier to effective project risk management and that inadequate resources can lead to project failure.

5) Lack of cooperation between top management and employees: one criterion for developing an effective environment for project risk management is the relationship of mutual trust between top management and employees (Liu, Wang, et al., 2015). Top management should therefore always build and facilitate mutual trust in the organisation by delegating authority and listening to suggestions from all employees (Dandage et al., 2017).

6) Lack of formal training: training on project risk management is important for

effective project risk management practice (Papadaki et al., 2014; Tummala, Leung, Mok, Burchett, & Leung, 1997), because a lack of training on these concepts can be a barrier to their implementation and the effective use of risk management procedures (Dandage et al., 2017). According to Hanna et al. (2016), training provides access to several essential competencies required for project risk management practice.

7) Increased cost of risk management: risk management can be very costly, and can drive cash flows to a negative balance; for example, this occurs when additional funds must be set aside for risk mitigation strategies (Allen, Carpenter, Hutchins, & Jones, 2015; Sato & Hirao, 2013).

8) Avoidance of talking about risk: individuals and project team members usually try to emphasise good news about projects and fear transferring bad news; this creates poor communication between them and top management (Bhoola et al., 2014; Dandage et al., 2017). In turn, this can affect the effectiveness of implementation and counter the benefits of project risk management (Liu et al., 2015).

9) Cross-functional conflicts: for any organisation, employees are distributed into different functional departments; projects usually involve team members from various functional departments. According to Huo, Zhang, and Guo (2016), relationship conflicts within multi-functional projects are very common; these authors also believe that such conflicts usually arise from cultural differences, project uncertainty, intrapersonal diversity and behavioural anticipations from team members. All of this will have a negative effect on the successful implementation of project risk management.

10) Cultural differences: this can be a serious issue for risk management; for example, Harner (2010) indicated that there is a solid relationship between risk management practices and corporate culture. Any cultural differences can create different strategic perceptions, which in turn can become an obstacle for successful project risk management implementation.

From the above discussion, it can be seen that implementing project risk management effectively is not easy; it requires a good deal of attention to detail and an early identification of the problems and the challenges an organisation might face during the implementation process. Having discussed the challenges that limit the effectiveness of project risk management practices, the next section will focus on identifying the critical success factors for this process.

### 3.5.10 Critical success factors for implementation of effective project risk management practices

Although there is a large amount of research done on the topic of risk management, the literature indicates that insufficient empirical knowledge has yet been derived from existing studies to determine the Critical Success Factors (CSFs) for implementing an effective risk management process (Hosseini, Chileshe, Jepson, & Arashpour, 2016; Yaraghi & Langhe, 2011).

Indeed, specifying CSFs can fill in the gap between academic literature and professional practice, so that organisations can focus their limited resources to enhance the chances of successful implementation of project risk management practices (Yaraghi & Langhe, 2011).

Accordingly, although insufficient research has examined CSFs within a project management context, as stated previously, various researchers have nevertheless tried to fill in this gap. For example, Hosseini et al. (2016) examined the CSFs for implementing risk management in developing countries. These authors concluded that there are four (4) highly significant factors:

- Top management support
- Awareness and knowledge of the risk management process
- Training and education on project risk management
- Systematic delivery of projects

In a similar study, Yaraghi and Langhe (2011) investigated CSFs for risk management systems, classifying CSFs into three different standpoints during the implementation of risk management systems within any organisation. These standpoints included (1) factors that influence the readiness of the organisation to implement risk management systems, (2) factors that have a significant effect on the successful planning and employment of risk management systems and (3) factors that are important to retaining and managing risk management systems effectively after their implementation. The authors concluded that throughout these three stages, strategic factors are most important, because they impact not only the risk management system but also the organisation's culture and approach to risk. According to the authors, a strategic orientation helps in the successful implementation of risk management systems by recognising the need for it and the role it plays in resource allocation, as well as supporting development plans during the implementation and maintenance phases. These authors also emphasise the importance of awareness and knowledge of risk management concepts, as well as tools, techniques, applications and benefits, by senior management to ensure their full support and commitment towards the successful implementation of risk management systems.

Different scholars have also pointed out several key factors that contribute to the successful implementation of project risk management practices. For example, Hampton (2006) believed that successful risk management is centred on the sharing of knowledge and best practices within the field. Lenckus (2005) and Coccia (2005) stressed the importance of management board involvement in the risk management process in addition to the importance of the dedicated efforts and time for planning, proper communication and promoting the culture of risk management. Papadaki et al., (2014) also investigated the essential factors that increase the effectiveness of project risk management, identifying such elements as: senior management leadership and support, training and education on project risk management for all levels of the organisation and support from an assigned risk manager.

On the other hand, practice standard for project risk management established by the PMI (2009), also recognises the importance of CSFs to help in the successful implementation of project risk management. As shown in Figure 3-11, this guideline identifies six (6) CSFs for project risk management, including:

- Recognising the value of risk management
- Individual commitment/responsibility

- Open and honest communication
- Organisational commitment
- Scaling risk effort to project
- Integration with project management


Figure 3-11 Project risk management critical success factors
(PMI, 2009).

The guideline also stresses that project risk management must be implemented in line with the current organisational policies and practices, and should also acknowledge business challenges including the multi-cultural nature of the global business environment, which involves different parties such as customers, suppliers and contractors.

Therefore, it can be seen that, although research on the CSFs of project risk management has been limited, it is nevertheless important that each organisation consider these factors to increase the chances of successful implementation.

The above sections (3.5.9 and 3.5.10) have provided an overview of the challenges organisations face as they strive to implement project risk management processes, and has also provided detailed information on the CSFs that help with effective project risk management practices. While one might expect this body of research, if implemented, would help reduce the rate at which projects are failing. However, many projects – especially within the oil and gas industry – still fail due to a lack of proper project risk management practice; the next section will provide information on project failures in the oil and gas industry as well as reviewing the literature on project risk management within this industry.

## 3.6 Project performance in the oil and gas industry

Many oil and gas E&P companies around the world have experienced difficulty in delivering large capital projects within time and budget constraints (EY, 2014; Judah, 2016). In contrast to other industries (refer to the figure 3-12 below), oil and gas projects have performed poorly; one reason for this might be because oil and gas projects are considered to be among the most challenging of all industries, due to their complexity and difficulty in both technology and management (Akinremi et al., 2015). Indeed, Briel et al. (2013), Deloitte (2015) and EY (2014, 2015), have pointed out that such projects are very risky and in need of a clear system of management that would offer specific strategies in relation to time, cost and quality.

| Measure of Merit | Upstream Megaprojects | Other Megaprojects |
|---|---|---|
| Cost overrun (%)* | 25 | 15 |
| Cost competitiveness % of industry average capex** | 127 | 1.11 |
| Slip in execution schedules (%)^ | 22 | 15 |
| Severe and continuing production shortfalls^^ | 45 | 32 |

* Cost overruns are measured as the final actual cost, including Phase 1 well construction, divided by the FID estimate, with both adjusted to the same currency and time base (escalation removed).

** Competitiveness is measured as the relationship between project cost per unit of capacity vs. industry average cost, with all adjusted to the same currency and time base.

^ Slip is measured as the actual time from FID to first production divided by the time promised at FID.

^^ A project is considered a production attainment failure if the project suffers extended shut-ins of production into the second year after first oil. E&P projects in this category averaged less than 50% of first-year planned production, even after adjusting for slips in execution schedule.

Figure 3-12 Oil and gas project delays and cost overruns (Merrow, 2012).

To this end, it can be said that with all the challenges in the oil and gas environment, ultimately the experience of project managers and teams is acutely needed to ensure the implementation of all required project management practices. However, Briel et al. (2013) believe that experience is not enough on its own; instead, project managers should also follow a coherent reference framework that is based on, but not limited to, constant monitoring and reviewing of official project phases from start to finish. Also, the existence of integrated project teams will help in providing the maximum quality of management and in minimising project failure. Accordingly, Denney (2006) declared that most companies have adopted effective project management strategies based on the need to help them remain competitive within the industry; this attempt will clearly enhance project performance and, accordingly, set higher project delivery outcomes.

Therefore, (Al Subaih, 2015; Carvalho & Rabechini Junior, 2015; Rabechini Junior & Monteiro de Carvalho, 2013; Rogers & Ethridge, 2013; Salazar-Aramayo et al., 2013) all agree that developing effective time, cost and quality management strategies is a requirement of efficient management policies across the oil and gas sector, which accordingly increases the demand for knowledge to further reduce project failure rates.

One of the most effective strategies in this respect is project risk management, if risk factors are carefully assessed, project failures can be minimised (Al Subaih, 2015; Carvalho & Rabechini Junior, 2015; Rabechini Junior & Monteiro de Carvalho, 2013; Rogers & Ethridge, 2013; Salazar-Aramayo et al., 2013). However, despite the importance of project risk management, many projects within the industry still fail as a result of poor implementation of this concept. As was noted in section 1.2, EY (2014) have stated in a global study on a number of oil and gas projects that the main factor leading to their failure is poor management of project duration and budget, which has negatively affected project delivery compared to the overall industrial outlook. Improper project risk management practices and processes, in particular, were identified by the same study as specific root causes of this failure (EY, 2014).

Other studies have also recorded the failure of many oil and gas projects as a result of a lack of project risk management practices. With particular reference to NOCs, a study conducted by Nolan and Thurber (2010), identified one reason for the lack of strong risk management practices within NOCs: they have been relatively free from competitive pressure (by contrast with IOCs), perhaps because, as state-owned companies, they are supported by soft budgetary practices as well as a monopoly over hydrocarbon sales in their domestic markets, hence they are never exposed to the risk of bankruptcy or overthrow in case of unsuccessful project investment. Long (2015) also identified several problems related to improper project risk management that cause oil and gas projects to exceed their budget and lead to major delays. The author summarised the main problems:

- Inadequate project definition during early project stages
- Insufficient documentation
- Lack of an experienced workforce
- A large number of changing directives
- Inadequate facilities, leading to additional cost and time in construction for additional facilities to fill the gap
- Incorrect cost estimates
- Unclear contract documents
- Poor baseline schedules
- Poor production designs
- Insufficient project management team to manage changes

Moreover, Suda et al. (2015) conducted a review of risks and project risk management within the oil and gas industry and indicated that many upstream oil and gas projects fail to meet their deadlines and predetermined budgets; the authors claim that poor project risk management is the root cause for this phenomenon. In another study, Elliott (2005) identified twenty reasons for poor project performance in the oil and gas industry in Canada, all of which can be linked to poor project risk management practices. These reasons include: lack of an experienced workforce, incorrect appointment of contractors, unsuitable contractual agreements, lack of clear definition of roles and responsibilities, lack of effective risk analysis experience and lack of familiarity with the company’s standards and practices. Finally, Fazlali, Ebrahimi, and Hosseini (2011) conducted a study to analyse the major challenges to the implementation of oil and gas projects in Iran, concluding that among those challenges is the risk mismanagement, which contributed to the poor performance of projects.

The above section provided an overview of the current project performance of oil and gas projects; it can thus be concluded that many projects fail within the oil and gas industry as a result of poor project risk management. The next section will provide information on the performance of oil and gas projects within the Libyan context.

### 3.6.1 Oil and gas project performance in Libya

As was mentioned previously, the oil and gas industry plays an important role in the Libyan economy as approximately 96% of hydrocarbon sales contribute to total government revenues (see section 2.6). The Libyan government recognises the importance of the oil and gas industry, as it is the main economic driver for the country (IMF, 2013). Prior to the 2011 civil war and the 2013 oil sector crisis, Libyan decision makers made several project announcements to increase oil and gas production, while the National Oil Corporation (NOC) of Libya expected to invest in enhanced oil recovery (EOR) projects to boost production. In fact, NOC introduced a development program to rehabilitate and develop several oil and gas fields (EIA, 2015).

In the meantime, any plans to engage in capital-intensive projects in Libya have been delayed due to the unpredictable security environment and political instability (EIA, 2015). Kusakcı, Ayvaz, and Bejtagic (2017) analysed the causes and effects of delays in construction projects within the Libyan oil and gas industry. Kusakcı et al. (2017) stressed the fact that many projects within the industry were delayed, and as a result, they have not been delivered on time and within the agreed budged. The authors even reported that many projects have been temporarily or totally abandoned. Kusakcı et al. (2017) reported that unstable security, political systems, shortage of materials, lack of funds, contract-related disputes, external factors, improper site management and insufficient construction methods are all factors that contribute to the poor performance of projects within the industry.

Similarly, Gahndour (2017) reported the same issues related to poor project performance within the oil and gas industry in Libya. Gahndour (2017) stated that since 2010, around 519 NOC capital projects suffered from delays and cost overruns. The author believes that most causes of this poor performance were due to political and security unrest in the country which subsequently led to lack of funds, the freezing of many foreign oil companies' activities and a reduction of employed expertise due to shutting down so many business activities.

Consequently, it can be seen that the Libyan oil and gas projects are suffering from poor performance as many projects fail to be delivered within their constraints. From the above discussion, it is shown that this poor project performance is rooted in the project risk factors discussed in subsection 3.5.4. Therefore, project risk management is vital to account for and manage all of these risks in order to enhance project performance. In fact, Kusakcı et al. (2017) stressed the importance of establishing a complete project management framework within the Libyan oil and gas industry that serves the need for identifying and avoiding time delays and cost overruns. This further justifies the importance of this research that aims to investigate current project risk management practices within the industry that will ultimately establish an effective process.

## 3.7 Studies on project risk management in the oil and gas industry

Although Suda et al. (2015) claim that not many studies have applied project risk management concepts within the oil and gas industry, other sources point out the importance of risk management and the continuous need for research and improvement of the topic within the oil and gas industry. For example, Cagianelli et al. (2015) introduced an Integrated Risk Management (IRM) model, stressing the importance of planning, in the early project phases, and sufficient allocation of resources, as the key success factors for oil and gas projects. Akinremi et al. (2015) emphasise the requirement for further high-performance risk management models; they further developed a three-dimensional sustainable approach (including investment, social and environment risks). Their justification for this model is that many oil companies only focus on investment risks and ignore the two other dimensions. Aven et al. (2007) have proposed a decision framework for risk management for offshore oil and gas projects, consisting of simple elements related to the decision-maker's vision, values and strategies, problem definitions and challenges, related stakeholder's values, visions and long-term goals and the analyses of the consequences of each decision taken. Although this framework was developed for offshore oil and gas projects, the authors believe it is general and can be useful in other contexts.

Other scholars such as Kenzhetayeva, Ribeiro, Oliveira, Carvalho, and Bicho (2014), proposed a Risk Management Road Map (RMR). These authors rely in their approach to past projects, especially in terms of mobilising the knowledge gained previously to improve traditional risk management practices to assess and classify project risks. Aven and Pitblado (1998) discussed the tools of safety management in the Norwegian and UK continental shelves, concentrating on the practices of risk analyses, risk communication and risk interpretation. Zuofa and Ochieng (2014) investigated risk management practices within the Nigerian oil and gas industry and concluded that a lack of project risk management awareness, a lack of training, a bureaucratic government system and incomplete team formation are among the factors that limit the effectiveness of project risk management.

In the context of the Arab world, specifically the Gulf Cooperation Council (GCC), a recent study was done by Muralidhar (2010). The aim of this study was to investigate the practice of Enterprise Risk Management (ERM) in oil and gas companies. The author stressed that there is a requirement for an ERM implementation and concluded by recommending additional research, as the topic is newly emergent within the industry in this region. Similarly, again in the Arabic world and more specifically in Saudi Arabia, the oil and gas sector is fully controlled by Saudi Aramco, a state-owned company. Saudi Aramco is, in fact, the world's largest oil and gas production company (Aramco, 2013). The company recognises the importance of project risk management as a key integrated element within the company's co-operative strategy. Saudi Aramco has recently established what they called 'Saudi Aramco Enterprise Risk Management'. According to the company, this task guarantees that the risk management process is in line with the company's decision-making and planning processes (Aramco, 2013).

## 3.8 Summary

The aim of this chapter was to address objective one (1) of this research study: to critically review the importance and effective practices of risk management with particular reference to the oil and gas industry. This chapter therefore investigated the meaning of risk, risk management, project management and project risk management. The chapter also reviewed the literature on the practices and approaches used to manage project risks, and provided a list of different tools and techniques used to support the project risk management process along with limitations to the effectiveness of such practices to enhance project performance. Furthermore, the researcher examined the meaning of project success and the link between project risk management practices and project performance. The researcher also discussed the current challenges that organisations face in attempting to establish an effective project risk management practices. Moreover, the researcher identified critical success factors that, if implemented, would increase the chances of applying effective project risk management processes. Finally, the researcher provided an overview of oil and gas project performance, noting how poor performance can be rooted in the lack of project risk management practices. Finally, the chapter outlined some previous studies on project risk management within the oil and gas industry. The next chapter will discuss the research methodology adopted for this study.

# Chapter 4 Research Methodology

## 4.1 Introduction

Research methodology is a systematic approach taken by researchers to achieve the research aim (Creswell, 2009). Hence, in designing a research methodology, the researcher should consider the most appropriate approach to achieve the research aim and objectives (Joyner, Rouse, & Glatthorn, 2012). It has been argued that the main influencers involved in selecting an appropriate research methodology include: the problem to be investigated, the research question and the availability of adequate resources (Remenyi & Williams, 1998).

Therefore, the aim of this chapter is to provide justifications as well as the rationale behind the choice of research methodology for this research. To establish an effective strategy, various aspects were considered, all of which are discussed in this chapter. These aspects include: research models, research philosophy, research approach, methodological choice, research strategies, time horizons and data collection and analysis procedures.

## 4.2 Research methodology definition

Before defining research methodology, the term 'research' should be defined. Many academics, such as Walliman (2005), believe that the word 'research' is not used in terms of its true meaning. The author argued that the term is used incorrectly and focuses on the mere collection of information and facts with no clear objective or on the reordering of information without explanation or interpretations. Consequently, Saunders et al. (2016) defined research as 'something that people undertake in order to find out things in a systematic way, thereby increasing their knowledge'. The two terms 'systematic' and 'find out' are the main characteristics of the research; the former recommends that the research be based on logical relationships, while the latter suggests that the research will include multiple purposes (e.g. explaining, analysing, criticising and understanding) (Ghauri & Grønhaug, 2005). Therefore, research methodology can be defined as a systemic approach a researcher takes to achieve the research objectives (Creswell, 2009).

## 4.3 Research models

Several research methodology frameworks exist in the literature, such as the nested model suggested by Kagioglou et al. (1998) and the research onion proposed by Saunders et al. (2016). The nested model consists of three elements, as shown in Figure 4-1. These include the research philosophy, research approach and research techniques.

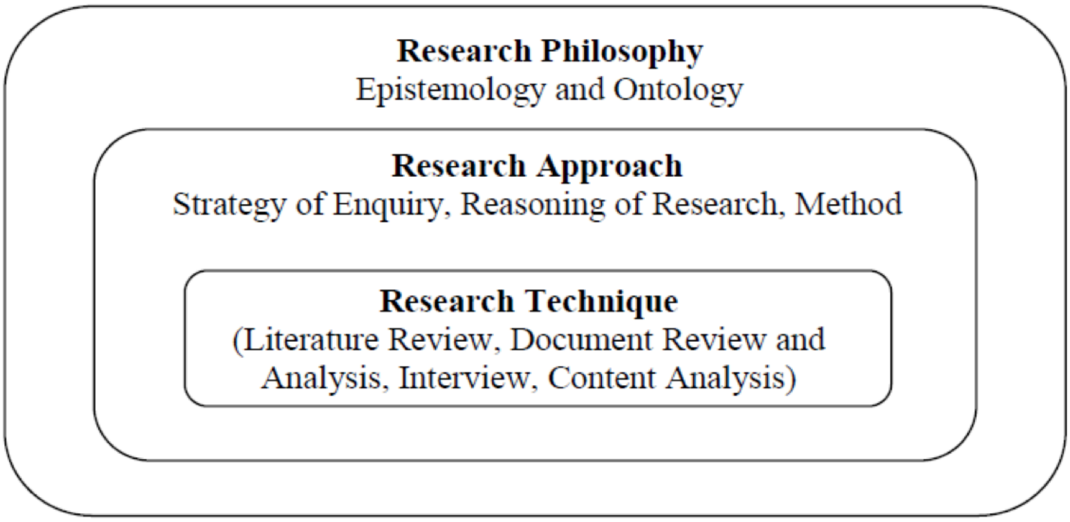



Figure 4-1 Nested model (Kagioglou et al., 1998)

On the other hand, the research onion is comprised of six steps: the research philosophy, research approaches, research strategies, research choices, time horizons and data collection and data analysis, as shown in Figure 4-2.

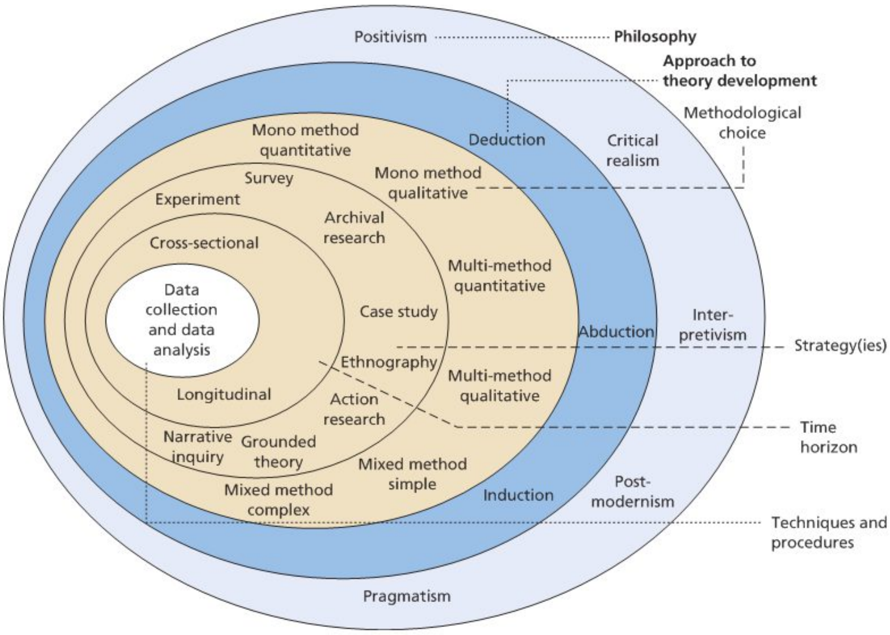



Figure 4-2 Research onion (Saunders et al.,2016)

For this research, the research onion model developed by Saunders et al. (2016) was followed because it is a simplified model that provides a clear understanding of the research process to be followed. The next sections discuss each of the model layers, which assisted in making a systematic and analytical decision regarding which research design is more applicable to this research to achieve the research objectives.

## 4.4 Research philosophy

Although philosophical concepts are still ambiguous when applied in research (Slife & Williams, 1995), they continue to influence research practices and hence should be identified. Understanding research philosophies helps researchers make decisions and provide explanations for the choice of method, e.g. qualitative, quantitative or mixed methods (Creswell, 2009).

According to Saunders, Lewis, and Thornhill (2009), a research philosophy is related to the nature of knowledge and the development of that knowledge. The authors argued that a research philosophy has essential assumptions regarding the means the researcher uses to interpret reality and the world. While an understanding of a research philosophy is essential, Johnson and Clark (2006) argued that the relation between the logical and well-defended approach of the chosen philosophy and the set of alternative options available is critical. Creswell (2009) expanded Saunders et al.'s (2009) proposal and argued that a research philosophy is crucial and must be understood at the early stages of the research. In addition, Saunders et al. (2009) emphasised that understanding a research philosophy is important, as it will support the research strategy and therefore the chosen methods as part of that strategy. The authors argued that the importance of a research philosophy is that in many cases, a researcher who is concerned about the feelings and attributes of his/her subjects adopts different approaches than a researcher who is mainly concerned with facts, such as the manufacturing process. The difference between these two extreme examples is not only the way in which the two distinct researchers view what is more important but also the methods and approaches they select to answer the research question. There are three concepts relevant to research philosophies, which include ontology, epistemology and axiology (Miles & Huberman, 1994). Each of these three concepts are discussed in detail in the following subsections.

### 4.4.1 Ontology (The nature of reality)

According to Saunders et al. (2016), ontology is linked with the nature of reality. Blaikie (2009) argued that an ontological assumption is concerned with the nature of social reality and focuses on what types of social phenomenon do or can exist. Therefore, there are two different aspects of ontology: objectivism and subjectivism**.**

**Objectivism:** Bryman and Bell (2015) defined objectivism as '*an ontological position that asserts that social phenomena and their meanings have an existence that is independent of social actors*'. Saunders et al. (2009) further explained that objectivism is the assumption that social units are external to the social players.

**Subjectivism:** This is the opposite of objectivism. Saunders et al. (2009) defined it as follows: 'The subjectivism view is that social phenomena are created from the perceptions and consequent actions of social actors'. In addition, Bryman and Bell (2015) defined this view of ontology as constructionism. The authors agreed with Saunders et al.'s (2016) definition and emphasised that social phenomena are in a continual state of revision, rather than solely generated from social interactions.

### 4.4.2 Epistemology (What is measured as acceptable knowledge)

The epistemological assumption is concerned with what types of knowledge are possible in addition to the criteria for deciding when knowledge is both legitimate and adequate (Bryman, 2008). Epistemology takes the elements that shape adequate knowledge in a field of research into account. Therefore, the researcher determines what is important in the field of his/her research. A researcher might follow the natural scientist's position in which reality is represented by objects. On the other hand, a researcher might consider or perceive human attributes and feelings as more important. Consequently, the researcher's view would be on the opposite extreme of the epistemological continuum. In general, there are two positions within epistemology: positivism and interpretivism (Saunders et al., 2016).

**Positivism (A natural science epistemology):** If the research philosophy mirrors the position of positivism, then it is likely to take the natural scientist attitude. This is because the outcome, or the end product, of a particular research project is more likely to be a law-like generalisation, such as those found in physical and natural sciences. Another component of the positivist stance is that the research is taken as far as possible being a value-free (Remenyi & Williams, 1998). Bryman and Bell (2015) defined positivism as 'an epistemological position that advocates the application of the methods of the natural sciences to the study of social reality and beyond'.

**Interpretivism**: This is the opposite of positivism. It could be argued that the social world is far more complex and complicated to be explained by general laws, as in the case of natural science epistemology. Interpretivism can be defined as 'an epistemology that advocates that it is necessary for the researcher to understand the difference between humans in our role as social actors' (Saunders et al, 2009).

### 4.4.3 Axiology

Axiology involves the explanation for which values are inherent in the research and the assumptions with the value system (Miles & Huberman, 1994). It is therefore a study of the judgements related to value. This is important, as the credibility of the results depend on the researcher's values in all stages of the research. Moreover, the choice for a particular research topic as well as the choices of the data collection techniques reflect the researcher's own values. An example of this is that if the researcher emphasises collecting data through interviews (the case for this research), this means that the researcher values personal interactions with participants more than their views shared through questionnaires (Saunders et al., 2016).

In general, in recent years, there has been a tendency to view these philosophies as existing on a multidimensional continuum rather than independent positions. These dimensions include the three concepts relevant to the research philosophy and tend to answer three questions, as shown in Figure 4-3 (Saunders et al., 2016).

| Question (dimension) | continua | | |
|---|---|---|---|
| **What is the nature of reality?** | external<br>objective | ⟺<br>⟺ | socially constructed<br>subjective |
| **What is considered acceptable to knowledge?** | observable phenomena<br>law-like generalisations | ⟺<br>⟺ | subjective<br>subjective meanings |
| **What is the role of values?** | value free | ⟺ | value bound |

Figure 4-3 Research philosophy multidimensional continuum (Saunders et al., 2016)

In addition, Figure 4-4 summarises the three research philosophies applied in business and management research studies.

| | Positivism | Interpretivism |
|---|---|---|
| Ontology | Objective, external and independent of social actors. | Subjective, may change, socially constructed and multiple. |
| Epistemology | Centre on law-like generalisation. Credible data only made available by observable phenomena. | Centre on the details of circumstances, and the truth behind these details. Subjective meanings and social phenomena. |
| Axiology | Value free. Therefore, the researcher is independent of the research and assume both objective position. | Values are bound. Cannot be separated (subjective). The researcher is part of what is being studied. |
| Most common data collection technique used. | Large samples. Very much structured, quantitative. | Small samples. In depth examination, qualitative. |

Figure 4-4 Summary of the research philosophies found in business and management research studies (Saunders et al.,2016).

This section has provided detailed information of the first layer of the research onion model (research philosophy). The next section explains the justification for the adopted philosophy for this research.

## 4.5 Adopted research philosophy justification

In this section, the chosen philosophy for this research is justified. The purpose is to provide a logical approach regarding which philosophical position (discussed in sections 4.4 and its subsections) is more suitable for this research. While there are two distinct ends of the philosophical continuum, positivism and constructionism (interpretivism) (Easterby-Smith, Golden-Biddle, and Locke (2008), the positivists believe that reality presents externally and is usually measured through objective methods. On the other hand, constructivists believe that the world (reality) is socially constructed and not objective (Easterby-Smith et al., 2008). Sexton (2007) argued that the distinction between these two is based on their ontological, epistemological and axiological assumptions. Positivism involves the ontological belief of reality being external and objective (realism) as well as an epistemological belief that reality is only important if it is based on remarks related to external knowledge. Moreover, for the axiological view, Easterby-Smith believed that research is value-free (Easterby-Smith et al., 2008). Constructivists support the ontological view that reality is socially constructed and subjective, and they represent the other end of the ontological continuum (idealism). They hold an epistemological view that reality is subjective; in addition, axiologically, they believe that research is value-laden (Gummesson, 2000).

This research involved interactions between different people and technological influences in real-world situations. Different perspectives regarding project risk management within the Libyan oil and gas industry were investigated during the research. It largely involved in-depth studies of the targeted sample to establish recommendations based on an understanding of people's interactions. Therefore, this research followed the social constructionism (interpretivism) philosophy, the ontological position of subjectivists and the axiological view of being value-laden, as shown in Figure 4-5.

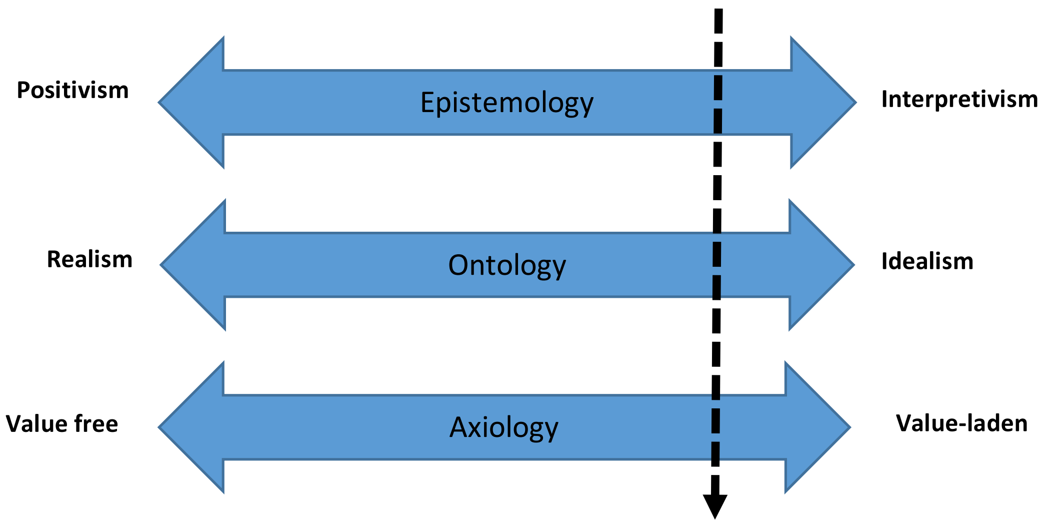



Figure 4-5 The philosophical stance of this research

## 4.6 Research approach

Because this research follows the Saunders model of research methodology framework, the second layer of the research onion model to consider is the ‘research approach’. There are three different research approaches defined by Saunders et al. (2016), including deductive, inductive and abductive approaches. Each of these three approaches and the selected approach for this research are discussed in the next paragraphs.

**Deduction:** This is a research approach that is believed to be closely related to scientific research. It is most commonly used for law generation in natural sciences. More importantly, one characteristic of the deduction approach is the variable, or causal, relationship between two concepts. In addition, facts are measured through quantitative methods, where large and sufficient sample sizes are selected to allow for generalisations (Saunders, 2009; 2016). Blaikie (2009) identified the six steps involved in deduction research:

1. The generation of a hypothesis (or more) and ideas with the aim of producing a theory.
2. The deduction of measurable variables by using available literature or by identifying the circumstances, which contribute to the creation of the theory.
3. An examination of the propositions and the logic of opinions that formed them compared with current theories to determine whether they can generate the further understanding of an issue.
4. The collection of data to measure the variables or concepts and to analyse them.
5. If the outcome from the analysis is not reliable, then the test fails. Therefore, the theory is rejected or must be modified.
6. If the outcome from the analysis is reliable, then the theory is validated.

Bryman and Bell (2015) created a simplified diagram (Figure 4-6) of the different process stages of a deduction approach.

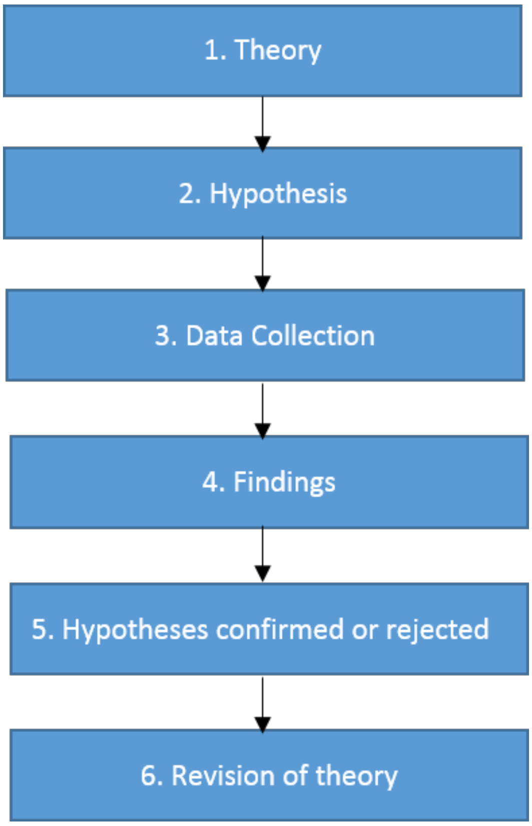



Figure 4-6 Deduction approach research process (Bryman & Bell, 2015)

**Induction:** While deduction is more commonly adopted for the natural sciences, the induction approach is generally used for the social sciences as well. Researchers who adopt the inductive approach are likely to focus more attention on a context in which the phenomenon occurs. Unlike the deductive approach, where the study of large samples is crucial, the study of small samples is more appropriate for the inductive approach. Therefore, researchers tend to use different methods of qualitative data collection to produce various views of a particular phenomenon. Data are collected, and a theory is developed through the analysis of the collected data (Saunders et al., 2016: Easterby-Smith et al., 2008).

**Abduction:** In contrast to the two abovementioned research approaches (induction and deduction), the abductive research approach involves alternating between theory and data and vice versa (Suddaby, 2006). As Saunders et al. (2016) noted, this is the typical approach that many business and management researchers apply in their studies. The abductive approach involves gathering data to investigate phenomena, classifying themes and patterns and then using this to generate or modify a theory (Saunders et al., 2016).

Based on this discussion and beginning with the deductive approach, the researcher has carried out an extensive literature review on project risk management with particular reference to the oil and gas industry and has deduced principles to generate suitable data collection tools. Thereafter, the primary data was collected through the use of the inductive research approach. Data was then analysed to recommend improvement for the project risk management practices in the oil and gas sector in Libya. Hence, as this research study involved the use of both the deductive and inductive approaches, the abductive approach was the most suitable approach for this research.

## 4.7 Framing the research design

The first two layers (research philosophy, see section 4.4) and the research approach (see section 4.6) of the onion research model influenced the ***research design*** (referred to as the next four layers in the research onion model, see figure 4-2). According to Easterby-Smith et al. (2008), a research design can be defined as the organising of research activities to achieve the research aims and objectives through different data collection techniques. The design of the research is an important aspect of any research study, as it allows the researcher to have a structured general plan of how the research question(s) will be answered. It includes a clear plan of the different research strategies, research methods, details of the sources and data collection techniques and analyses. The nature of a particular study and the philosophical position of the research problem will determine which research design is more appropriate to fulfil the aim(s) and objectives of the research. To understand which design would be most appropriate for a particular research project, the researcher should recognise the nature and the purpose of the research (Creswell, 2014; Saunders et al., 2016)

## 4.8 Methodological choice

As mentioned, the research onion model was adopted for this research, and the third layer to consider is the methodological choice for the research. This is based on the selection of one of the three commonly used methods, which include qualitative, quantitative and mixed methods. It is important to note that these methods should not be viewed as rigid or polar opposites but rather as existing on a continuum. The main difference between these methods involves their use of numbers, closed-ended questions (quantitative) or open-ended questions (qualitative) (Newman & Benz, 1998); Creswell, 2014; Saunders, 2016).

**Quantitative research design:** This method is used to establish and study the relationship between two variables or concepts; therefore, it is used to ***test a theory***. These variables are measured numerically, and the results are analysed numerically through statistics or graphs. Researchers who adapt this method usually tend to be more deductive in their research approach and tend to follow the positivism epistemological position, where highly structured data collection techniques are used. Here, the most commonly adapted research strategy would be linked to experimental and survey research (Creswell, 2014; Saunders, 2016).

**Qualitative research design:** This method is used to explore and understand the individual meaning of a social problem. Therefore, this method uses different data collection techniques and facilitates various analytical processes to ***build a theory*** or develop a ***conceptual framework***. Researchers who adopt this method usually tend to be more inductive in their research approach; they also generally have an interpretive philosophy. The most commonly used research strategies for qualitative research include the action theory, grounded theory, case study, ethnography and narrative research. (Creswell, 2014; Denzin & Lincoln, 2005; Saunders et al., 2016).

**Mixed (multiple) methods research design:** This design includes both quantitative and qualitative methods. This method can involve the use of both deductive and inductive research approaches; therefore, it can be used to test a theory and can also involve either qualitative or quantitative research designs to develop a theory or a model. This method does not necessarily follow the positivism or interpretivist point of view; instead, it is likely to follow the pragmatist's philosophical position, which allows for the selection of whichever method and philosophical position that is most appropriate to help to answer the research question (Creswell, 2014; Saunders, 2016).

Figure 4-7 summarises the methodological choices available for the methods discussed. There are two choices from which the researcher can choose: the **mono method** or **multiple methods**. In multi-method research, data can be collected through several techniques but will only be limited to one of the methods (quantitative or qualitative). For example, in a multi-method qualitative study, data can be collected through documents and interviews. On the other hand, for a multi method quantitative study, data can be collected and analysed through observations and questionnaires (Saunders et al., 2016).

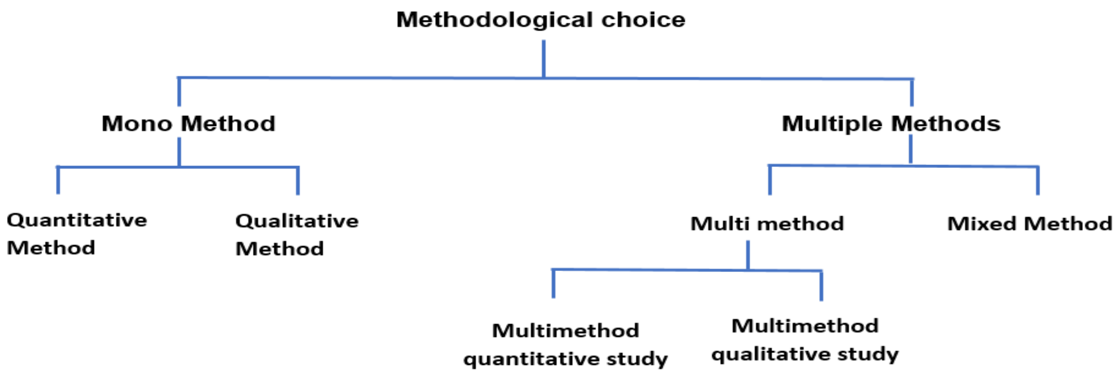



Figure 4-7 Summary of the methodological choices available

The ***multi-method <u>qualitative</u> study*** was primarily adopted for this research. Data was collected through qualitative techniques (this is discussed in detail in section 4.12.1), which included semi-structured interviews and document reviews. ***The aim was to obtain an in-depth understanding of the project risk management practices available and the current problems faced within the oil and gas industry in the Libyan context***. In the researcher's opinion, this can be achieved through interactions with experts in this field of study by conducting in-depth interviews with the aim of generating recommendations for an effective risk management process. The quantitative or mixed methods approaches would not necessarily answer the questions of this research, as testing an existing theory or a model was not the aim. In addition, the selected method reflects the researcher's philosophical view, which is of the interpretivist and abductive research approach.

## 4.9 Research strategy

A research strategy is viewed as the methodological connection between the research philosophy (see section 4.4) and the selection from different research methods (see section 4.8) used to collect and analyse data. It is important to note that the selection of a particular strategy depends on the philosophical stance of the study as well as the effectiveness of the strategy in meeting the research objectives or answering the research question(s); therefore, these strategies do not have an advantage over another. In some cases, a researcher may adopt more than one research strategy; for example, the researcher might conduct a survey in a case study. In general, the selection of the research strategy is directed by the research purpose and approach, the rationality in which the strategy is associated with the research philosophy, the research timeframe and available resources (Denzin & Lincoln, 2005; Saunders, 2009; 2016).

Therefore, the aim of this section is to focus on the selection of a research strategy that meets the research aim and objectives. A decision will be made from the available strategies, as outlined by Saunders et al. (2016): experiment, survey, archival research, ethnography, action research, grounded theory and case study.

Accordingly, as noted in this section, the selection from the research strategies was mainly influenced by the philosophical stance of the study discussed in sections 4.4 and 4.5. Sexton (2007) placed these strategies on a continuum based on ontological and epistemological views, as shown in Figure 4-8.

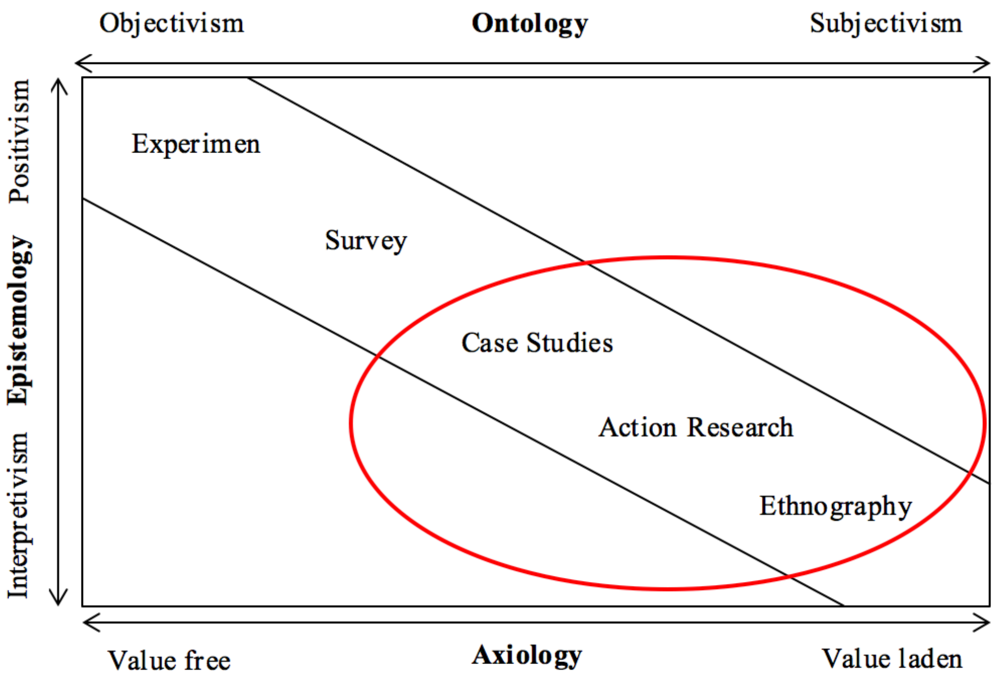



Figure 4-8 Research approaches on a continuum (Adapted from Sexton, 2007)

Figure 4-8 shows that experiments and surveys are placed close to the realism (objectivism) end of the ontological view and the positivism end of the epistemological view. This clearly does not reflect the philosophical stance of this research, which favours the interpretivism and subjectivism views. Therefore, adopting strategies such as experiments and surveys are unjustifiable. For experimental research, the strategy is rooted in natural science or laboratory-based studies (Hakim, 2000); therefore, hypotheses are used rather than research questions and hence is more suitable for quantitative research studies. Experiments are often carried out in laboratories rather than in the field, and laboratories are not connected to the real world of companies or organisations. The feasibility of this strategy for this type of research is dependent on the nature and type of researcher. As the goal was not to test the relationship between two variables or to use a hypothesis but rather to use open questions to arrive at a conclusion, this research strategy is not suitable for this research. Likewise, surveys are commonly linked with the positivism research philosophy. This strategy's most commonly used method of data collection is a questionnaire (Saunders et al., 2016). Again, this strategy is not suitable for this research, as the researcher did not collect data through questionnaires. In addition, this strategy does not reflect the philosophical stance of the study.

On the other hand, case studies, action research and ethnography research are placed more towards the end of subjectivism of the ontological view and the interpretivism end of the epistemological view, as shown in Figure 4-8. Because this research is characterised by interpretivism and subjectivism, the research approach was based on a choice from ethnography research, action research or case study strategies.

**Ethnography research** is mainly used when studying groups. Researchers join a group and spend a considerable amount of time with the group, usually many years. On many occasions, the researcher visits foreign lands, monitoring occurrences and taking notes. Therefore, it can be viewed as a qualitative research strategy. The aim of this strategy is to investigate a culture or a phenomenon by engaging in listening to and observing people. Subsequently, the researcher would return to write a report on what he/she observed and noted (Bryman & Bell, 2015; Saunders et al., 2016). Although this strategy is qualitative in nature, which is the case for this research, due to the long time period required to produce reliable results and due to the researcher’s limited accessibility to data and participants, it was not feasible to conduct this research using this strategy.

**Action research**, on the other hand, is an ***iterative*** process that aims to solve real organisations’ problems; thus, action research is effective in generating practical outcomes for continuous organisational development. This is done by identifying issues and problems, planning actions, taking actions and then evaluating the actions (Saunders et al., 2016). According to Brannick and Coghlan (2010), action research is ‘research **in** action rather than research **about** action’. Action research consists of several stages. The first stage includes the setting of a problem context, diagnosing the problem, planning an action, taking an action and evaluating the action. The final stage (evaluation) is used as input for the next cycle in the iterative process. Saunders et al. (2016) emphasised that to ensure this strategy works, it requires high collaboration among participants, and he also stated that students who conduct their research in the organisation for which they work use this strategy. Due to the nature of this strategy, which involves several stages that require considerable time before reaching a valid conclusion, this strategy was not feasible for this research. It is also used to influence a particular action in the organisation, which is clearly not the intention of this research.

In terms of a **case study**, according to Yin (2014), a case study can be defined as 'an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident'. Huberman and Miles (2002) asserted that case studies make available the use of both qualitative methods (e.g. interviews and documents) and quantitative methods (e.g. questionnaires) to achieve several aims and objectives. A case study is believed to be useful ***in gaining a rich understanding*** of the context of the research (Morris & Wood, 1991). For this research, a case study has been chosen, and further justification for choosing this strategy is provided in the following section.

Due to the nature of this research study, a case study approach is the most appropriate approach to adopt. During action research, the researcher seeks to solve a problem by being part of the problem environment, which is clearly not the scenario for this type of research. An ethnography approach is suitable for understanding the behaviours of phenomena within an extended period of time, which again is not the scenario for this research. Therefore, a case study is the most appropriate strategy to use for this research. Yin (2014) stated that a case study is a relevant research strategy if the researcher hopes to ***obtain an in-depth and rich understanding of phenomena in a <u>real-world context</u>***. This is clearly the case for this study because the researcher planned to gain an in-depth understanding of the project risk management practices within the oil and gas sector in Libya to develop of a set of recommendations. As explained, in-depth semi-structured interviews were used to achieve this objective. Therefore, a case study strategy was the most appropriate strategy to adopt.

An additional reason a case study was selected for this research is because a case study is not limited to a single source of data; instead, according to Yin (2014), a good case study benefits from having multiple sources of evidence. According to the author, there are six common sources of evidence: direct observation, interviews, archival records, documents, participant observation and physical artefacts. Multiple sources of data add rich quality to the data gathered and lead to reliable conclusions.

## 4.10 Case study design

Yin (2003) identified two case study strategies, namely ***single*** case and ***multiple*** case studies. A single case study can be used to characterise a unique or a critical case. It provides the researcher with an opportunity to observe and analyse a phenomenon that few researchers have examined. According to Yin (2014), a single case study design is acceptable under five circumstances:

- Critical testing of a theory
- Unique or uncommon circumstances
- Revelatory cases
- Typical cases
- Longitudinal cases

Multiple case studies, on the other hand, involve the use of more than one case. This approach is more popular because the findings from one case can be used to check the occurrence of such findings in other cases (Saunders et al., 2016). Yin (2014) suggested that there are four types of case study designs, which lead to a two-by-two matrix (as shown in Figure 4-9); this matrix is based on the choice of single or multiple cases and the choice for the case(s) to be holistic or embedded in subcases. In other words, the case study design can be as follows:

- ❖ Single case (holistic)
- ❖ Single case (embedded)
- ❖ Multi case (holistic)
- ❖ Multi case (embedded)

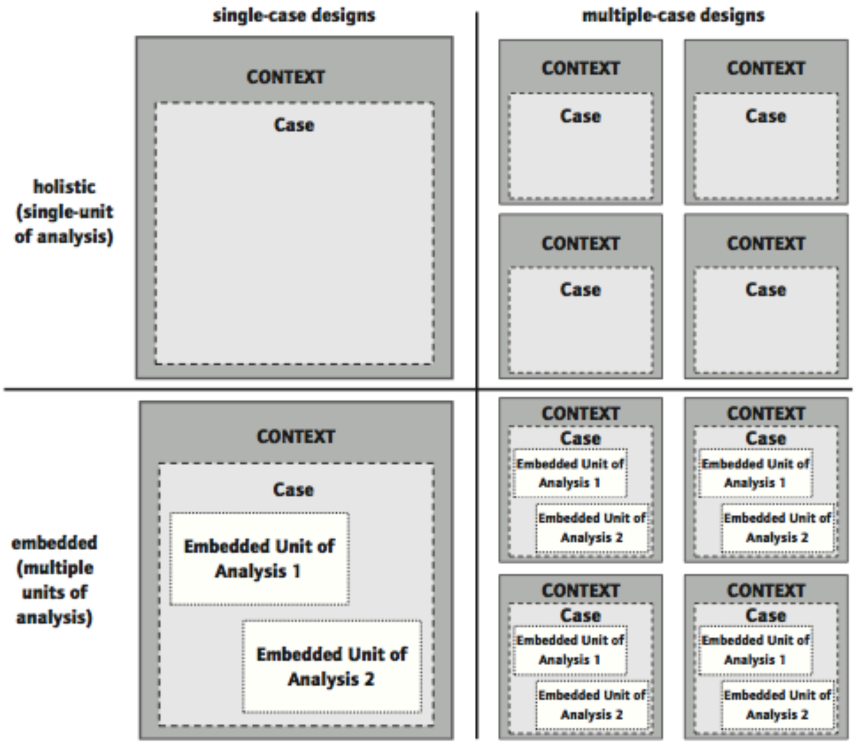



Figure 4-9 Different types of case studies (Yin, 2014).

The terms ‘holistic’ and ‘embedded’ indicate the unit of analysis. The unit of analysis (or the case) defines what the case is; for example, a ‘case’ can be an individual. In other words, the individual is the case being studied, and data related to the individual would be gathered and then analysed. If a study were concerned with several individuals (cases), then it would be part of multiple case studies. Of course, a case is not limited to an individual and can be a single organisation or multiple organisations. The crucial point is that the selection of a suitable unit of analysis is related to the research question(s). If an organisation as ***a whole*** is selected as the unit of analysis (single) and the study is ***only*** concerned with this organisation, then the case study is defined as a ***holistic case study***; however, a single case study can include more than one unit of analysis. For example, if the study of sub-units, e.g. different departments (more than one unit of analysis), within an organisation is required, then the case study would be referred to as an ***embedded case study design***. The same logic applies for a multiple case study design (Saunders et al., 2016; Yin, 2014).

Based on this discussion, a single case study design appears to be suitable for this research. As the aim of this research was to obtain an in-depth understating of the project risk management practices within the oil and gas industry in Libya to develop a set of recommendations, and provided the fact that all oil and gas activities are controlled by the NOC of Libya, a single case study is more appropriate for this research. This is also supported by Yin’s (2014) criteria for classifying a single case study. Section 4.10.2 provides additional details regarding the selection of design for the case under investigation.

### 4.10.1 Unit of analysis

In terms of the unit of analysis, the project risk management practices in the oil and gas industry within the Libyan NOC is the unit on which the analysis is based.

### 4.10.2 Selection of a single case study

When selecting a case, it is important to take the aim of the research into consideration (Yin, 2014). The aim of this research was to enhance the current practices of project risk management within the Libyan oil and gas industry. The oil and gas industry in Libya is controlled by the NOC. The NOC is responsible for all activities of the upstream (exploration and production) and downstream (refineries) aspects of the Libyan oil sector. The NOC has fully owned sub companies or enters into joint ventures with international oil companies. Therefore, the NOC fits Yin’s (2014) definition of being unique and critical.

To this end, for the present research, the NOC was selected as a single case study due to its critical role, as it is responsible for all oil and gas activities within the Libyan context. By doing so, the researcher could attempt to obtain a full understanding of the project risk management practices in the Libyan oil and gas industry.

## 4.11 Time horizon

The fifth layer to consider in the research onion is the time horizon. According to Saunders et al. (2016), the time horizon can be described in two ways: cross-sectional and longitudinal. For cross-sectional research, the researcher investigates a phenomenon at a specific period of time, whereas for longitudinal research, the researcher spends a longer period of time investigating the development and changes of phenomena over time. As this study investigated the practices of project risk management within the Libyan oil and gas industry, and provided that this study is limited in time due to the fact that it is part of a PhD study, a cross-sectional time horizon is more suitable because a specific phenomenon at a particular time was the focus.

## 4.12 Research techniques

Because the research strategy used in this study is based on a case study, the research techniques are in line with a case study research strategy. The research techniques are usually divided into two stages: data collection techniques and data analysis techniques (Keraminiyage, Amaratunga, & Haigh, 2005). These stages are discussed in the following sections.

### 4.12.1 Data collection

As mentioned, for this research, a single case study strategy was selected. According to Yin (2014), there are six sources of data collection techniques in case study approaches: archival records, direct observation, documents, interviews, physical artefacts and participant observation. Yin (2014) also emphasised the importance of using multiple sources of evidence (triangulation) to reduce the number of problems and to increase the quality of case study research. Semi-structured interviews and document reviews formed the basis of the sources used to create the ***data triangulation*** in this research. Similarly, Kumar (2011) classified data into two types: primary and secondary. For this research, to achieve data triangulation, both secondary data and primary data were used to enhance the quality of the findings and the conclusion of this research.

Primary data refer to raw data from the field of study that the researcher collects. For this research, as mentioned, primary data was collected in the form of qualitative methods (namely semi-structured interviews). Heaton (1998) defined secondary data as '*…*the use of existing data, collected for the purposes of a prior study, in order to pursue a research interest which is distinct from that of the original work; this may be a new research question or an alternative perspective on the original question'. Windle (2010) stated that secondary data have various sources, which include reviewed research articles and companies' databases. For this research, a review of journal articles, books, previous theses, related website pages on the topic of project risk management and the NOC's internal policies and documentations formed the basis of the secondary data collection process.

Creating a record of a database by gathering all related evidence assisted in meeting the aim and objectives of this study. Hence, for this research, a combination of a review of documents and semi-structured interviews was used mainly because two sources of evidence can complement each other. For instance, there could be limitations in the interpretation of the reviewed documents; however, this limitation is overcome by combining the evidence gathered from the interview results. An in-depth understanding of the semi-structured qualitative technique was achieved by seeking and exploring the participants' views and opinions of the phenomena of project risk management practices within the Libyan oil and gas industry. This process was further enhanced by reviewing books, journal articles, archival records, websites, legislations and the NOC's policies.

The next subsections provide details regarding the interview design, document selection and the data analysis procedures adopted for this research.

#### 4.12.1.1 Interview design

Primary data was collected through a series of interviews. Wethington and McDarby (2015) and Qu and Dumay (2011) recognised that interviews are one of the most common and important sources of data collection methods in qualitative research. Amaratunga, Baldry, Sarshar, and Newton (2002) also indicated that interviews are considered a commonly used method, especially in the built environment research.

There is a wide acceptance that interviews are classified into three categories: structured, semi-structured or unstructured (Saunders et al., 2016).

For structured interviews, or standardised interviews, researchers develop a prearranged set of questions, similar to questionnaires. Structured interviews restrict the ability of the researcher to receive in-depth information from interviewees. This is common when using a survey strategy, which can be analysed quantitatively later. On the other extreme, for unstructured interviews, or informal interviews, the researcher has no predetermined questions. Thus, the researcher must have a clear understanding of the topic under investigation because the interviewee is given the opportunity to speak freely, informally and openly about any particular topic under investigation. Consequently, the analysis of gathered data is challenging because there is no consistency in the answers received. Conversely, semi-structured interviews are considered the most common type of all qualitative methods due to their flexibility and accessibility. Using this technique, the researcher has more flexibly in collecting primary data because it allows the researcher to prepare a list of predetermined themes and questions to be covered during the interview and allows the researcher to collect in-depth data in a systematic manner. It also allows for follow-up questions to further clarify any ambiguous responses (Kvale & Brinkmann, 2009; Myers, 2013; Qu & Dumay, 2011; Saunders et al., 2016).

Based on this discussion and in consideration of the aim and objectives of this research, semi-structured interviews are the most suitable method for collecting primary data because the researcher could obtain in-depth information regarding the topic of project risk management within the oil and gas industry in Libya. Semi-structured interviews allowed the researcher to obtain valuable, in-depth and consistent information of the actual perspectives, knowledge and experiences of the interviewees. Due to its flexible nature, semi-structured interviews also provide the opportunity to ask follow-up questions while ensuring participants have the opportunity to provide further detailed information when the answers/questions are unclear.

#### 4.12.1.1.1 Sampling of interviewees

The need for sampling is important; thus, researchers should determine the best approach to sampling. On some occasions, the research questions require the collection and analysis of data from all possible cases, which is known as a **census**; however, this can be difficult to achieve for various reasons, such as limited time, access and money. Researchers may also gather unnecessary data that are not related to the research question. Therefore, the researcher must consider **sampling**. In this case, researchers will save time and reduce the amount of data collected, as only reliable data would be gathered by targeting subgroups or specific group members instead of all possible cases. According to Barnett (2002), **sampling** can be more accurate than a **census**, as collecting data from small samples can ensure detailed information is obtained. More importantly, researchers should be aware that when using sampling, the research question must be considered (Saunders et al., 2016).

Based on this discussion as well as the aim and the objectives of this research, the use of **sampling** is appropriate. Because this research study focused on project risk management practices in the oil and gas industry in Libya, it would not be logical to focus on the whole population (cases) of people working in the oil and gas industry. It was more appropriate to use a sampling technique, which targets individuals who are experienced in working with project risk management practices, which consequently addressed the research question.

In general, there are two types of sampling techniques: **probability** (representative) sampling and **non-probability** sampling. Probability sampling is frequently used in survey and experimental research strategy studies, where the sample is chosen arbitrarily from a sampling frame. The samples are selected from the population with an even probability, which is believed to be more time-consuming than non-probability sampling. Probability sampling includes simple random, systematic random, stratified random and cluster (random) methods. On the other hand, non-probability sampling is based on a **subjective** judgement, and it can be used to obtain an in-depth understanding of a phenomenon by focusing on small cases. Non-probability sampling includes quota, purposive (extreme, heterogeneous, homogeneous, critical case, typical case and theoretical case), volunteer (snowball, self-selection) and haphazard sampling. According to Neuman (2005), **purposive** sampling is popular in case study research strategies when the researcher works with small samples. Purposive sampling is often called **judgemental sampling,** as researchers have flexibility and use their personal judgement to identify samples that best answer the research question. In general, the choice of a particular technique depends on the researcher’s access to data, the time required and the ability to answer the research question (Saunders et al., 2016).

Based on this discussion and in consideration of all the factors (including aim and objectives, nature of research and the researcher’s access to data), it was more appropriate to choose **non-probability purposive sampling** for this research. Probability sampling is not suitable, as it is more applicable to a survey research strategy for which a significant number of participants are required. In addition, probability sampling consumes more time, and the researcher was restricted to the typical PhD timeframe. This research examines a single case (NOC of Libya); therefore, there is a specific number of departments within the organisation. To reduce the amount of bias that can occur with a non-probability purposive sampling technique, the department directors were targeted. In addition, to ensure that these samples were representative, the researcher specifically targeted departments that are directly involved with projects in the Libyan oil and gas industry. Moreover, the researcher included project managers and team members from within these departments. To avoid any bias in the identification of the participants, the researcher set clear criteria for the selection of the participants based on their knowledge, experience, involvement in project management practices (especially the project risk-management process), job role and relevance to the study. Hence, judgmental sampling is more suitable. Another reason is that the researcher aimed to select accessible samples to obtain rich data, and this was achievable through already established contacts within the organisation.

When selecting an appropriate interview sample number, researchers must ensure the point of saturation is achieved, which is when no new information is received from the participants and no emerging themes evolve. Saunders et al. (2016)

recommended a minimum sample size for a non-probability sample, as shown in Table 4-1.

Table 4-1 Minimum sample size for non-probability sampling (Adapted from Saunders et al., 2016).

| **Nature of the study** | **Minimum sample size** |
|---|---|
| Semi-structured/in-depth interviews | 5–25 |
| Ethnographic | 35–36 |
| Grounded theory | 20–35 |
| Homogeneous population | 4–12 |
| Heterogeneous population | 12–30 |

Bryman and Bell (2015) claimed that one advantage of semi-structured interviews is that the researcher can decide who to include and who to exclude. Although selecting a sample size is not viewed as critical for qualitative research as it is for quantitative research, determining an adequate sample size for qualitative research can be a challenging task. For example, a small sample might result in collecting poor-quality data (Saunders et al., 2016; Kumar, 2011). Therefore, to acquire a suitable sample size, the researcher should always select a size that fulfils the aim and objectives and constructs a debate for the research. In addition, as mentioned, an appropriate interview sample number is reached when no new information is received from the participants and no emerging themes evolve, which is referred to as saturation (Francis et al., 2010; Kumar, 2011; Saunders et al., 2016; Suter, 2011).

Therefore, with the support of Table 4-1, which provides a minimum sample size for non-probability interview sampling, the researcher also considered the saturation point. Consequently, thirteen semi-structured interviews with department managers, project managers and project teams were conducted to achieve the aim and objectives of the research. The saturation point appeared to occur during the seventh interview; however, to take any bias in the results into account, the researcher continued to conduct additional interviews to reduce the margin of bias error.

#### 4.12.1.1.2 Designing semi-structured interview questions

The semi-structured interview questions were designed to ensure the fulfilment of the aim and objectives of the research. The questions were also designed in a way that ensured the generation of rich and in-depth data from participants. To achieve this, a literature review formed the basis of the question design. The aim of this research was to investigate the current project risk management practices within the oil and gas industry in Libya. Thus, the researcher divided the interview questions into four sections. The interview questions were first written in English and then later translated into Arabic. The English and Arabic versions of the interview questions are available in Appendix A and B, respectively. Classifying the interview questions into sections helped obtain consistent information, which in turn assisted the researcher during the data analysis stage.

The aim of section one of the interview questions was to receive general background information about the participants. Although the answers were not used for analysis purposes, by asking these questions, the participants were carefully targeted according to the predetermined set of selection criteria (see section 4.12.1.1.1), and only those who fit within these criteria were included in the research.

Section two of the interview questions was designed to investigate the current practices of project risk management within the Libyan oil and gas industry; therefore, the questions mainly focused on the following points:

- The awareness and understanding of the term ‘risk’ and project risk management
- A structured written framework for project risk management, or if not available, how project risk management is conducted
- Understanding the type of people involved in the project risk management process

- The availability of training and initiatives to develop project risk management practices
- The nature of the individuals responsible for enforcing project risk management policies and processes

Section three of the interview questions was designed to investigate the current project risk management tools and techniques used in the Libyan oil and gas industry; therefore, the questions mainly focused on the following points:

- The main tools and techniques currently used to evaluate project risks
- Limitations of current tools and techniques in relation to the Libyan context
- Factors that influence the choice of these tools and techniques
- The effectiveness of project risk management practices along with its supportive tools and techniques in achieving/increasing project success

The final section of the interview questions was designed to investigate the current challenges that limit the effectiveness of project risk management within the NOC in Libya; therefore, the questions mainly focused on the following points:

- Identification of factors and challenges that limit the effectiveness of project risk management in the Libyan oil and gas industry
- Particular reference to Libya's current political and security situation compared with the pre unrest era (before 2011) and its influence on achieving an effective project risk management process
- Interviewees' opinions regarding any further suggestions that support the development of effective project risk management in the Libyan oil and gas industry

In addition to the four sections of the semi-structured interviews, follow-up questions were asked during the interview sessions, which allowed the researcher to ask additional questions to clarify and validate any unclear answers.

#### 4.12.1.1.3 Face-to-face vs telephone interviews

Qualitative research interviews can be defined as 'an interview, whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the described phenomena' (Kvale, 1983, p. 174). According to Saunders et al. (2016), in qualitative research, semi-structured interviews can be conducted in different ways, such as face-to-face, telephone and electronic (email, internet messaging, VoIP/web conferencing) interviews; however, face-to-face and telephone interviews are the dominant types of data collection techniques used by researchers for qualitative research (Cachia & Millward, 2011; Opdenakker, 2006).

Both face-to-face and telephone interviews allow researchers to engage with the interviewees to acquire an in-depth understanding of a particular phenomenon (Saunders et al, 2016). Although telephone interviews have received criticism by some scholars in that there is no interaction between the researcher and the interviewee, there is an absence of telephone coverage and there is a lack of visual cues (Shuy, 2002; Trochim, Donnelly, & Arora, 2015), Sturges and Hanrahan (2004) found that there is no major distinction between the two methods. Telephone interviews can provide rich-quality data similar to face-to-face interviews (Trier-Bieniek, 2012). Telephone interviews also offer several advantages, such as increased access to geographically separate participants, reduced costs, more privacy and access to politically sensitive and dangerous locations (Saunders et al., 2016; Sturges & Hanrahan, 2004).

Therefore, because this research was conducted within a Libyan context in which there is currently an unstable political and security situation, telephone semi-structured interviews were the most suitable method. Telephone interviews ensured the researcher's safety while collecting in-depth, rich data, and costs were reduced.

#### 4.12.1.1.4 The pilot study

The aim of the pilot study was to test whether the research methodology was appropriate and whether the questions asked fulfilled the aim of the research. For the pilot test, two semi-structured interviews were conducted for the targeted samples. The two samples selected had significant experience in working in the oil and gas industry, and more specifically as project managers, for more than 15 years. This added to the value and the reliability of the collected results.

The flexibility and the semi-structured nature of the questions allowed for asking further detailed questions when needed. The researcher ensured that the questions were provided to the interviewees well ahead of the pilot study interview, which provided the participants with time to review the questions and to prepare relevant answers.

The researcher benefited from the pilot study in many ways, including gaining increased knowledge of the related field of study from experienced employees, gaining confidence in conducting semi-structured interviews and having the opportunity to check the clarity of the questions and to modify the questions if needed to ensure reliable data was obtained in future interviews (main study).

In addition to the experience gained from the interview pilot study, the researcher was able to further enhance his knowledge and confidence. This was achieved through face-to-face discussions with an experienced project manager who worked in the oil and gas industry in Libya and who recently received a PhD degree in the same industry. This meeting was an informal interview; the researcher's goal was to increase awareness regarding the challenges and issues the Libyan oil and gas industry faces. This meeting was highly useful, as it eliminated many doubts and concerns, especially those related to primary data collection.

#### 4.12.1.1.5 Collecting data from semi-structured interviews (The main study)

All 13 semi-structured interviews were conducted between July and September 2016. All participants were contacted via phone and/or email to arrange for the interviews. The researcher ensured that all interviews were conducted within the specified time frame agreed to by the researcher and the interviewee. The researcher also ensured each participant received the interview guidelines before the scheduled interview.

All participants were given an information sheet as well as a consent form (see Appendix C and D), which provided background information of the research as well as their right to withdraw from the interview at any time without explaining the reason.

All semi-structured interviews were conducted via phone and lasted between 47 minute to 70 minute. The researcher covered all questions provided in the semi-structured interview guideline; however, the sequence of questions differed depending on the flow of the conversation. Follow-up questions were also asked depending on the clarity of the answers received.

After notifying and receiving consent from the interviewees, all interviews were audio recorded. The interviews were conducted in the Arabic language and were later transcribed and translated into English for data analysis purposes.

#### 4.12.1.2 Document review and archival records

As discussed, the main source of evidence for this research was the semi-structured interviews. A document and archival record review is considered an important aspect of qualitative research, especially for case study research, because it increases the quality and reliability of the research. Hence, this method is used for triangulation (Hancock & Algozzine, 2016; Saunders et al., 2016; Yin, 2014). Documents used in qualitative research are also important, as they are easy to access and provide information that might agree/disagree with the interview findings. Documents include letters, formal studies and evaluations (associated with the case under study), written reports of events and news clippings. Archival records include organisational records, public use files and service records (Yin, 2014).

Documentations and archival records are one of the six sources of evidence for case study research, as suggested by Yin (2014). For this research, the review of existing documents and archival records triangulated the findings of the semi-structured interviews. In fact, the most vital use of documents and archival records in a case study is to corroborate and enhance evidence from other sources of evidence (semi-structured interviews in the case of this research) (Yin, 2014).

Therefore, in the context of this research, the researcher ensured the selection and identification of documents and archival records that best fulfilled the aim and objectives of the research (Hancock & Algozzine, 2016). Therefore, documents and archival records were chosen based on genuine origin, meaning, clarity and credibility. Documents and archival records such as NOC's internal reports, NOC's rules and regulations, statistics, governmental reports and laws were reviewed to support the results from the semi-structured interviews.

### 4.12.2 Data analysis

While section 4.12.1 provides a detailed explanation of the data collection techniques used for this research, the aim of this section is to provide a detailed justification for the qualitative data analysis method used. A qualitative data analysis can be defined as the 'process of bringing order, structure and meaning to the mass of collected data' (Marshall & Rossman, 2014). It can also be defined as the series of procedures in which the researcher, after collecting data, attempts to describe, understand, explain and interpret a situation or a social phenomenon under investigation (Sekaran & Bougie, 2010). A much broader definition of a data analysis is 'searching for patterns in data' (Neuman, 1997). The importance of the interactive nature of qualitative data collection (discussed in 4.12.1) and the data analysis process should also be noted because this iterative process allows the researcher to identify important themes as data is collected (Cassell & Symon, 2004; Saunders et al., 2016). Without an analysis, qualitative data would simply be a mass of text data.

According to Yin (2014), analysing case study data is the most difficult step in case study research. Houghton, Casey, Shaw, and Murphy (2013) argued that there are no systematic rules in analysing qualitative data. Instead, the goal should be to thoroughly and inventively classify data, identify patterns and draw out themes from the collected data (Burnard, 1996). There are different types of qualitative data analyses, which include but are not limited to thematic analysis, template analysis, explanation building and testing (including analytic induction, deductive explanation building and pattern matching), the grounded theory method, discourse analysis, narrative analysis and content analysis (Saunders et al., 2016). Regardless of which method is used, they all share the same goal in that they reduce the amount of text collected and classify and categorise data in a way that provides a more understandable meaning (Bengtsson, 2016). Nevertheless, although there are a number of methods and techniques used for a qualitative data analysis, there is no definite method for analysing data in case study research. Instead, researchers can choose from an extensive range of methods that answer the research question(s) (Petty, Thomson, & Stew, 2012; Yin, 2014).

Accordingly, due to the flexibility of a case study, for this research, a content analysis was chosen as a method for data analysis. A Computer Assisted Qualitative Data Analysis Software (CAQDAS), namely NVivo, was used to provide excessive data management support as well as to aid in the process of data analysis and presentation.

#### 4.12.2.1 Content analysis

A content analysis is a common method used in analysing qualitative data. It can be defined as ‘a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use’ (Krippendorff, 2012, p. 24). One benefit of a content analysis is that it has no definite rules to follow. Instead, it can be utilised for all types of texts (Berg, 2004; Downe-Wamboldt, 1992). Therefore, it is a flexible approach in which a procedure that will ultimately fulfil the aim and objectives of the research can be chosen. In all qualitative data analysis processes, the ultimate aim is to categorise and extract meaning from the text to draw a convincing deduction (Polit & Beck, 2006). Hence, a content analysis is viewed as a systematic coding and categorising process utilised to investigate large amounts of textual data to identify patterns and themes of words and their relationships (Grbich, 2013).

According to Kulatunga, Amaratunga, and Haigh (2007), a content analysis can be classified into four major approaches. The first is a word count analysis (textual analysis, word-based analysis and quantitative content analysis), and this approach involves counting the word frequency. The words that are repeated most indicate the importance of the term. The second is a conceptual content analysis (thematic analysis). In contrast to a word count analysis, this approach identifies the presence and regularity of a concept or a theme (implicitly and explicitly) in texts. Hence, this approach is used to identify similar perceptions under an equivalent concept. The third is the relational analysis (semantic analysis). Like the conceptual content analysis, this approach identifies similar concepts and attempts to identify a relationship between them. The fourth is the referential analysis. This approach focuses on the fundamental meaning of data; hence, it is based on the subjective judgment of the researcher.

For this research, a conceptual content analysis was selected, as it is a widely used data analysis method in qualitative research because it allows the researcher to systemically classify and categorise a large amount of data into meaningful inferences. Both semi-structured interview and documents text data were analysed using the conceptual content analysis approach.

**4.12.2.1.1 Coding of semi-structured interview data**

For a qualitative analysis, codes can be referred to as names, tags or labels; thus, coding can be defined as 'the process of putting tags, names or labels against pieces of the data. These pieces may be individual words, or small or large chunks of the data' (Punch, 2009, p. 176). Coding is an important process in a content data analysis. Ryan, Bernard, Denzin, and Lincoln (2000) referred to it as the 'heart and soul' of a text analysis.

According to Punch (2009), coding is the first activity of a qualitative data analysis and serves as the basis for what follows. The process of using codes and classifying data makes a content analysis an expressive and rich method (Stemler, 2001); however, determining what needs to be coded and developing a name for different categories or themes can be a challenging task (Krippendorff, 2012). Nevertheless, according to Kulatunga et al. (2007), researchers can rely on literature reviews or their own experience to support them in this task. Researchers should also ensure that codes or themes are identified that will eventually meet the requirements of the research (Kulatunga et al., 2007).

Before the coding process begins, researchers should be familiar with their own transcribed interview data. During this phase, researchers read the data several times to become familiar with the text (Bengtsson, 2016). In general, according to Elo and Kyngäs (2008), a content data analysis process follows three broad phases: preparing, organising and reporting. Figure 4-10 depicts the three phases of the content analysis process. During the preparation phase, as discussed, researchers become familiar with their own transcribed interviews as well as identify the unit of analysis on which coding will be based. During the organising phase, the approach the researcher chooses (inductive or deductive) for the coding process will influence the conclusion. Finally, during the reporting phase, the researcher describes the contents of the themes and categories.

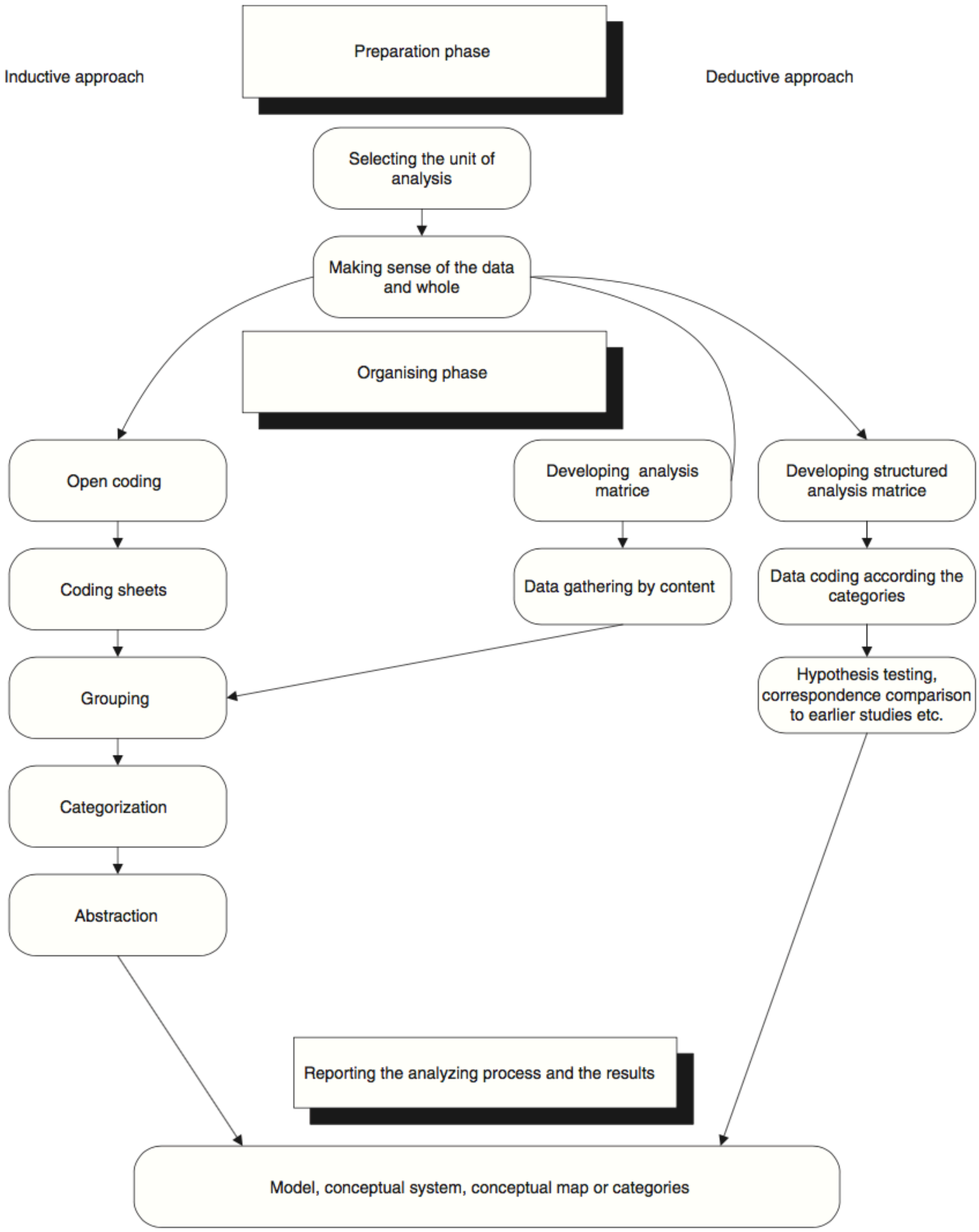



Figure 4-10 Content data analysis process (Elo & Kyngäs, 2008).

As mentioned, coding is the most challenging and important part of a content data analysis. There are two main approaches for coding data in a content analysis: inductive and deductive coding (Elo & Kyngäs, 2008; Kulatunga, 2007). Depending on the aim and objectives of the research, researchers choose the most suitable method (Bengtsson, 2016; Marshall & Rossman, 2014).

**Inductive coding**

For inductive coding, the researcher allows codes, themes and categories to develop from the text itself (Kulatunga et al., 2007). Therefore, the generated codes can change and emerge as more data become present and as the research progresses (Bengtsson, 2016). According to Elo and Kyngäs (2008), the process of inductive coding includes open coding, coding sheets, grouping, categorising and abstracting (producing categories to formulate an overall description of the research topic under study).

**Deductive coding**

In contrast to inductive coding, where the text speaks for itself, for deductive coding, the process begins before the researcher engages with text data (Bengtsson, 2016). In this case, researchers establish a preliminary list of categories and codes to connect them with the raw text (Bengtsson, 2016; Kulatunga, 2007). Although this approach is considered a well-organised data analysis approach that benefits from pre-planned and founded codes and categories, it can mistreat any concepts or themes that do not necessarily fall under the pre-determined themes (Kulatunga et al., 2007). This approach is mainly based on literature reviews, theories or models (Hsieh & Shannon, 2005).

Nevertheless, Miles and Huberman (1994) argued that for some research studies, a coding approach that is a combination of the two broadly classified approaches could be more suitable. Therefore, a number of codes and themes can emerge from the text as the analysis process progresses, while researchers can use their own pre-identified themes and codes that were developed from the literature.

For this research, as a content analysis was selected to analyse the semi-structured interviews, all audio-recorded interviews were listened to repetitively to become familiar with the data. While there is no clearly structured procedure for a data analysis in a content analysis, the importance of coding was acknowledged. For this research, both inductive and deductive approaches were used to arrive at a valid conclusion. The researcher used the abovementioned approach suggested by Miles and Huberman by establishing pre-determined selected codes and themes, which were derived from the literature, while also allowing new themes to emerge from the data. All coding and text analysis processes were developed with the support of CAQDAS, namely NVivo software. The next section discusses the use of this software during the data analysis process.

#### 4.12.2.1.2 Use of computer aided software (NVivo) for the semi-structured interview data analysis

There are number of CAQDAS (e.g. ATLAS.ti, NVivo, HyperRESEARCH) available to support and facilitate the qualitative analysis process, and these software programmes can help researchers perform coding and word counting, build themes and link terms to networks (Bernard, 2013; Saunders et al., 2016). Although these software programmes can vary slightly, they share common features in facilitating the qualitative data analysis (Saunders et al., 2016). In general, CAQDAS can assist researchers in structuring work, exploring data, coding and retrieving, organising data, writing notes, memos and comments and producing graphical representations, reports and charts (Saunders et al., 2016).

Accordingly, the researcher chose a software programme that was accessible as well as familiar (Saunders et al., 2016). NVivo 11 software was chosen to assist in the management of data in terms of coding, categorising and producing data visualisations, all of which supported the implementation of the content analysis. One reason for this choice is that the researcher already had knowledge and skills related to this programme due to training. In addition to the fact that the NVivo manages numerous interview transcripts, it is easy to understand and simple to use during the data analysis process (AlYahmady & Alabri, 2013). Another reason for choosing NVivo 11 for this research is that the large amount of text data was relatively difficult to manage and analyse manually. Hence, the software allowed for performing a complete data analysis process for coding and retrieving, categorising and presenting data.

During the data analysis process using NVivo software, all transcribed semi-structured interviews were uploaded. The first step after uploading was to read through the documents several times to become familiar with the data. Following this step, the coding process began to categorise data into meaningful themes related to a particular concept. As mentioned in section 4.12.2.1.1, coding is the most important and critical part of a qualitative data analysis. Therefore, a combination of inductive and deductive coding was used. When a concept was identified, a code(s) was assigned. Hence, for theme/sub-theme formation, the researcher utilised pre-established categories (deductive coding) based on the literature review (that reflects the objectives of the research) as well as allowed for the emergence of new themes from the interview transcripts (inductive coding). When using NVivo, a theme is referred to as a 'Node', while a sub-theme is known as a 'Sub-node' (see figure 4-11). The process of creating nodes and sub-nodes depends on the understanding and interpretation of the researcher.

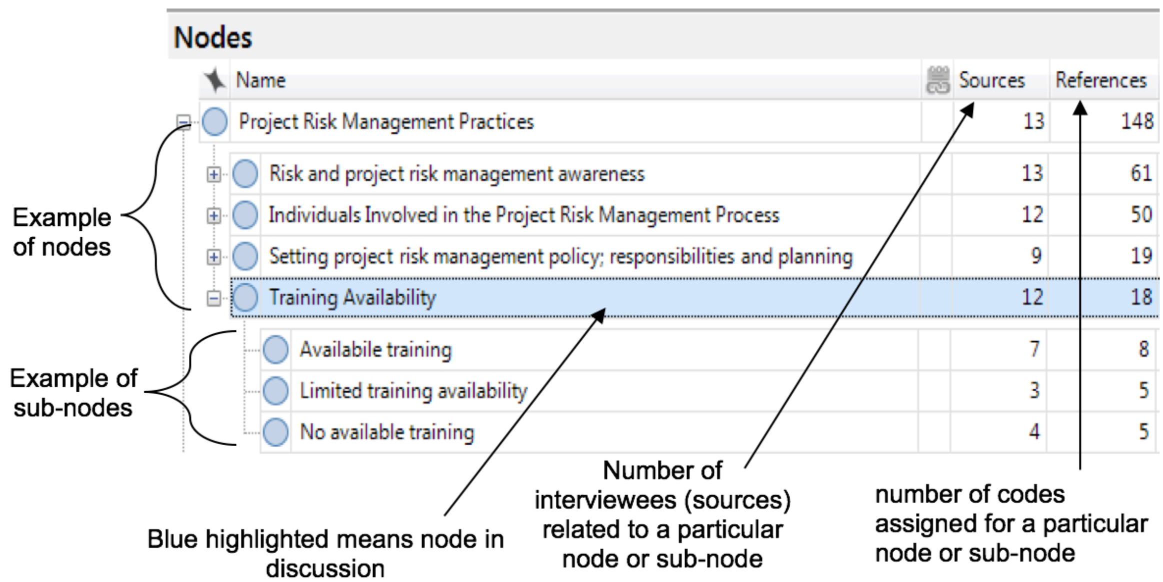



Figure 4-11 Example of data presentation using Nvivo 11

Accordingly, the identification and assignment of codes to a node(s) and/or sub-node(s) depends on the relevance of code(s) to the concept covered by the node(s)/sub-node(s). This process was replicated for all semi-structured interview transcripts until no new node(s)/sub-node(s) were developed. All nodes and sub-nodes were created to fulfil the aim and objectives of the study.

Following the establishment of the final nodes and sub-nodes, all nodes were exported along with their assigned codes to Microsoft Word software. This assisted in the presentation of the results, which are discussed in detail in Chapter 5.

## 4.13 Validation of the recommendations

The final objective of the research was to provide a set of recommendations to enhance the project risk management process in the Libyan oil and gas industry. After the development of the set of recommendations, a verification and validation task was carried out using these recommendations. The aim of this exercise was to check the clarity of the proposed recommendations, the challenges in the implementation of these recommendations and the likelihood of these recommendations to be implemented in practice and to provide suggestions for how these recommendations could be improved. To achieve this, the researcher conducted another set of interviews with selected participants who worked in the NOC of Libya. These interviewees included the board of director advisor and two project managers. Details of the outcomes and the validation process are further discussed in Chapter 6.

## 4.14 Validity and reliability

The ultimate goal of any research study is to obtain high-quality, trusted, valid and reliable results (Yilmaz, 2013). Therefore, researchers should ensure that the adopted research methodology meets the defined standards and criteria. Common criteria used to achieve these standards in research methodology are validity and reliability. Yilmaz (2013) and Denscombe (2014) described the term ‘validity’ as the appropriateness and accuracy of collected data. Yilmaz (2013) defined reliability as ‘consistency or the degree to which a research instrument measures a given variable consistently every time it is used under the same condition'. A qualitative case study was used as a research strategy for this study; however, qualitative research is usually criticised as being biased, as it is affected by the researcher's perspective. Golafshani (2003) claimed that the aim of validity and reliability is to abolish any biased results in qualitative research. Validity and reliability are also central to achieving rigidity in case study research (Thomas & Magilvy, 2011; Yin, 2014).

Accordingly, as a case study strategy was used for this research, to maximise the quality of the research, Yin (2014) suggested four tests for validity and reliability that are commonly used in social research regardless of the data collection technique. The tests include:

- Construct validity
- Internal validity
- External validity
- Reliability

### 4.14.1 Construct validity

Construct validity is referred to as the establishment of the correct operational measures for the research topic under study (Yin, 2014). Miles and Huberman (1994) stated that this type of validation is largely based on testing proper instruments during the data collection phase. This ensures that the most accurate and rich information is collected after a rigorous review of previous documents, an academic literature review and the conducted interviews; however, accuracy can be achieved through a focused use of different techniques/tactics, which include referring to multiple sources of evidence and establishing a chain of selections. The establishment of a rich chain can help immensely in producing a complete draft of evidence for further validity evaluations. For this research, construct validity was achieved through the triangulation of research techniques using different sources of evidence, as explained in section 4.12.1 and section 4.12.1.2.

### 4.14.2 Internal validity

This criterion refers to the appropriateness of the data analysis techniques utilised to analyse the collected data. It is therefore important that the theoretical propositions are linked with the data accurately in addition to the appropriate application of the analytical strategies. For this research, to increase the internal validity, a careful and comprehensive review of the literature related to the topic of choosing a research design to enable the selection of an accurate data analysis technique was conducted, and the analysis steps were followed precisely. In addition, by fulfilling all research objectives, internal validity was achieved.

### 4.14.3 External validity

External validity refers to the degree to which the research findings can be generalised or stratified in other research studies. For qualitative research, the generalisation of results is less applicable, as generalisation can only occur for theoretical propositions. The findings of this research can be generalised or transferred to a context similar to the Libyan context. Therefore, as this research involves the study of project risk management within the Libyan oil and gas industry, the findings of this study could be generalised to other countries within the same industry which are prone to the same political and security unrest situations.

### 4.14.4 Reliability

Reliability means that the process (such as data collection procedures) of the study can be repeated to obtain the same results (Yin, 2014). For this research, reliability was achieved by selecting and following an appropriate research methodology model to ensure that the aim and objectives were fulfilled. In addition, to further ensure reliability, all participants were provided with an overview of the research background to ensure all questions were understood in the same way. Conducting a pilot study using the interview questions (see section 4.12.1.1.4) before the main study was conducted also increased the reliability of this research.

## 4.15 Summary

This chapter has discussed and justified the research methodology adopted. For this research, the research onion model was followed; therefore, a detailed account of the research philosophy, approaches, strategies and data collection and analysis techniques that were selected to address the research problem of this study has been provided. The next chapter presents the analysis of the semi-structured interviews and describes the review of related documents.

# Chapter 5 Data Analysis and Research Findings

## 5.1 Introduction

Chapter 4 discussed the methodology adopted for this research study. The aim of this chapter is to present the findings of the analysis of the case study data, according to the following sequence:

- provide background information about the case study;
- present findings and analysis of data from the semi-structured interviews and documents related to the case study.

Data collection was guided by the objectives of the study: to investigate the awareness of risk and project risk management; to examine the current practices in the domain of project risk management; to evaluate the challenges influencing project risk management practices within the Libyan oil and gas industry, and to present suggestions proposed by those interviewed for developing effective project risk management processes.

Different sources of evidence were combined to achieve the objectives of the study. The main source of data consisted of semi-structured interviews, enhanced by a review of published and archival documents, such as official reports, newsletters, memos, minutes of meetings and statistics; data from the latter sources were used to triangulate the analysis and findings of the semi-structured interviews.

Interviews were conducted with thirteen leading experts involved in management and heads of departments of the NOC of Libya (Table 5-1). For ethical reasons, each participant was assigned a code that did not explicitly specify his/her department. However, the participants in this study largely came from departments that are directly involved in the management of oil and gas projects in Libya, including the exploration department, the production department, the projects and maintenance department and the health, safety and environment department.

Table 5-1 Codes and current position of each interview subject

| No | Participants | | Position |
|---|---|---|---|
| 1 | | EXP1 | Department director |
| 2 | | EXP2 | Department director |
| 3 | | EXP3 | General manager of operation, maintenance and refinery |
| 4 | | EXP4 | Project manager |
| 5 | | EXP5 | Board advisor and chairman, Gas development committee, NOC |
| 6 | | EXP6 | Department director |
| 7 | | EXP7 | Senior project manager (projects and maintenance department - team member) |
| 8 | | EXP8 | Senior mechanical engineer (project team member) |
| 9 | | EXP9 | Department director |
| 10 | | EXP10 | Senior project manager |
| 11 | | EXP11 | Department director |
| 12 | | EXP12 | Project team member (engineer) |
| 13 | | EXP13 | Project engineer |

The data from the interviews have been analysed using NVivo software (version 11.4 for Windows). NVivo is one of the most common programs used to analyse qualitative data. As discussed in section 4.12.2.1.2, the advantages of this software include searching for combinations of words in the text; importing and coding written data and information, editing the text without affecting the coding and separating data into sub subsections, which provide a simpler structure for reviewing emergent themes and offers more security for backup and retrieval.

The following sections will provide a background for the case study and present the findings from the primary data collected (semi-structured interviews and documents).

### 5.1.1 Case study background

The NOC of Libya is a state-owned company that controls Libya's oil and gas production and exploration (Noc.ly, 2017a). The NOC was established under law No. 24/1970; the General Libyan Petroleum Corporation was replaced, to enable Libya to face massive and rapid development in the oil and gas industry with greater flexibility (Noc.ly, 2017a) and to enable Libya to remain more up to date with changes in the international gas and oil industry. The General Secretariat (of the General People's Congress No. 10/1979 741) made the decision to reorganise the NOC to ensure that it could fulfil developmental goals in the oil and gas sector (Falola, Morgan, & Oyeniyi, 2012).

This reorganisation helped support the Libyan economy through the extension, restructuring and re-capitalisation of oil wealth throughout Libya, through a collaboration between its full-owned companies and partnerships. Some of these companies are engaged in production operations, while others conduct refining, processing and domestic or international marketing. The NOC also performs other activities in partnership with foreign exploration, production and specialised oil service companies. The NOC exercises numerous key roles in Libya apart from those named above: for example, it helps to train employees in technical fields, preparing comprehensive annual plans to achieve its training objectives. It is also responsible for long-term planning, to ensure that there is adequate financing for Libya's oil and gas sector as a whole (Noc.ly, 2017a). The NOC consists of fifteen main departments and twenty-seven sub-departments; Figure 5-1 below shows the organisational structure of the NOC.

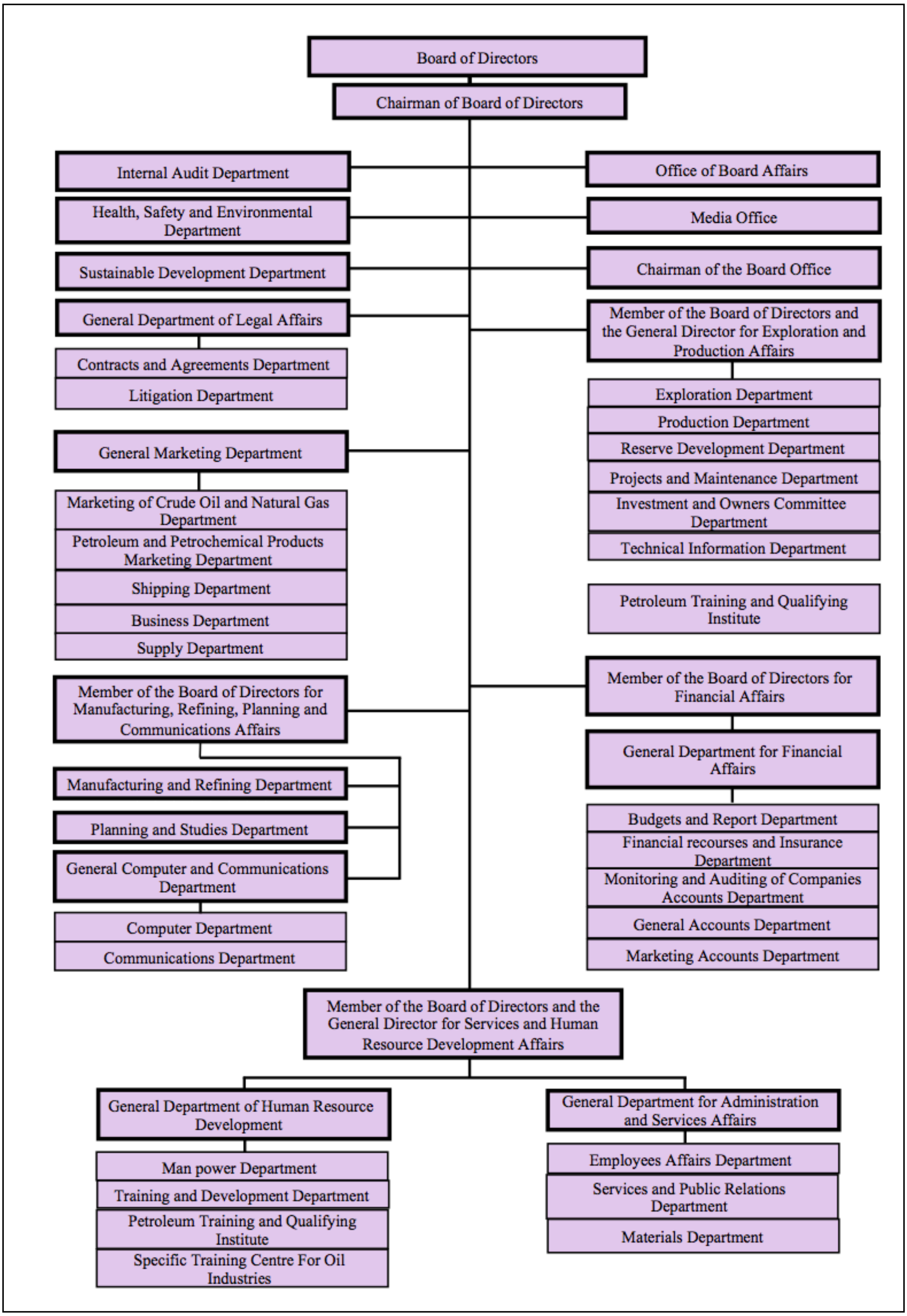



Figure 5-1 The organisational structure of the NOC.

The above section provided background information about the case study; the following sections of this chapter will focus on the presentation of its main findings based on analysis of the semi-structured interviews and relevant documents. These findings are presented in five main sections:

- Project risk management practices
- Project risk management tools and techniques
- Challenges
- Developing effective project risk management processes
- Review of documents

Detailed discussion of each of these findings will be provided in the following sections of this chapter.

## 5.2 Project Risk Management Practices

The aim of this section is to discuss the level of awareness and understanding shown by interview subjects on the topics of ‘risk’ and ‘project risk management’ as well as the current project risk management practices, fulfilling the second and third objective of this research study. A set of questions was asked (see Appendix A and B) to evaluate levels of literacy about risk and project risk management within the Libyan oil and gas industry, as well as to examine its current practices. The following subsections provide the participants’ responses in relation to these issues; figure 5-2 maps the main themes of this section as generated by NVivo.

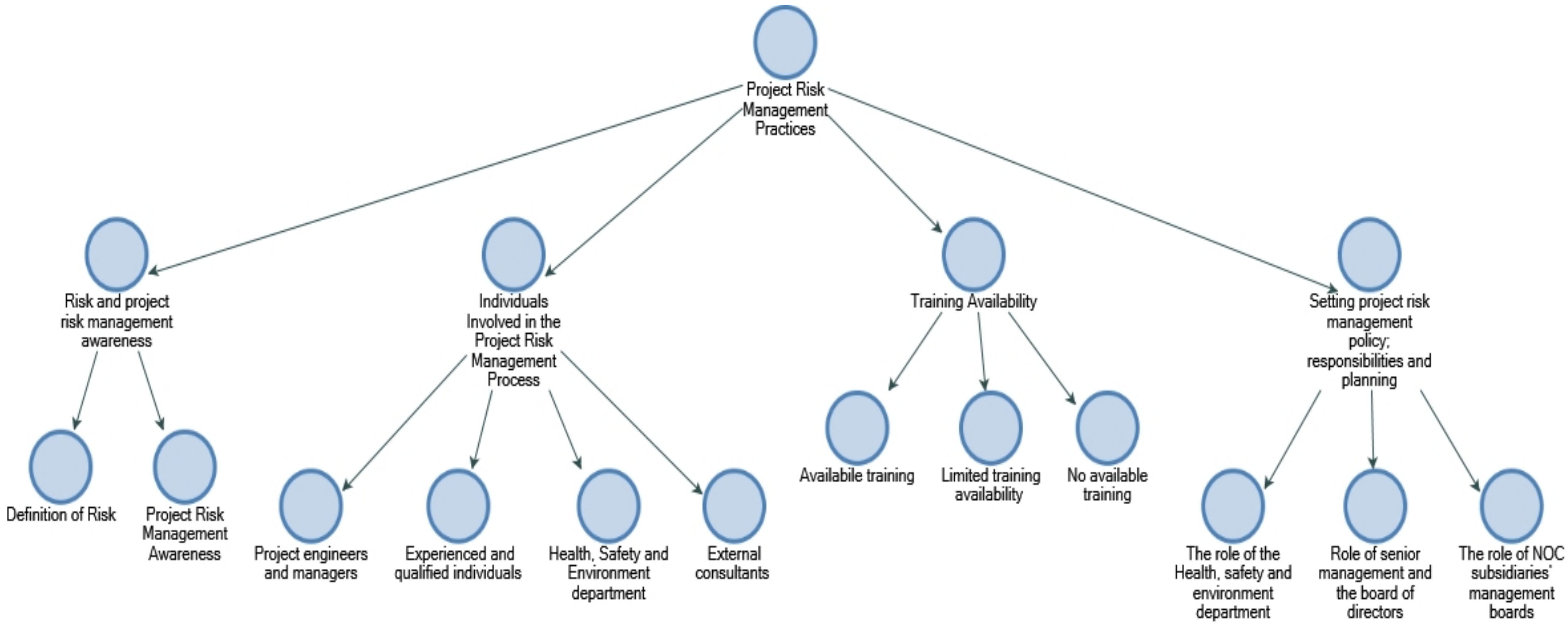



Figure 5-2 Main themes concerning risk management practices.

### 5.2.1 Risk and project risk management awareness

#### 5.2.1.1 Definition of risk

In line with the second objective of this research study, the question posed to informants was open-ended: 'What do you understand by the term risk?'. The term 'risk' has been viewed by participants in different ways.

The aim of this question was to capture the undersetting and awareness of the concept of 'risk'; those interviewed showed differing interpretations of the concept of risk within the Libyan oil and gas industry. Their responses were categorised according to nodes uncovered using NVivo software, reflecting the following definitions: risk as a threat or negative impact, risk as uncertainty, risk as obstacle, and risk as an effect on the system. The outcome of this NVivo analysis is summarised in Figure 5-3.

| | | |
|---|---|---|
| Project Risk Management Practices | 13 | 148 |
| Risk and project risk management awareness | 13 | 61 |
| Definition of Risk | 11 | 18 |
| Risk as an uncertainty | 2 | 3 |
| Risk as a threat or negative impact | 6 | 6 |
| Risk as an obstacle | 3 | 3 |
| Risk as an effect on the system | 4 | 6 |

Figure 5-3 Definitions of risk

##### 5.2.1.1.1 Risk as a threat or negative impact

Risk can be viewed as a threat or an opportunity; however, according to EXP4, people within the Libyan oil and gas industry see risk solely as a threat: *'Risk is defined as threats and opportunities, however in our department we do not look at the risks as opportunities but rather we view them as threats that could jeopardise the project, as they might cause a delay or could hinder the project'*. EXP10 also shared the attitude that risk is solely seen as a potential negative impact, declaring that *'The word "risk" always has a negative effect and we do not consider it as an* *opportunity'*. In this case the term risk is not seen as an opportunity within the Libyan oil and gas industry.

Further, some participants emphasised that risks were defined in terms of their possible negative effects. For example, EXP9 clearly states that: *'Risks are the probability of an event happening and the negative or undesired consequences of that event, which will lead to losses in either the project's infrastructure, investments, programmes or other losses in the related activities that the NOC conducts'*. Along the same lines, another interviewee declared that they focus on projects that are related to increased production, ensuring that they do not have any risks in their projects, and guaranteeing that these projects have allocated enough financial support for their completion (interviewee EXP11). Interview subjects EXP6 and EXP8 share the same opinion about the concept of risk, defining it in terms of threats that could delay a project; in this context, EXP8 gave a clear definition of the term: *"Risks are all the negative things that could happen".*

To this end, according to the above, risk can be seen as a threat or the negative impact (rather than an opportunity) on the project, in that if it happened it would have an undesirable effect on the project.

#### 5.2.1.1.2 Risk as uncertainty

An additional definition was mentioned by two of the interview subjects (EXP7 and EXP10), who interpreted risk as an uncertain event or a situation. EXP7 talked about his long experience in the Libyan oil and gas industry and provided some details, explanations and examples from this perspective:

> *Risk is something caused by uncertain events … we always try to avoid the uncertainty of a situation with certain situations. For example, in any project, you have to have some predictable scenarios in order to get good project performance … If you are faced with any risks, this will cause an uncertainty in the project, the life of the project will be extended, the cost will increase and, in turn, this might affect the time, cost and quality, which will eventually lead to the failure of the project.*

EXP10 expressed a similar understanding of the term, defining it as *'known unknowns or uncertainties'*. Hence, the term risk can be seen an uncertain future events that if happened will have an effect on the project whatever this effect was positive or negative

#### 5.2.1.1.3 Risk as an obstacle

In this context, three participants stated that risk represents potential obstruction to a project. This was clear in the response of EXP2, who mentioned that *'risk is any obstructions or potential obstructions that limit the achieving of operational targets in a secure and safe manner'*. EXP2 further emphasised that this obstruction is understood in terms of its effect on oil or gas production rates: '*in terms of the definition of risk, it is defined as the cessation or reduction of oil and gas production as a result of the security situation or caused by financial and technical circumstances within production units in the field'.* Meanwhile, EXP8 also viewed risk as an obstacle that has an impact on the project, indicating that: *'… risks as all obstacles and negatives that prevent the project from achieving its predetermined objectives'.*

Along the same lines, EXP13 expressed the same opinion as EXP8, providing an example and advice of how to assess different types of risk from the beginning of the project. EXP13 pointed out that *'Risks consist of any obstacles that can affect the schedule or the cost of a project'.* The participant further provided an example of such obstacle, stating that: '… *currency exchange rates represent types of risk: a project might have started with a certain budget, but at any given time the costs might increase as a result of exchange rates.',* therefore, EXP13 indicated that: '*… it is very important to assess these types of risk or obstacle from the beginning of a project, as this will allow you to have a sense of where the project is heading and hence to avoid any cost overruns.'*. This emphasises on the importance of early risk assessment could help to overcome such obstacles.

Hence, it can be seen that such risk obstructions limit projects from achieving their predetermined objectives. These obstructions can vary from financial, security, to financial. Therefore, in many times they can result in unfavourable project outcomes. Thus, it is important to take them into consideration early in the project.

#### 5.2.1.1.4 Risk as an effect on the system

Some interviewees stated that risks can be identified through their potential effects on the system. For example, interviewee EXP3 insisted on a unitary definition of risk: *'anything that has an effect on the system that eventually will lead to harm, whether this harm is financial or moral for the employees'.* He adds that *'in terms of projects … this will affect the total cost, which with time might create additional risk'.*

In the same manner, EXP12 expressed a similar view, stating that *'Based on my understanding, risk is anything that can go wrong that will affect the production or the operation of a system.'* Furthermore, EXP3 stated that they take risk factors into consideration from the beginning, to make sure they do not affect the execution phase of the project and system as a whole: *'we are trying to operate our systems with minimal losses. In the execution phase of the project, we consider risk factors from the beginning, from engineering, to the supply department (import risks, material transport risks) …'* EXP3 further stress on the importance of safe operation in that: '… *we also have a safety policy applied to our cranes and other equipment, and they must be certified from an approved company'.* Therefore, based on the interviewees answers it can be argued that whatever the system the participants they refer to, they indicated that risk can effect it in unwelcomed way and can lead to problems, also mitigations plans are important to reduce the undesirable effect of these risks.

The above section has shown the interview participants' varying perceptions of the term risk; the next subsection will present findings regarding project risk management awareness and practices within the Libyan oil and gas industry.

### 5.2.1.2 Project risk management awareness and practices

The aim of this subsection is to capture the participants' awareness of the concept and practices of project risk management. Those interviewed were asked about the availability of a structured framework to conduct the risk management process within the Libyan oil and gas industry, and were also asked how they conduct this process if a structured framework was not available. By asking these questions, the researcher aimed to fulfil the second and third objectives of this research study. Most of those interviewed reported that there are no structured official project risk management procedures, but also claim that a process is applied to some extent. Their responses were categorised according to nodes as analysed in NVivo; the nodes include the following: no clear definition or systematic project risk management approach, implicit project risk management and contract strategy (risk transfer). The outcome of this analysis is summarised in Figure 5-4.

| | | |
|---|---|---|
| Project Risk Management Practices | 13 | 147 |
| Risk and project risk management awareness | 13 | 61 |
| Definition of Risk | 11 | 18 |
| Project Risk Management Awareness | 12 | 43 |
| No clear definition or systematic project risk management approach | 7 | 12 |
| Implicit project risk management | 10 | 18 |
| Contract strategy (Risk transfer) | 5 | 13 |

Figure 5-4 Project risk management awareness.

#### 5.2.1.2.1 No clear definition or systematic project risk management approach

When asked about the availability of a structured project risk management framework, the majority of participants (EXP1, EXP5, EXP6, EXP9, EXP10, EXP11 and EXP12) declared that they did not know about project risk management or that definitions or frameworks were not available. For instance, EXP1 was not optimistic about the overall situation of Libyan companies in this respect: *'First of all, I do not want you to get the impression that we have a systematic approach for management in general; we apply all of these on "as it goes" basis, but as an approach or a system for project management, or project risk management in particular, it is not available.'*. EXP10, EXP11 and EXP12 shared similar perceptions on this matter and stated: *'we do not have a model or a structured framework for project risk management that we can refer back to'* (EXP11). EXP1 further emphasised the concept of risk is not well understood even among top managers, declaring:

> *in 2010 I was working on one of our projects … I approached the department manager as we were preparing a plan for the type of equipment we wanted to*

> *purchase … I included a statement/section on risk … at that time I did not even know what was meant by the term "risk management" … I still remember when the department manager commented on my risk section as he said: what is this risk? … what I mean is that even the concept was not available … to this day, this has not changed*.

EXP1 added that even among engineers working within the industry, the concept is not clear: *'if I approach any of our engineers and ask them to provide a definition of risk or how risk is managed, they would not provide an answer; frankly it is not available'*. In the same context, EXP5 agreed with EXP1 and confirmed this interpretation: *'[I]n terms of project risk management as an approach or as a tool for management, believe me, nobody is using it nor are they talking about it!'.* One reason for this could be rooted to the Libyan culture as EXP5 indicated: *'We are not using the science of risk management as part of management of our projects. We are not using it at all; even our culture does not support this.'* While the participant did not specify on the meaning of culture in this context (national/organisational), one would argue that both definitions could play an important factor to the reasons why the Libyan oil and gas sector lacks the effective usage of the science of project risk management.

Moreover, although EXP9 provided a definition of risk (see section 5.2.1.1.1), this interview subject claimed that there is no clear process or systematic approach to project risk management within the Libyan oil and gas industry: *"we do not have project risk management in the NOC"*. EXP1 further confirmed this perspectives, stating: *'…no templates or forms for risk management are available…'*. In addition, EXP5 reflected on his experience, providing a real example: '*… we have 13 companies in the industry that propose 800 projects per year; the smallest project costs 100 million dollars. I have never seen a section about risk management in these projects, ever, and I am very familiar with the process…'.* Other respondents (EXP6, EXP9 and EXP10) shared a similar view, and were not optimistic about risk management planning within the NOC. EXP6 frankly pointed out this fact, stating: *'No, we do not have a plan for risk management'.* EXP10 mentioned that there was no plan for project risk management, and also pointed out the lack of knowledge of the concept of project risk management, even at top levels of management, saying*: 'I do not think that our top management understand the concept of project risk management; they lack knowledge in the field. All positions are based on personal loyalties and not competence'.* Therefore, it is clear that there is no clear written systematic approach for project risk management within the NOC, one reason for this could be due to the national culture as stated above.

However, although there is no written approach, and the practices of project risk management are not explicitly applied, according to the findings from the interviews, there are some evidences to suggest that these practices are implicitly applied. These will be shown in the next subsection.

**5.2.1.2.2 Implicit project risk management**

While it was clear from the findings above (5.2.1.2.1) no systematic approach towards, nor indeed any clear definition of, project risk management is followed within the Libyan oil and gas industry, some of those interviewed did indicate that while project risk management practices are not explicitly applied in the industry, or are confined narrowly to health, safety and environmental issues, these practices are nevertheless implicitly followed at times. EXP8 supports this argument*: 'Risk management in my department is "implicit" and it is not independent. All the engineering work is conducted by the different engineering disciplines (mechanical, civil, electrical, chemical, architects) in addition to the cost control and support services units. The construction work is supervised by construction units in the oil fields and consists of all the engineering disciplines'.* EXP11 shared the same perspective, noting that: *'for any of our projects, we make sure to follow up to assess any obstacles that affect the execution of the project or limit the completion rate, we take these issues into consideration and we address them but we do not have a systematic approach'.* Interestingly, EXP9 stressed that *'we try to find solutions when the problem occurs; what we have is management by crisis and not crisis management'.* This indicates that in the Libyan oil and gas industry, problems are mainly managed only after they occur, rather than taking measures to prevent them from happening.

At the same time, it was also noted from those interviewed that the focus of risk management in many cases had to do with the health and safety rather than project-based perspectives; according to interviewee EXP4: *'Yes, totally, in our operating companies, we relate risk only to HSE.'* EXP5 agreed with EXP4: *'it might be only in safety studies that we apply these practices …we do apply Quantified Risk Assessment (QRA) – when we design a particular facility, we do apply QRA, to recognise fatal risks, in case we need to increase our safety systems for our offshore platforms'*. EXP7 believed that '*to avoid risks in the working area, for example, in petrochemical refining or production … you have to take safety precautions in order to avoid any physical risk of injury or any damage'*, this means that the practices or rules of risk management are intended to support a safe work environment for employees.

On the other hand, some participants believed that even when project risk management practices are applied, only the project manager or project engineer's knowledge and experience is taken into account, rather than applying a systematic approach. EXP1 shared this perception, providing an example:

> *From the beginning of the preparation for our project, for example, when we talk about the schedule, we prepare a schedule. If you ask any of our engineers about project risk management, they wouldn't know what it means, but they apply it anyway! For instance, we will prepare a contingency plan for scheduling. We may know, for example, that in three months we will have to go to tender; the engineer knows that the committee always takes a long time and that the vendor selection process may be affected by political interference. Therefore, the engineers know that it will take time so they add buffering to the schedule, so instead of putting three months, they would put six months. Also, as for budget-related risks, we know that the materials will cost us 5 million dollars for instance, but we also know that the contract award or the purchase order might be delayed, so in this case the engineer might have to add another year, which could lead to a higher cost, so the engineer will also add 10% on top of the cost as a contingency. What I mean is that the project manager applies risk assessment practically but not according to a systematic approach.*

In addition, EXP5 and EXP10 agreed with EXP1; EXP5 stating that *'…what I mean is: if you are an experienced project manager, you may have some feelings about what might affect the budget, schedule or quality; you find yourself independently solving these issues on your own terms, without really applying a coherent approach that is professional and that deploys the right people in the organisation to conduct the task. We do not have this option at all.'* The views expressed by EXP12 were very similar, providing another example: *'"We take risks into consideration; this is based on the experience and knowledge of our employees. For example, in the drilling phase of a new exploration area, we take into account what type of risks might occur as part of the process.'* This reflects the fact that the effectiveness and implementations of project risk management practices within the Libyan oil and gas sector mainly rely on the knowledge, experience and willingness of the individual rather than following a clear approach.

Therefore, it can be argued that project risk management practices are to some extend applied within the Libyan oil and gas industry, however, it seems that these practices solely rely on the identification and assessments of the risks impacts, even then, in most of the times these risks are related to HSE. Another point that can be noted is that, the implementation of these practices are in many times depend on the prior knowledge and experience of the analysts rather than following a clear written framework.

**5.2.1.2.3 Contract strategy (Risk transfer)**

In line with the previous subsection (5.2.1.2.2), one form of risks management is to share or transfer responsibility to other parties through contractual agreements. Many oil and gas projects are conducted under Engineering Procurement and Construction (EPC) contracts. Within the Libyan oil and gas industry this type of agreement predominates; in the words of one senior project manager, *'…many of our projects are EPC projects'* (EXP10). EXP10 explained how this type of contract is typically understood: *'In EPC contract projects most of the risks are transferred to the second party (the contractor).'* EXP5 shares the same perspective: *'but do not forget that managing project risks are the responsibility of the contractor'*. Similarly, EXP1 expressed the same opinion, and described the procedures in detail: *"When* *you talk about issues related to technical risks, it is always expected that contractors are the ones that deal with risks: they identify them along with the mitigation plans, but for us to prepare plans on risk management, we do not have a plan."* Therefore, one way of managing risk in the oil and gas industry in Libya could be through the transfer of risks to the contractor.

The above section has shown the degree of awareness and practice of project risk management within the oil and gas industry in Libya, the next subsection will present, based on the interviews, findings about the types of individuals involved in the project risk management process.

### 5.2.2 Individuals involved in the project risk management process

The aim of this subsection is to identify the roles and qualities associated with the project risk management process within the NOC, to fulfil the third objective of this study. Most of the answers received revealed that project engineers and managers are understood primarily as the ones who should be involved in the project risk management process in the Libyan oil and gas industry. In addition to these managers, many participants also mentioned that other experienced and qualified individuals, external consultants and the Health, Safety and Environment (HSE) department each have an important potential role in this process. The outcome of NVivo analysis is summarised in Figure 5-5.

| | | |
|---|---|---|
| Project Risk Management Practices | 13 | 147 |
| Risk and project risk management awareness | 13 | 61 |
| Individuals Involved in the Project Risk Management Process | 12 | 50 |
| Project engineers and managers | 10 | 20 |
| Experienced and qualified individuals | 6 | 13 |
| Health, Safety and Environment department | 6 | 11 |
| External consultants | 6 | 6 |

Figure 5-5 Individuals involved in the Project risk management process.

#### 5.2.2.1 Project engineers and managers

Most of those interviewed (EXP1, EXP2, EXP3, EXP4, EXP5, EXP6, EXP7, EXP8, EXP11 and EXP13) considered that 'Project engineers' and 'Project managers' are the most appropriate individuals to be involved in the project risk management process within the Libyan oil and gas industry, in their experience. In this regard, EXP3 believed that the project manager typically has full authority over the project, stating: *‘usually, the person who is directly responsible for this process in the project manager’*. In the same respect, EXP6 and EXP7 held a similar view, that engineers ought to be the individuals most involved in this process. In addition, EXP3 added that the project manager does not work alone, but with a team that brings experience in a variety of disciplines, including electrical and mechanical engineering. In a similar vein, EXP4 discussed risks related to project design, mentioning that the process engineer or chemical engineer should assess the risks related to engineering process design, while the ‘project risks’ are managed by project engineers (interview with EXP4).

#### 5.2.2.2 Experienced and qualified individuals

To this end, EXP1, EXP2, EXP6, EXP8 and EXP13 agreed with the above observations, adding that the most important skill that managers or team members hold is their technical and project management experience. For instance, EXP1 mentioned that: *‘If I choose, it will mainly be based on the technical expertise, because most of our problems come from the technical side, Secondly, a project manager/engineer or team member must have experience in managing projects … this complements their technical experience and gives the project manager or team member the know-how required to manage projects, especially when confronting scope changes, cost changes or schedule overruns’*. Therefore, it is evident that the technical experience is just as equal as the project management experience and knowledge.

To this end, the connection between appropriate experience and qualifications is one of the most important characteristics described by EXP12: *‘I think the most important characteristics are experience and qualifications. The relevant experience of project risk management processes is most important, not how long the person has been working in the oil and gas industry.’* However, other participants voiced a different perspective, bringing together the number of years of experience with academic qualifications; in this context, EXP2 pointed out: *‘the individuals who are involved in* *the process of studying and managing risks related to production are general managers and production and maintenance managers in operation companies; they are specialists and have at least 15 years of technical and management experience'.* The same respondent spoke about the characteristics an individual would require to perform this process, citing a number of years working in the oil fields, as well as academic qualifications such as PhD, MSc and Bachelor's degrees.

**5.2.2.3 External consultants**

On the other hand, similar opinions were voiced by several of those interviewed (EXP3, EXP4, EXP6, EXP7, EXP8 and EXP13) when answering the question whether or not they employed external consultants; they all replied that the decision depended on the budget, type and size of the project. If local engineers were familiar with the proposed project, they would employ in-house engineers, but in large or strategic projects, the NOC would usually engage external consultants (EXP3). EXP3, EXP4, EXP6, EXP8 and EXP13 endorsed this perspective, indicating that the size of the project would determine whether personnel inside the NOC could conduct the project risk management process or not.

**5.2.2.4 The Health, safety and environment department**

Safety issues are taken very seriously within the oil and gas industry. According to six interview subjects (EXP1, EXP3, EXP4, EXP6, EXP7 and EXP8), the HSE department is one of the main departments that should be involved in the project risk management process. While EXP3 indicated that the project manager carries primary responsibility (see section 5.2.3.1), he continued, *'along with the safety officer who is one of the most important members.'* EXP7 had the same view on this matter, stating that *'the HSE department has its own staff; they are trained and educated in this field and know their discipline very well. They know what specific precautions and steps are required, that is why they carry these responsibilities."* Moreover, EXP8 supported this perspective, specifying that they have in-house engineers and hire external consultants for areas where they lack prior experience: *'"The NOC has an HSE department that consists of engineers and technicians from the same company. With regards to risk management in my department (engineering), it has engineers from both inside and outside the company. From time* *to time, we do employ external consultants for activities that we do not have prior experience in'.* Along the same lines, EXP1 discussed the second part of the question, identifying the characteristics individuals should have to perform this role, and specified that they must have an engineering background, and also adequate knowledge of HSE to make the optimal decision while ensuring a safe operational environment. EXP6 confirmed these perspectives, in that there should be an assigned team, where the HSE department is part of this team; in many cases the interviewee mentioned that they rely on experienced and specialised personnel from outside the company to do this process.

The above subsection has illustrated the different characteristics identified for those involved in the project risk management process in the Libyan oil and gas industry; those interviewed indicated different priorities concerning who should exercise these roles. The next subsection will present findings on the type of individuals understood as setting project risk management policy or responsible for planning within the oil and gas industry in Libya.

### 5.2.3 Setting project risk management policy; responsibilities and planning.

The aim of this section is to understand who sets the rules and procedures for project risk management in the oil and gas industry in Libya, in pursuit of the third objective of this research study. The responses received in the interviews represented varying opinions, indicating the lack of a clear or systematic approach within the NOC. Most participants believed that senior management had the greatest responsibility for setting these plans, but others viewed this responsibility as resting with NOC's subsidiaries, while only three interviewees indicated it to be the responsibility of the HSE department. Figure 5-6 presents the findings from the NVivo analysis.

| | | |
|---|---|---|
| Project Risk Management Practices | 13 | 148 |
| Risk and project risk management awareness | 13 | 61 |
| Individuals Involved in the Project Risk Management Process | 12 | 50 |
| Training Availability | 12 | 18 |
| Setting project risk management policy; responsibilities and planning | 9 | 19 |
| Role of senior management and the board of directors | 7 | 10 |
| The role of NOC subsidiaries' management boards | 4 | 5 |
| The role of the Health, safety and environment department | 3 | 4 |

Figure 5-6 Project risk management responsibility plan.

### 5.2.3.1 Role of senior management and the board of directors

Most of the informants (EXP3, EXP4, EXP5, EXP7, EXP8, EXP12 and EXP13) shared the perspective that the top management holds the main responsibility (and authority) to plan and to enforce the project risk management process within the Libyan oil and gas industry. EXP13 pointed out the role of the project manager, but stressed that to have a successful plan, continuous communication and connection between the project manager and senior management is required: *'I think both the project manager and senior management should participate in project risk management planning. This is because, if project managers are faced with any difficulties, they will always notify senior management, so there must be a connection between them.'* Before deciding on any plan it is important to develop a shared institutional culture; as EXP12 expressed it: *'I think that senior management has a major role to play in the dissemination of project risk management culture.'* This is because the board of directors are the ones responsible for implanting any policy and ensuring the spreading of the project risk management culture within an organisation.

### 5.2.3.2 The role of NOC subsidiaries' management boards

Four of those interviewed described the management boards of NOC subsidiaries as responsible for project risk management policy planning. EXP11, for instance, declared that while they do not focus on project risk management within the NOC, subsidiary companies do. Similarly, while EXP3 acknowledged the role of senior management at the NOC, he also pointed out the role of NOC subsidiaries in risk management planning: *'Senior management at the NOC, for example, or management committees at any of the NOC's subsidiary companies, usually have periodic meetings to monitor the progress of our projects in terms of execution, spending and everything. I mean that there are regular meetings held, and they are responsible for any [risk management] planning'.* Hence, one would argue that both the NOC and its subsidiaries both have responsibility to enforce and implement an effective project risk management policy.

Accordingly, while the mother company (NOC) owns all of its subsidiary companies and sets policies and regulations for them, the role of its subsidiaries is then to follow and enforce these directives. For instance, EXP8 stressed that: *'[I]f the NOC required its subsidiaries to apply project risk management principles, then all of the management boards of NOC's subsidiaries would have to follow that decision.'* Another view was suggested by EXP12, who suggested that risk management planning '*is a sharing process between the NOC and its subsidiaries'*. Therefore, for an effective project risk management policy and planning setting the NOC should ensure that its subsidies companies are involved in the process.

**5.2.3.3 The role of the Health, safety and environment department**

Three respondents (EXP2, EXP6 and EXP7) specified that risk management planning is the responsibility of the HSE department, although support from senior management is also required. EXP2 articulated this perspective clearly: *'The responsibility for the risk management plan in our organisation falls under the department of health and safety, and environment development and is effectively supported by senior management.'* EXP6 expressed a slightly different view, suggesting that the HSE department interprets risk assessment as a technical tool rather than an overall management practice. Meanwhile, EXP7 confirmed the role of senior management support, further pointing out the role of the HSE department as various actors interpret risk management from a health and safety perspective: *'senior management and the HSE department in the NOC are very much concerned about risk management, it is their responsibility to come up with procedures to avoid any undesired risks.'* However, the HSE department role is solely based on the identifications and assessments of risks that are related to health and safety of the employee rather than the other types of risks that might effect a project.

The above section has examined the views of participants concerning who sets project risk management policies and procedures, as well as identifying related roles and responsibilities in the Libyan oil and gas industry. The next section will focus on the availability of training on project risk management within the industry.

### 5.2.4 Training Availability

This section investigates the availability of training on project risk management in the Libyan oil and gas industry, fulfilling the third objective of this research project. Training plays an important role in spreading the culture and awareness of the concept of risk management to individual actors as well as around the industry. The interviews showed that many participants believe that training is available (7), while others claim that its availability is limited (3); a few of the participants (4) claim that no project risk management training is available within the Libyan oil and gas industry. Figure 5-7 shows a summary of these findings as analysed using NVivo software. A detailed explanation of each sub-node will be presented in the following subsections.

| | | |
|---|---|---|
| Project Risk Management Practices | 13 | 148 |
| Risk and project risk management awareness | 13 | 61 |
| Individuals Involved in the Project Risk Management Process | 12 | 50 |
| Setting project risk management policy; responsibilities and planning | 9 | 19 |
| Training Availability | 12 | 18 |
| Availabile training | 7 | 8 |
| Limited training availability | 3 | 5 |
| No available training | 4 | 5 |

Figure 5-7 Training availability.

#### 5.2.4.1 Available training

The interview subjects who indicated that training is available are represented by EXP2 and EXP3, both of whom indicated that most engineers working on oil and gas projects are well-educated, having at least a university degree as well as specialised training; EXP3 stated that *'Most of our engineers have university degrees, in addition to the certification they receive in project management or project planning'*. Although the participant did not frankly specify project risk management training, however, one would argue that project management is the umbrella that covers it different topics including project risk management.

In addition, EXP6 confirmed that training is conducted regularly, both in-house and externally, based on an annual plan, stating that: '*Training programmes are done on a regular basis, whether national or international training. An annual plan should be implemented, but the implementation of these plans depends on external circumstances.'* EXP13 and EXP11 share this opinion, though EXP11 observed that the availability of training has decreased since 2013, due to the domestic situation in Libya: *'Yes, we do facilitate training to increase the capabilities of our engineers … However, to be honest with you, we have not facilitated any training sessions, as a result of the country's security situation.'* Meanwhile, EXP7 views this form of trainings from a health and safety perspective, suggesting that their aim is to avoid risk in the workplace: *'when our engineers start working with the company, after two or three years, they will be allocated to the training department. For example, they will receive training on any mechanical equipment so they become aware how to avoid risks in hazardous areas … some training is offered in-house while other courses take place abroad.'* It seems that training on risk management only focuses on the identification and assessment of risks in the work place in order to provide a safe work environment for all employees in their daily operations.

Another perspective was voiced by EXP10; after noting that overseas training was facilitated, this participant wondered about the uselessness of these courses especially for trainees who were sent abroad without prior fluency in English. EXP10 questioned the attendance patterns of trainees and the appropriateness of their credentials, as well as expressing concerns about their objectives and background:

> *We do facilitate training … but what are the benefits from these training events? … The problem is, there is variation in terms of knowledge in people who attend these training sessions … some people just want to travel and do not care how much knowledge they actually gain. Even if the instructors are*

> *highly knowledgeable, when they see that most of the trainees lack basic knowledge, they will try to explain the basics. Also, some people find the science of project management to be boring because it involves a lot of reading; therefore, the subject requires a person with relevant background knowledge about how it is applied, as well as the motivation to learn.* (EXP10)

The answers discussed here have confirmed the existence of internal and external training on various subjects, but did not specify the availability of project risk management training in particular. It appears that most of these training opportunities focus on the highly technical engineering side rather than on more versatile project management skills. Additional subsections (5.2.4.2 and 5.2.4.3) will describe more precisely the evidence from the interviews where more criticism was expressed about the availability of training.

**5.2.4.2 Limited availability of training**

Three interviewees (EXP1, EXP8 and EXP13) stated that the training courses available are limited to specific subjects, and that sessions dealing with project risk management are very rarely offered. For example, EXP8 said, *'My department offers training and development in technical engineering disciplines. As for project risk management training, it is very rarely mentioned in the project management training sessions.'* EXP1 shared this perspective, observing that project management training courses are usually short in comparison with the technical courses:

> *Most of the longer-term training is focused on technical or academic courses; for example, if you have a BEng degree you might be sponsored to get a Master's degree within a year. But project management courses are usually short in duration; it occasionally happens that some of our staff are sent to project management courses, but this is very rare. I mean, in many cases it is only available for supervisory positions or higher.*

Although EXP13 claimed that training programmes are available and supported by the NOC (see section 5.2.4.1, above), he also reports a problem due to the security situation in Libya, observing that managers have lost some of their authority in the period of social upheaval while lower-level employees became more powerful.

#### 5.2.4.3 No training available

Four of those interviewed (EXP1, EXP4, EXP9 and EXP12) described training courses in project risk management as being simply unavailable. EXP12, for example, affirmed that *'Our department does not provide training on project risk management. I have never heard or attended a course on risk analysis or project risk management. Most of the training is focused on the technical side.'*

Similarly, EXP4 declared that there is no training available in this domain: *'"If we are talking about project risks, then no training is available …the culture of project management itself is not present … if you think that oil and gas is the most well-planned industry, you will be surprised! … the oil and gas industry in Libya lags behind in project management practices'.* EXP9 and EXP1 shared this perspective, that specific training on project risk management is not available.

Even though EXP1 observed in a previous section (5.2.4.2) that training is limited to those occupying higher positions, he insisted that training sessions for engineers were entirely absent: *'but for engineers to teach them on the concept project management I believe there is no training available, they are only expected to work as a technical engineer'*.

The above section has discussed the availability of training on project risk management within the oil and gas industry in Libya, showing the various perspectives held by different participants. Table 5-2 provides a summary of the key findings for section one, overall. These findings, fulfilling the second and third research objectives.

Table 5-2 Summary of key findings on risk management concepts.

| Theme/Concept | Key findings |
|---|---|
| Definition of risk | • Different participants viewed the term 'risk' differently. Based on interview responses, risk can be seen as an obstacle, an effect on the system, as an uncertain event or a threat. |
| Project risk management awareness and implementation | • Some of those interviewed indicated that the concept is not well understood within the NOC; a number of participants also pointed out the absence of a systematic, official project risk management framework in the organisation.<br>• Some indicated that, although there is no clear definition or systematic official approach to project risk management within the NOC, its practices may still be applied in some cases, mostly when identifying and assessing risks related to health, safety and the environment.<br>• Another form of project risk management identified by five participants is the transfer of risk to a contractor, who assumes responsibility in case of unforeseen eventualities. |
| Individuals Involved in the Project Risk Management Process | • According to interview data, project engineers and managers were identified as the main people that should participate in the project risk management process. They also indicated that experienced and qualified individuals and |

| | |
|---|---|
| | the HSE department have important roles to play in the process. Other participants also claimed that for large and complicated projects, external consultants could perform the process. |
| Setting Project Risk Management policy, responsibilities and plans | • Most of those interviewed identified senior management, or the board of directors, as ultimately bearing responsibility for developing and setting the rules and regulations for project risk management processes within the NOC. Meanwhile, others believed that the management boards of NOC subsidiaries should be setting these regulations. Only a few respondents mentioned the role of the HSE department in this process. |
| Training Availability | • Many participants indicated that training and development programmes are available within the NOC; however, in many cases these programmes are only focused on the technical engineering side rather than on project risk management practices. Some of those interviewed claimed that even if training is offered on project risk management, the topic is only discussed briefly as part of general project management courses. Other respondents clearly believed no such training to be available within the NOC. |

## 5.3 Project Risk Management Tools and Techniques

The aim of this section is to explore the tools and techniques currently used to support project risk management practices and processes within the Libyan oil and gas industry. Those interviewed were also asked to evaluate the effectiveness of these tools and to identify their limitations. Therefore, this section is divided into three subsections, covering currently used tools and techniques (5.3.1), their effectiveness (5.3.2) and their limitations (5.3.3). This section supports section 1 above, and is designed to realise the third objective of this research study. Detailed findings from the interviews will be presented in each subsection. Figure 5-8 shows a map of the main themes for this section, as generated by NVivo.

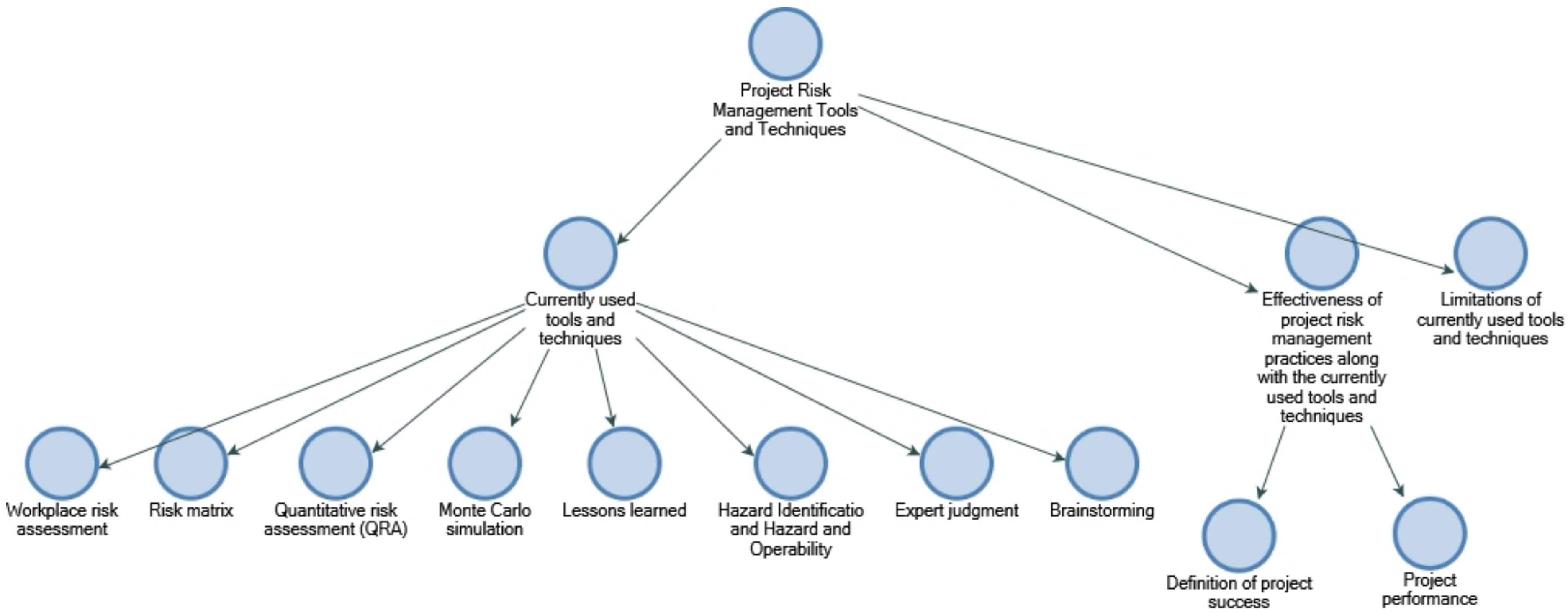



Figure 5-8 Main themes concerning project management tools and techniques.

### 5.3.1 Currently used tools and techniques

All interview subjects discussed various tools and techniques used to evaluate project risks, including such approaches as brainstorming, risk matrix, Hazard Identification (HAZID) and Hazard and Operability (HAZOP), lessons learned, expert judgment, workplace risk assessment, QRA and Monte Carlo simulation. Figure 5-9 presents the project risk management tools and techniques used in the NOC as analysed by NVivo.

| | | |
|---|---|---|
| Project Risk Management Tools and Techniques | 12 | 80 |
| Currently used tools and techniques | 12 | 44 |
| Brainstorming | 7 | 13 |
| Risk matrix | 7 | 13 |
| Hazard Identificatio and Hazard and Operability | 5 | 9 |
| Lessons learned | 2 | 3 |
| Expert judgment | 3 | 3 |
| Workplace risk assessment | 1 | 1 |
| Quantitative risk assessment (QRA) | 1 | 1 |
| Monte Carlo simulation | 1 | 1 |

Figure 5-9 Currently used project risk management techniques.

#### 5.3.1.1 Brainstorming

Most of those interviewed (EXP3, EXP4, EXP6, EXP7, EXP10, EXP11 and EXP13) mentioned 'Brainstorming' as a tool or technique used to assess project risk. In this context, EXP10 was responsible for a project, and said he facilitated a brainstorming session himself, although no official nor systemic approach was available to follow.

Two interview subjects (EXP3 and EXP11) stated that they employed brainstorming along with risk matrix techniques (see following section 5.3.1.2). EXP11 stated that *'Yes, we do apply these techniques. And during the brainstorming sessions, we discuss any problems that our projects might encounter, and ways to overcome these problems.".* EXP3 confirmed this observation, saying *'Most often we use the risk matrix method, along with brainstorming …'* Similarly, EXP6 observed that

*‘Typically, brainstorming is a tool applied in all disciplines, whether regarding risks or other issues”.* It can be concluded that brainstorming technique is widely used within the Libyan oil and gas industry to support the identification and assessment of risks.

**5.3.1.2 Risk matrix**

The risk matrix approach is a very popular technique used to assess risks across various industries. Most of those interviewed (EXP3, EXP4, EXP6, EXP7, EXP10, EXP11 and EXP13) revealed that they used this technique to assess project risks in the Libyan oil and gas industry. The same participants who indicated that brainstorming is one of the main techniques they used (see section 5.3.1.1), also described the risk matrix method as widely used within the industry. EXP3 and EXP4 confirmed this; EXP4 declared, *‘We mainly use brainstorming and risk matrix methods; we do not use decision trees, etc. … I see that risk matrix is widely used, and so we do not use the other techniques.’* This confirms what has been mentioned in the previous section (5.3.1.1), in that brainstorming and risk matrix techniques are widely used and in many cases are applied in combination.

Another view was expressed by EXP10, who suggested that, in practice, this technique is limited to HSE risks: *‘Since we only focus on risks that are related to safety, our culture became focused on these risks along with their tools and techniques. We use a risk matrix method, but with very limited applications.’* This fact confirms the previously mentioned finding (see section 5.2.1.2.2) in that the identification and assessment of risks within the Libyan oil and gas industry only focus on those risks related to HSE.

**5.3.1.3 Hazard Identification and Hazard and Operability**

Hazard Identification and Hazard and Operability were mentioned by five of the interview subjects (EXP1, EXP4, EXP6, EXP10 and EXP13) as a tool used to evaluate project risks. According to EXP4, these tools were mainly used to assess risks related to safety: *‘When we look at HSE risks, we talk about HAZID and HAZOP techniques… as I have previously mentioned, we do HAZID and HAZOP, but this is purely related to technical HSE risks’.* Meanwhile, EXP1 explained the process of using these techniques at the early stages of the project, adding that

HAZOP sessions are considered to be a type of brainstorming session or a method for a risk identification. This participant claimed:

> *We use HAZOP and HAZID, which involves some risk assessment practices. We conduct these sessions with our contractors who work with us on our engineering projects, during the FEED (Front End Engineering Design). These HAZOP sessions are attended by our engineers, who participate to a certain degree but not very effectively; this is considered to be a type of brainstorming session or a method for risk identification, which is mostly technical (on the engineering side of the project), rather than project risk related.*

While it is important to conduct this study at early stages of the project life cycle, according to EXP6, the NOC mostly employs these techniques in the context of big projects, e.g. construct a plant.

#### 5.3.1.4 Lessons learned

Another technique mentioned by two interviewees (EXP7 and EXP8) is taking into account lessons learned from previous projects. According to EXP8, this technique is used to identify any risks that affected previous, similar projects. EXP7 shared this perspective, stating that: *'There is another technique, which is incorporating the lessons learned from accidents … For example, when an accident has happened, you have to benchmark it with any other, related projects in order to avoid any mistakes that happened in the previous project. They call these the lessons learned from that project; I think this is a very important technique.'* Beside the lessons learned from previous projects, EXP8 also observed that their team also used internet resources and received support from more experienced managers. The use of these techniques varied depending on the project and the departments concerned.

#### 5.3.1.5 Expert judgement

Risk assessment or analysis is often centred on the subjective viewpoint of the person identifying the risk, which, in many cases, is based on the experience of the individual. Within the Libyan oil and gas industry, three interviewees (EXP3, EXP8 and EXP11) mentioned that they rely on the opinions of experts to help them to identify project risks. EXP3 and EXP11 observed that the opinion of experienced personnel plays an important role in identifying project risks, often during brainstorming sessions. As EXP11 pointed out, *'During the brainstorming sessions, we discuss any problems that our projects might face, and we also discuss ways to overcome these problems … the opinions and experience of people has an important role in this.'* EXP3 added that in cases for projects that are in high risk areas, they choose the most experienced people.

#### 5.3.1.6 Workplace risk assessment

Only one interviewee (EXP2) described workplace risk assessment as the main tool or technique currently used to evaluate project risks.

#### 5.3.1.7 Quantitative risk assessment (QRA)

Another tool used in many workplaces is QRA**,** mainly to assess safety-related risks and risks of exposure on the part of employees and the environment. Only EXP5 mentioned the use of this tool, which was also mentioned above (see 5.2.1.2.2 in the previous section).

#### 5.3.1.8 Monte Carlo simulation

One interview subject (EXP12) mentioned MCS as a tool or technique currently used to evaluate project risks. This participant claimed that, while in use, this tool is only applied moderately and only in relation to technical risks: *"We do not apply sophisticated tools; we use the very simple ones. We apply Monte Carlo simulation but in a very simple way in an Excel sheet … mainly in relation to technical risks."* It can be seen that the application of MCS in very limited in practice since only one participant noted that.

The above section has discussed the availability of the current various tools and techniques used to evaluate project risks, within the oil and gas industry in Libya, showing the various perspectives held by different interviews. The next section will focus on the effectives of project risk management practices along with its supportive tools and techniques.

### 5.3.2 Effectiveness of project risk management practices along with the currently used tools and techniques

When asked about the effectiveness of project risk management practices, along with the tools and techniques currently in use, only interviewee EXP9 declined to answer to the question, while most of those interviewed (EXP1, EXP2, EXP3, EXP5, EXP6, EXP7, EXP10, EXP11, EXP12 and EXP13) believe that these tools and techniques are very effective in identifying and assessing project risks, as well as improving project performance in the Libyan oil and gas industry. EXP11 confirmed this by saying, *'Yes, I think they can be effective in addressing the problems we face.'* EXP13 seemed to be very confident of this, declaring: *'Yes, of course. Based on my knowledge and my MSc degree in HSE, I totally understand what you mean; I can say with confidence that these tools are very effective.'* EXP13 added, *'Yes, of course they will improve the project success rate'*. Similarly, EXP10 assesses these tools as offering a good initial indicator of risks, stating, *'These tools give you indications and a pointer to help you to identify impacts of each risks; if the impact is high then further study will be required.'.* In addition, EXP10 thinks risk registers are a very effective way to improve the performance of projects, providing the user with details of risks and sub-risks, as the participant stated *'When I have a risk register, that enables me to include all the main and sub risks, and all of these will improve the performance of projects while making sure to avoid any cost overruns and schedule delays'* Surprisingly, although the great majority participants believe that project risk management and its supportive tools and techniques are effective, their actual implementation within the industry is still very low.

To this end, only two respondents (EXP4 and EXP8) did not seem to be very optimistic about these tools and techniques; EXP4 expressed directly their shared view: *'I do not think they are very effective'*. This perspective has arisen due to certain limitations, which will be discussed in more detail in the next subsection (5.3.3).

#### 5.3.2.1 Definitions of project success and project performance

##### 5.3.2.1.1 Definition of project success

The relationship between the use of project risk management practices and its tools and techniques and positive project outcomes was pointed out by the majority of participants (see section 5.3.2). However, the concept of project success was viewed differently by different informants within the Libyan oil and gas industry. According to EXP2, EXP6 and EXP12, project success is defined as meeting the predetermined project objectives, while EXP2, EXP3, EXP4, EXP8 and EXP13 expressed similar perspectives, defining success as achieving a target in terms of work, schedule, budget and quality. Expressing another view, EXP7 agreed with the previous definitions but added that avoiding accidents is a measure of project success, insisting that HSE is an important factor within the oil and gas industry. Meanwhile, according to EXP10 and EXP11, success in the Libyan oil and gas industry is often viewed as achieving an increase in the rate of hydrocarbon production, regardless of additional costs that may occur in the project; EXP10 believed that this could be due to the fact that oil and gas projects are in many cases highly profitable.

##### 5.3.2.1.2 Project performance

The performance and success rate of projects within the Libyan oil and gas industry are not very promising, according to the majority of study participants. One interpretation for this rests with the poor application of project risk management principles (according to EXP7 and EXP8); in another vein, EXP10 related this to the risk inherent in choosing a contractor for a project, stating: *'A contractor failed to execute one of our projects; this occurred because of a problem in the selection of the contractor right from the beginning. This project was known to be risk-driven, so the selection of the contractor had a decisive impact on the success of the project.'* Another reason for this poor project performance is related to corruption, according to EXP13. Meanwhile, EXP8 provided examples of unsuccessful projects:

> *For example, a gas processing project in one of our fields was considered to be unsuccessful, because from the nineties to the present, it has not been executed as planned. This has occurred mainly because the imported project equipment was not suitable for the gas produced in the field, because of an*

*error in analysis of the gas, which formed the basis for the equipment specifications. Also, as a result of the absence of project risk management, the time and cost of the project have increased, and therefore we had to change the specifications of the project by creating a gas processing unit that fits with the specifications of the imported equipment.*

Meanwhile, according to EXP13, although many projects have performed poorly, some have succeeded as a result of proper project risk management practices. EXP7 shared a similar perspective, providing an example of a previous, successful project:

*One of the pipelines in the Sahara Desert, in the Mesla oil field, was finished on time and within budget and met the project objectives without any accidents. I consider this to have been one of the best projects executed by one of our Japanese contractors, which used to work in Libya mainly with AGOCO ... The budget was 70% US dollars and 30% Libyan dinars, and the aim of the project was to install 11 pipelines; total production was about 20,000 Barrels per day (BPD) … we installed high-quality (grade A) materials, which means you can replace the pipelines after 14 years and you can be confident that you will benefit from wells for 12 or 13 years … What is the name of the project? … C-44, Mesla oil field ...the budget was around $ 5-10 million, as I told you 70% of that was in US dollars and 30% Libyan dinars.*

The results from the interviews, shown above, indicated that project risk management practices and the tools and techniques supporting them can contribute to the success and increased performance of projects; however, some of those interviewed indicated shortcomings of some of these tools and techniques, which limit the effectiveness of project risk management in the Libyan oil and gas industry. These observations will be discussed in the following subsection.

### 5.3.3 Limitations of currently used tools and techniques

According to the interview data, several limitations of these project risk management tools and techniques were identified, with respect to the Libyan oil and gas industry.

First, most participants observed that the use of these tools and techniques was based on the experience and knowledge of the individual (according to EXP1, EXP3, EXP4, EXP5, EXP7, EXP8, EXP9, EXP10, EXP11, EXP12 and EXP13).

EXP1, EXP4 and EXP8 shared the view that the current management system limited the use of these tools and techniques in the Libyan oil and gas industry, with EXP1 observing, *'…Senior employees are still working with old school methods; they do not accept project risk management, and think it is just theoretical'.* EXP8 added that the fear of change and the unknown has limited the effective use of these tools and techniques.

According to EXP6 and EXP10, the size and type of project limits the choice and the effectiveness of these tools and techniques, EXP10 declared that each project has its own characteristics, which affect the choice of techniques; also, individual knowledge and experience has a great influence on these decisions.

Meanwhile, EXP3 and EXP12 observed that the results of these tools and techniques were limited to the accuracy of the input data, with EXP3 stating: *'All of the available techniques rely on input data, so if people involved with the data input process provide accurate readings, then the results will be accurate, because the results are strongly related to the validity of the input data'.* EXP12 believed that the accuracy of these data depend on the person's own experience and knowledge. In the same vein, EXP8 stressed the importance of the familiarity of the analysts with the tools and techniques.

According to EXP6 and EXP10, the size and type of project limits the choice and the effectiveness of these tools and techniques, EXP10 declaring that *'I think each project has its own characteristics, which affect the choice of techniques; also, individual knowledge and experience has a great influence on these decisions.* Meanwhile, EXP3 and EXP12 observed that the results of these tools and techniques were limited to the accuracy of the input data, with EXP3 stating: *'All of the available techniques rely on input data, so if people involved with the data input process provide accurate readings, then the results will be accurate, because the results are strongly related to the validity of the input data'.* EXP12 believed that the accuracy of these data depend on the person's own experience and knowledge. In the same vein, EXP8 stressed the importance of the familiarity of the analysts with the tools and techniques they use for risk assessment.

The preceding section was developed to fulfil the third research objective, and respondents were asked a number of questions to further explore the current risk management practices, along with related tools and techniques, within the oil and gas industry in Libya and concerning their effectiveness to increase project success and performance. Table 5-3 provides a summary of the key findings from this section.

Table 5-3 Summary of key findings concerning risk management tools and techniques.

| Theme/Concept | Key findings |
|---|---|
| Currently used tools and techniques | • According to the interview responses, the following tools and techniques are currently used to evaluate project risks within the NOC: brainstorming, risk matrix, HAZID and HAZOP, lessons learned, expert judgment, workplace risk assessment, QRA and MCS. |
| Effectiveness | • Most interviewees believed that these tools and techniques are very effective in identifying and assessing project risks as well as improving project performance in the Libyan oil and gas industry. Only two interviewees claimed that these tools are not effective.<br>• Some of those interviewed believed that one of the main causes of poor performance in the Libyan oil and gas industry is the improper use or neglect of project risk management tools and techniques. |
| Limitations | • Most of the interview subjects believed that the applications and effectiveness of these tools and |

| | |
|---|---|
| | techniques were typically limited by the experience and knowledge of the individual practitioner; others emphasised the accuracy of the input data as well as the type and size of the project as affecting the usefulness of these tools and techniques. |

## 5.4 Challenges

The aim of this section is to explore current challenges that limit the adoption and effectiveness of project risk management practices in the Libyan oil and gas industry, addressing the forth objective of this research project. By understanding the current challenges facing the oil and gas industry, the researcher can confidently provide recommendations concerning the best ways to overcome these challenges and to implement project risk management practices effectively. Most respondents highlighted certain key challenges that limit the implementation or effectiveness of project risk management practices, including the lack of knowledge and experience among practitioners, the lack of support from senior management, resistance to change, lack of structured training plans, lack of coordination and cooperation, lack of a management system (e.g., a project risk management framework) and the unstable security and political situation in Libya. Figure 5-10 shows a map of the main themes for this section, as generated by NVivo, while Figure 5-11 demonstrates the challenges that limit the implementation of project risk management practices in the NOC, as analysed by NVivo. The following subsections will provide details of these challenges.

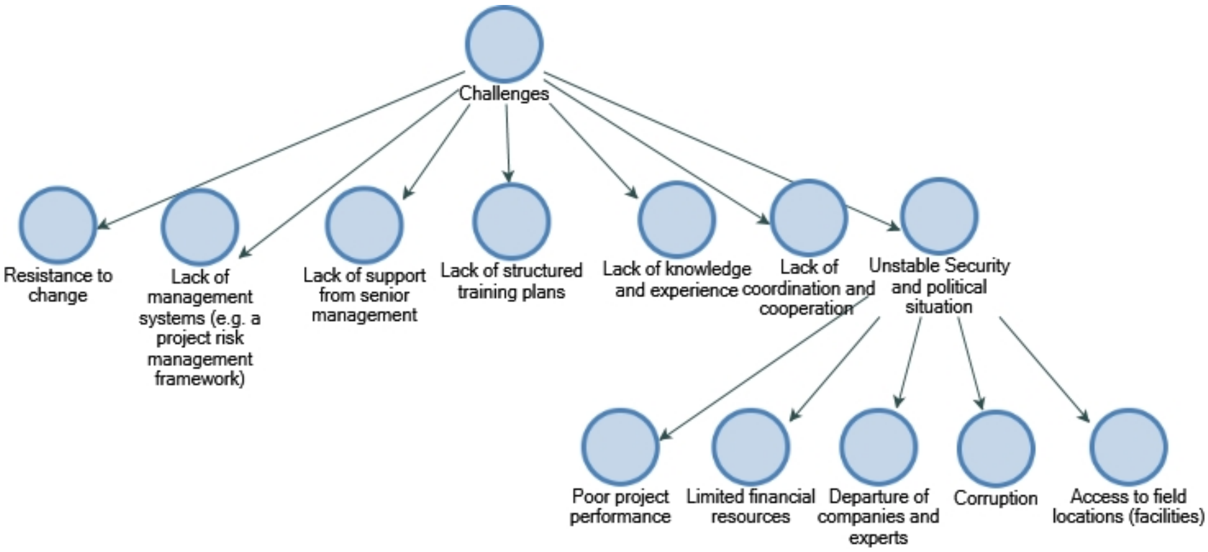



Figure 5-10 Main themes concerning challenges to project risk management.

| | | |
|---|---|---|
| Challenges | 13 | 95 |
| Lack of support from senior management | 9 | 12 |
| Lack of knowledge and experience | 9 | 21 |
| Resistance to change | 3 | 4 |
| Lack of structured training plans | 4 | 6 |
| Lack of coordination and cooperation | 4 | 5 |
| Lack of management systems (e.g. a project risk management | 5 | 11 |
| Unstable Security and political situation | 11 | 36 |

Figure 5-11 Challenges that limit the implementation of effective project risk management processes.

### 5.4.1 Lack of knowledge and experience

Regarding the lack of knowledge and experience among practitioners, the majority of those interviewed considered this to be one of the most important challenges within the Libyan oil and gas industry. As project risk management falls under the broader umbrella of project management, the lack of knowledge and experience of both concepts by practitioners and managers affects the entire Libyan oil and gas industry. EXP1 demonstrated this, indicating that, although qualified technical experts are present within the industry, the overall maturity level and the knowledge about these concepts is limited among practitioners: *'The maturity level concerning project management in general is still very low; the way companies deal with project management issues has to do with the degree of maturity and the level of knowledge among employees, which needs to be upgraded and developed ... due to the fact that project management and project risk management are bodies of knowledge that are constantly being updated, our industry is not keeping up with these developments'.* EXP4 added: *'In Libya, and in the oil and gas industry, the culture and the understanding of the concept of project management is not available'.* In addition, EXP2 shared the same view as EXP10, who declared that *'We have a lack of expertise in project management'*. EXP4 shared a similar perspective: *'We do not have people who have worked enough or have enough experience in project risk management.'*

According to EXP4, EXP5, EXP7, EXP8 and EXP12, this situation could result from Libyan national culture, as EXP5 mentioned: *'We are not using the science of risk management as part of managing our projects; we are not using it at all, even our culture does not support this.'* EXP7 and EXP12 expressed similar views, agreeing that the lack of knowledge and experience in project risk management is related to the Libyan mentality (culture). As EXP12 clearly stated, *'I also think that the Libyan mentality and understanding of management is a very important challenge.'* EXP4 agreed with these perspectives and added, *'The knowledge of the concept of project management is very limited here; they think that engineering work is project management … When there is no project management culture, how could you understand project risk management?'* Along similar lines, EXP7 and EXP8 suggested that the lack of a culture of concern and attention has led to a situation where many of those employed in the Libyan oil and gas industry do not take time or cost overruns seriously, because the NOC and its subsidiaries are fully state-owned companies. Moreover, EXP3 and EXP6 shared a similar view, questioning the level of understanding of the concept of project risk management at the highest levels of management.

### 5.4.2 Lack of support from senior management

Alongside the lack of knowledge and experience discussed in section 5.4.1, eight interviewees mentioned a lack of support from senior management as one of the main challenges in implementing an effective project risk management process within the Libyan oil and gas industry; and some of those interviewed specified this as the most important factor. For example, EXP2 and EXP7 noted that senior management has the ultimate responsibility and authority in any decision-making process within the NOC, as they sit at the top of the pyramid. EXP12 supported this perspective, declaring that *'The most important challenge is the lack of senior management support in establishing effective project risk management practices.'* From a similar perspective, EXP1, EXP4 and EXP10 also questioned the ability of senior managers to provide effective support when they themselves lack knowledge of key concepts, while EXP4 added that it is important to raise the awareness of project risk management among the top managers: *'I think the first thing we need to do is to educate senior management about the concept of project risk management"*. EXP1 added: "*Concerning senior management support, I think it is about maturity; there is no knowledge about the topic'.* EXP8 simply stated that *'We lack senior management support*.'

### 5.4.3 Resistance to change

Meanwhile, resistance to change was considered by three respondents (EXP6, EXP8 and EXP10) to be one of the important challenges that limit the effectiveness of project risk management practices in the Libyan oil and gas industry. This resistance to change comes from senior management or from a traditional resistance among engineers towards the implementation of new tools, techniques and technologies. In this context, EXP8 observed fear of change to be one of the challenges that limited the effectiveness of project risk management practices (see section 5.3.3); EXP10 also described resistance, mainly in association with limited knowledge on the part of senior management (see section 5.4.1): *'The main challenge is knowledge, especially the limited knowledge among senior management, also the fear of applying new technology. This fear arises from the fear of their limited knowledge and their incomplete understanding of the concept of challenges. Here they don't know how challenges are understood elsewhere; they are very traditional, having a purely operational mentality in that they only care about production rate*."

Moreover, EXP6 shared the opinion that, due to limited knowledge or to cultural factors, many engineers are content with traditional methods of managing projects. This resistance to change could be avoided if effective risk management were applied within a project from the beginning: *'We also have a problem with the culture; there is always a very old culture in terms of traditional engineering, always trying to avoid becoming involved in new, modern science and technology because they think it is a waste of time. Even the culture in the engineering team is always against these things.'*

### 5.4.4 Lack of structured training plans

Four respondents (EXP1, EXP4, EXP6 and EXP12) identified the absence of structured training in project risk management as one of the challenges they are face within the NOC. EXP6 and EXP12 agreed that they have a problem with the development of training plans, as it is presently very difficult to get proper development plans approved, whereas previously, many companies had offered various development training programs. EXP12 added that most training programmes at present relate only to technical skills, without offering any intensive exposure to project risk management, and noted that many participants only care about financial returns rather than skill development: *'We do not have structured annual training programmes that are specifically designed to teach risk analysis or project risk management; this area is still very weak … I think our human resource management practices are very weak in establishing strong, effective and structured training development programmes.'*

In the same context, another important point was mentioned by EXP6, namely, that there are not enough qualified personnel to provide project risk management training. Those who might technically be well-trained and valuable are usually attracted by other companies or may find themselves working in states in the Arabian Gulf or for multi-national corporations, stating:

> W*e don't have enough professionals to deal with training issues, and we also face another problem, namely that our highly-valued technical personnel are always attractive for other companies. We find them working in the Gulf states and for international companies – we put so much effort into training them and developing their skills just to find them being recruited by other companies; this is a very important issue*.

However, EXP9 confirmed the need for relevant training to enhance understanding, knowledge and awareness of project risk management, mentioning the *'"lack of actual knowledge, and the lack of awareness of the importance of building a risk management department, to establish the practical procedure for risk management to deal with different types of risks by setting in place the required plans and making sure that these plans are executed.'*

### 5.4.5 Lack of coordination and cooperation

A lack of coordination and cooperation between individuals and departments is considered to be one of the main challenges facing the NOC and limiting the effectiveness of project risk management practices. EXP1, EXP7, EXP8 and EXP13 all share a concern with the lack of cooperation among team members. According to EXP8, this results from bureaucracy within the NOC, while EXP7 describes the situation in greater detail, providing examples where bureaucratic practices inhibit communication with the Libyan oil and gas industry:

> *A lack of coordination between the departments … when there is no effective coordination between the departments everything will be a disaster. This is the main challenge we face in the Libyan oil and gas industry. For example, when you send a letter or a request they delay the process by 2-3 months, 2-3 weeks, 1 month – they don't care about the importance of things, because that is nature of the companies. Since it is owned by the government, not a*

*private company, so even if each one-minute delay costs money, they don't care about that.'*

Therefore, this lack of coordination and cooperation affects the project risk management, as an effective process requires the establishment of communication channels through coordination and cooperation, as well as the efforts of all team members to ensure the accurate identification, assessment, communication and management of all project risks.

### 5.4.6 Lack of management systems (e.g. a project risk management framework)

The lack of management systems to set rules and regulations, assigning responsibilities and establishing monitoring and accountability, is considered to be a factor limiting the effectiveness of project risk management within the Libyan oil and gas industry. For instance, EXP6 pointed out that many people working in the oil and gas industry in Libya, especially at a senior management level, still do not appreciate the benefits of project risk management:

> *The concept still not clear for people, but we are working on it. It takes time to implement – it is difficult because it needs cultural change and training for managers and senior management ... If these people are not convinced by this approach, they will just go through the motions and it won't be effective. Some companies in Libya have ISO certification, but on the ground the risk management system is not running because senior management does not care about it. Also, line managers should have knowledge and training for this system so that they appreciate its value when they practice it.'*

Clearly, the absence of a management system that would establish defined frameworks and procedures for effective project risk management procedures will make it difficult for individuals in the Libyan oil and gas industry to make effective use of these practices.

### 5.4.7 Unstable security and political situation

The current, unstable security and political situation in Libya has significantly influenced the country, with an incontestably negative effect on all business activities. The oil and gas industry is no exception; in fact, because of this sector's strategic contribution to the Libyan economy, the oil and gas industry has suffered the most from the ongoing, unstable security and political situation.

Most of those interviewed mentioned a list of security and political factors that influenced the NOC, limiting the effectiveness of project risk management practices. These factors included limited financial resources, the departure of companies and experts, loss access to field locations (facilities), poor project performance and corruption, as shown in Figure 5-12. The following subsections will provide details for each of these factors and how they affect the project risk management process.

| | | |
|---|---|---|
| Unstable Security and political situation | 11 | 36 |
| Departure of companies and experts | 8 | 11 |
| Access to field locations (facilities) | 5 | 7 |
| Poor project performance | 4 | 7 |
| Corruption | 3 | 3 |
| Limited financial resources | 5 | 8 |

Figure 5-12 Challenges resulting from the unstable security and political situation.

#### 5.4.7.1 Limited financial resources

The closure of many oil and gas fields and ports has paralysed the export of Libya's vast hydrocarbon resources, resulting in a pronounced decrease in financial returns. In parallel with this, the sharp decrease in world crude oil prices has had a drastic negative effect on the industry's financial returns. Most respondents therefore emphasised the limitations of financial resources among the challenges the Libyan oil and gas industry currently faces. Most of those interviewed referred to the closure of many oil fields and the sharp decrease in hydrocarbon production as negatively impacting all NOC projects including the company's plans for training, hiring and recruiting risk management professionals. EXP1 stated: *'You know, the last 2 years* *has been very difficult due to the country's unstable situation and limited financial resources, as the closure of many oil fields has affected this, and as a consequence this will have an effect on training ...". EXP7 added, 'The political conflicts have affected production significantly… Do you think this will limit the practices of project risk management? … Yes, it will limit everything.'*

Moreover, EXP2 confirmed these arguments, adding that the current situation in Libya has a direct impact, limiting the effectiveness of project risk management practices: *'One of the most important challenges our institution is facing is security and stability in the oil fields and oil ports, in addition to the lack of financial resources, experienced staff and specialised service companies; these factors in turn may reduce the effectiveness of project risk management in addition to their direct impact on production processes'*. This participant added: "*The security situation has led to an additional decrease in financial revenues.'*

On the other hand, EXP3 shared the same concern about the lack of financial resources, but believes that the problems resulting from budget delays began before the Libyan revolution in 2011, as political decisions by the previous regime. EXP3 observed *"The instability of senior management within the NOC also has an effect on its projects. We also suffer from budget delays, which Libya experienced even before 2011 – most of these delays were politically driven by the previous regime."*

The situation before and after the Libyan revolution was compared by EXP13, who stated that the Libyan oil and gas industry had faced certain barriers before the revolution, but experienced relatively smooth production and project activity; it also had many investment companies, training agreements with various partners and a plan to train and develop Libyan engineers, managers and supervisors was also available. This respondent added that since the revolution, the situation had changed dramatically, even affecting the salaries of our employees, which discouraged the NOC staff from paying close attention to project management. EXP13 stated: *'Of course the country's situation after 2011 has significantly affected our oil and gas industry. While we faced certain barriers before the revolution, our production and project activities proceeded fairly smoothly. We also had cooperation from many international companies to train and develop the local Libyan workforce. So, overall,* *we experienced smooth operations in the past (before 2011), but since then everything has changed dramatically in a negative direction, even affecting the salaries of our employees.'*

#### 5.4.7.2 Departure of companies and experts

The departure of companies and experts was considered by most of those interviewed (EXP2, EXP3, EXP7, EXP8, EXP9, EXP10, EXP11 and EXP12) to be one of the most significant effects of the deteriorating security and political situation. Many respondents gave an account of the situation after the Libyan revolution in 2011, and the seizure of oil fields and ports by militias in 2014, in terms of their negative impacts. Most international contractors and service companies left the country, and national production decreased significantly. EXP11 and EXP12 compared the situation before and after the revolution, and EXP12 acknowledged:

> *Before the revolution we had many activities and projects ongoing, we faced a few problems but achieved steady production. After the revolution, and let me say specifically since 2014, the industry has almost gone dead and many companies have had to invoke force majeure and suspend their activities. Most contractors have left the country, which I believe has affected our industry significantly. I think upon their return, these companies will play an important role in developing the oil and gas industry as well as their employees.*

Similarly, EXP11 added: *'Also, what happened in 2014 has had its own negative impacts; most of the contractors and service companies left the country and our production decreased significantly.'* Moreover, EXP7, EXP8, EXP9 and EXP10 shared this perception of the important negative impact caused by the departure of qualified foreign technical employees, while most of these companies reduced their staff and some totally closed down their operations in Libya. EXP3 further added that the country's security situation led to the departure of skilled labour, both Libyans and non-Libyans, observing that: *'The biggest challenge is the security situation of the country, which led to the result that good, skilled labour, both Libyans and non-Libyans, has left the country. Also, we lost the participation of effective contractors;*

*again as a result of the country's security situation'.* The departure of many foreign companies and experts will naturally have a significant, negative impact on the effectiveness of project risk management practices, as many of the most experienced staff (both Libyans and non-Libyans) left the country, leaving a huge shortage in personnel qualified to manage the country's projects and thereby limiting the application of effective project risk management practices.

**5.4.7.3 Access to field locations (facilities)**

The security situation has also influenced the ability of the NOC to control its facilities and premises, as well the ability of personnel to travel to the oil and gas fields and ports. The inability of personnel to conduct site visits has a direct impact on the effectiveness of project risk management practices, leading to incomplete information, which in turn affects the accuracy of risk assessments and thereby leads to incorrect conclusions. From his experience, EXP7 discussed this situation in detail: as the NOC cannot control its premises and oil fields, it cannot even produce hydrocarbon products on a large scale or sell them to global markets. EXP7 also suggested a solution to this problem: uncontrolled areas should be controlled by security forces to exclude these premises from any political conflicts:

> *We are now in an uncontrolled area, the NOC cannot control its own facilities and oil fields, which are controlled by militias and rebels, so it cannot even produce or sell its production because of the political situation … these facilities should be tightly controlled by the security forces to exclude these premises from any political conflicts … political conflicts can happen anytime, but they should be kept out of these facilities so that production is carried on smoothly. During the time of Qaddafi's rule nobody could touch these facilities, but after the regime collapsed, various militias controlled them, saying "I need to rule, I need this, this is my right".*

EXP8 added that this has led Libya to be an undesirable country from the perspective of multinational corporations in the oil industry, and most the oil fields have been placed under *force majeure*.

Along the same lines, EXP2, EXP3 and EXP11 shared this perspective, specifying that due to the safety and security situation in Libya they could not travel safely to the oil fields or have access to their facilities. EXP11 stated this clearly: *'Of course, the security situation has a major influence; due to the safety and security situation of the country we cannot travel safely to our fields or facilities'.* Therefore, the inability of the NOC to control its facilities makes it difficult to assess and manage project risks.

**5.4.7.4 Poor project performance**

The unstable security and political situation has had a huge effect on the performance of many of projects in the Libyan oil and gas industry. According to four participants (EXP2, EXP3, EXP6 and EXP8), the current status of Libya had limited the ability of the NOC to deliver successful projects. In this context, EXP2 stated that poor project performance has resulted from the unstable security situation that led many projects to be halted: *'The political and security situation have a direct impact on the performance of any organisation and also on the success rate of any economic projects. The best example of this is the poor performance record of our projects as a result of the unstable security situation, which has led many projects to be discontinued.'* EXP2 also added that the limitations of financial revenues and the losses of many project's assets as a result of theft, all of these factors resulted in the seizure of many of NOC's projects.

Similarly, EXP3, EXP6 and EXP8 confirmed the negative effect of the political and security situation on projects in the oil and gas industry in Libya, with EXP6 stating: *'Of course the political and security situation of the country has influenced many of our projects',* and EXP3 adding: *"The unstable political regime has a strong negative effect on our projects and our company, and led our budget to be reduced.'* EXP8 also spoke about poor project performance as many fields has been put under *force majeure*.

Therefore, poor performance and delays in many oil and gas projects have limited the ability of the industry to benefit from revenues from these projects. This lack of the financial resources affects the successful implementation of project risk management practices, because the lack of these resources reduces project risk management training budgets as well as other resources required to conduct effective project risk management practices.

### 5.4.7.5 Corruption

The appointment of unqualified personnel based on favouritism is considered to be a factor affecting the oil and gas industry in Libya and one of the challenges limiting the effectiveness of applying project risk management principles. These unqualified people are understood to lack the knowledge and experience needed to manage projects; rather, their selection was based on their connections regardless of their qualifications. This form of corruption has been observed within the Libyan oil and gas industry; for example, EXP8 mentioned that: *'One of the challenges we face is the appointment of unqualified people. Before the revolution, there used to be a limited sort of favouritism and appointment outside of the legal framework, but security was there, and Libya was producing 1.6 million barrels a day. After the revolution, new favouritism, back channels and conflicts were created within the industry.'*

From a different perspective, EXP10 and EXP13 observed that many projects within the Libyan oil and gas industry fail as a result of inappropriate selections of contractors; due to corruption in the award of the contract or selection processes based on personal interests and connections rather than on the qualifications and long term reputation of the contractor. EXP13 therefore stated that *'There are some projects that have succeeded. We also have many failed projects, some of which have remained unfinished for 14 years. The main reason for this I think is corruption.'* EXP10 provided an explanation of this type of corruption:

> *Before the revolution, the number of bidders (or contractors) was very limited due to corruption; for example, if I was a contractor, I would know that it is costly to prepare a bid, costing 1.5 or 2 million dinar for a project of 500 million, and due to corruption I would know that they had already selected another contractor so I would lose. From the beginning, these contractors would avoid the risk of entering a bid, which is why we had a limited number of bidders. On the other hand, after the revolution, as a result of the security*

*situation, many contractors refuse to do business in Libya. Other contractors only agree to work on our offshore projects; we have two main contractors working in that area without problems. But for our onshore projects, it is not safe, so no contractor will come.*

Meanwhile, the appointment of unqualified people to leadership positions, as a result of corruption, also has negative consequences and limits the effectiveness of project risk management processes, because these individuals often lack the required skills or even awareness of the concept.

As it was shown in the subsections above, various challenges limit the effectiveness of project risk management in the Libyan oil and gas industry; Table 5-4 provides a summary of the main findings from this section.

Table 5-4 Summary of key challenges that limit the effectiveness of project risk management

| Theme/Concept | Key findings |
| --- | --- |
| Main challenges | • All respondents highlighted the main challenges limiting the implementation or effectiveness of project risk management practices within the NOC, including the lack of knowledge and experience among practitioners, a lack of senior management support, resistance to change, the lack of structured training plans, a lack of coordination and cooperation, and the lack of a management system. |
| Challenges due to the unstable security and political situation | • Most of those interviewed mentioned a list of security and political factors that influenced NOC, limiting the effectiveness of project risk management practice in particular. These factors included limited financial resources, the departure of |

| | |
|---|---|
| | companies and of experts from Libya, loss of access to the NOC's facilities, poor project performance and corruption. |

## 5.5 Suggestions for developing effective project risk management processes

The aim of this section is to present the findings from the suggestions proposed by interview subjects for developing effective project risk management process in the Libyan oil and gas sector. This section is designed to help in achieving the final objective of this research project. The answers offered by participants were generally similar and covered four main themes, including training, workshops and seminars; management systems and risk management frameworks; improving communication inside the NOC and locating the right person in the right place. Figure 5-13 shows a map of the main themes for this section, while figure 5-14 shows the generation of these themes as presented by NVivo. The subsections will provide details on each of these themes.

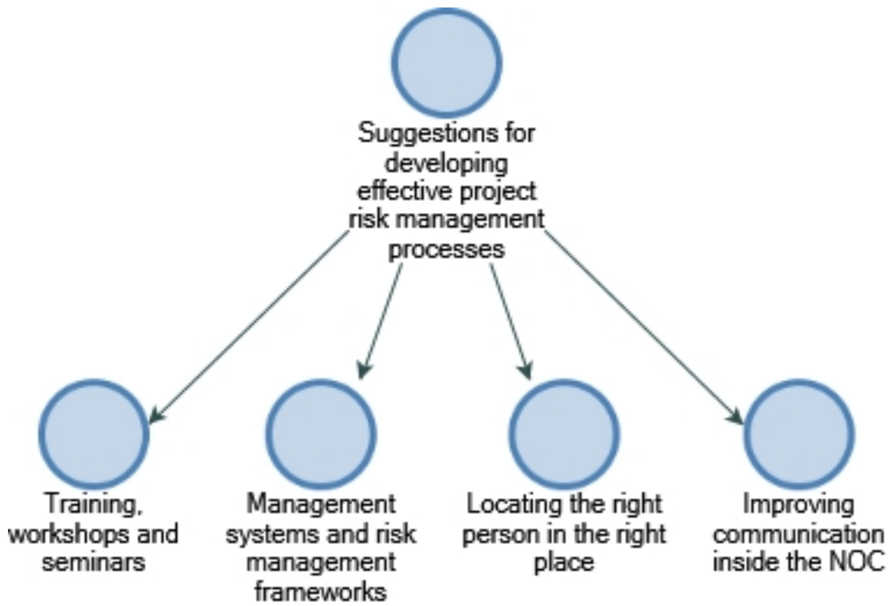



Figure 5-13 Main themes concerning suggestions for effective risk management.

| | | |
|---|---|---|
| Suggestions for developing effective project risk management processes | 10 | 36 |
| Training, workshops and seminars | 8 | 12 |
| Management systems and risk management frameworks | 5 | 18 |
| Improving communication inside the NOC | 2 | 4 |
| Locating the right person in the right place | 2 | 2 |

Figure 5-14 Suggestions for developing an effective project risk management process.

### 5.5.1 Training, workshops and seminars

As described in section 5.4.1, above, respondents described a lack of knowledge and awareness about the concept of project risk management in the Libyan oil and gas industry; therefore, it is not surprising that most of those interviewed mentioned training and workshops as an important factor to enhance project risk management effectiveness. Participants EXP1, EXP10, and EXP11 all focused on training and development programs for project risk management to increase the knowledge and understanding of this concept. EXP4 also stated that they should focus on workshops and seminars, and further proposed annual conferences where all companies would gather to share their experiences in managing risks; this would increase awareness of project management and project risk management concepts and practices in the Libyan oil and gas industry.

### 5.5.2 Management systems and risk management framework

The lack of effective management systems within the oil and gas industry in Libya had led a number of those interviewed (EXP1, EXP6, EXP8, EXP10 and EXP12) to suggest the importance of establishing management systems able to support the daily activities of the NOC as well as enhancing project risk management practices. For example, EX6 suggested that the main long-term goal for the NOC should be trying to achieve and implement a management system that would provide all the necessary details about projects, whether concerning risk management or other aspects. EXP6 stated, *'All companies in the Libyan oil and gas industry must follow a systematic management system approach which would provide details and personnel responsible for all parts of this system, and also provide an appropriate* *mechanism for control.'* EXP10 and EXP12 also shared the benefits they saw in having a systematic approach or framework for project risk management; EXP12 declared: *'I hope to see a systematic approach or a framework for project risk management'.* In addition, EXP10 believed that having this systematic approach in management would lead to better project performance.

### 5.5.3 Improving communication inside the NOC

As discussed in section 5.4.5, a number of respondents pointed out the lack of communication and coordination between departments and individuals as one of the challenges facing the Libyan oil and gas industry. Two of those interviewed (EXP8 and EXP13) suggested improving communication and cooperation between team members to achieve project objectives and increase the chances of project success. For example, EXP13 declared that the most important thing is the need for cooperation among team members, to ensure that the whole team works together to meet the objectives of the project.'

### 5.5.4 Locating the right person in the right place

Corruption is among one of the challenges the Libyan oil and gas industry faces, as pointed out by many of interview subjects (see section 5.4.7.5). To this end, EXP8 and EXP10 suggested that one way to fight corruption would be to appoint the right people to the right positions. As EXP10 indicated that, it is very important to put the right person in the right place; in addition, the NOC should have criteria for choosing project managers.

This concludes the presentation of findings derived from analysis of the semi-structured interviews. Overall, these four sections have provided detailed information about the current practises of project risk management in the Libyan oil and gas industry and the challenges that limit the effectiveness of these practices. The next section will present the findings of the review of documentary and archival evidence.

## 5.6 Review of documents

The investigation and analysis of documents related to project risk management will enhance the findings based on interviews, providing more of the benefits and advantages of case study approaches. According to Yin (2014), the selected information should be significant and relevant to every case study theme. Documents studied as part of this research project include such NOC documents as training plans, management board, HSE, and policy documents. In addition, legislation, financial reports annual reports and other publications were examined. All these documents were reviewed in detail as part of the NOC case study and have been analysed to triangulate support for the findings arrived at from the interviews. Figure 5-15 shows a map of the main themes that were derived from the review of documents. Each of these themes will be discussed in details in the following subsections.

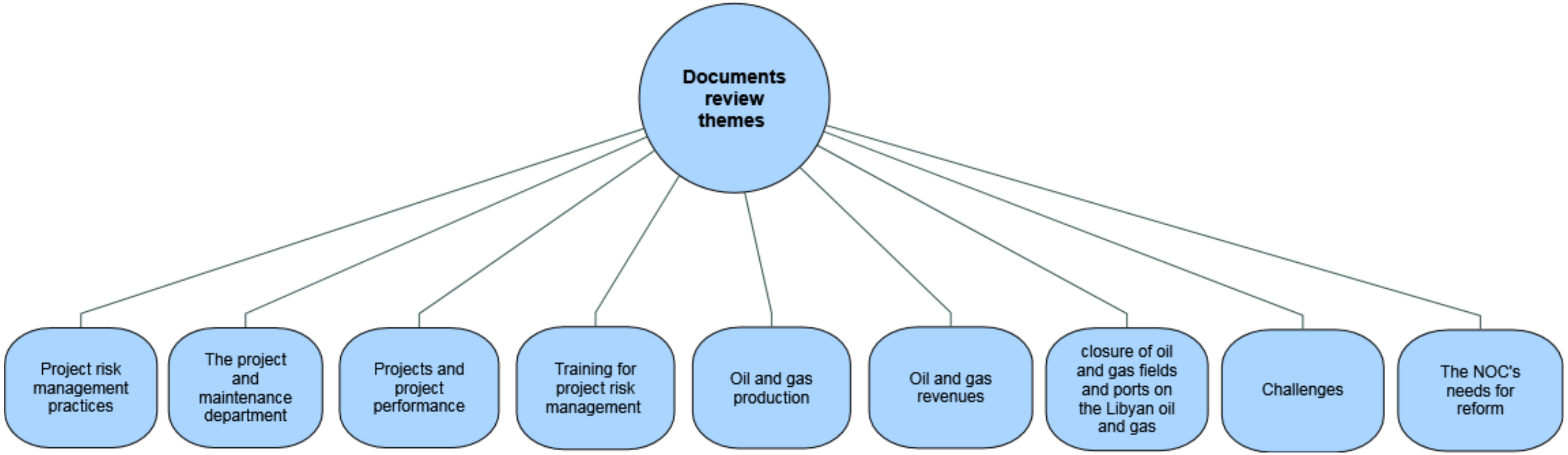



Figure 5-15 Main themes concerning document review

### 5.6.1 Project risk management practices

After detailed review of various documents, policies and archival records related to current risk management practices within the NOC, the researcher concluded that no clear official or systematic approach has been documented that could structure or be used as a guidance for project risk management practices in the organisation. In addition, the researcher observed that the only focus on risks within the industry concerned those related to the health and safety of workers and those impacting on the environment, but did not address other project risks that affect schedules, cost and quality of production.

The HSE department within the NOC therefore sets all rules and regulations (NOC, 2008) related to the management of risks which might have an impact on the safety of employees working within the industry, as well as risks that could impact the environment. The main roles and goals of the HSE department can thus be summarised as follows:

- enforcement of procedures and regulations concerned with general safety, as well as the protection of the company, users and employees from all injuries and accidents;
- assuring the commitment of the department to encourage a culture promoting HSE;
- ensuring continuous improvement of risk management programmes related to the health and safety of employees, contractors and others who may be exposed to the effects of the company's operations;
- training for all employees on health, safety, pollution and environmental protection rules and practises;
- guaranteeing a safe work environment for all employees;
- ensuring the transparency and accuracy of information related to performance reports on HSE practices;
- providing technical advice related to health and safety on new project proposals;
- supporting the use of renewable and sustainable sources of power;

- analysing of all accidents that occur, identifying their causes, preparing reports and working to avoiding similar accidents in the future.

Therefore, the conclusion is clear that the only focus within the NOC is related to risks with an impact on HSE, rather than other types of risks that jeopardise a project. Accordingly, the next subsection deals with the guidelines on how to perform an Environmental Impact Assessment (EIA), to identify and asses any risks that have an effect on the environment.

#### 5.6.1.1 NOC's Environmental Impact Assessment guidelines

According to the NOC guidelines (NOC, 2006), the EIA is defined as *'a process to identify, communicate, predict and interpret information on the potential impacts of proposed activities on the environment, including the impacts of human activities … the assessment should provide an evaluation of the potential risks and impacts associated with the proposed activities'* (p.1).

The EIA process applies to both onshore and offshore projects according to the same fundamental approach, although there might be slight differences according to the nature of the project. The procedure and method used for a project must comply with the NOC Health, Safety and Environmental Department's EIA guidelines (NOC, 2006), which illustrate the sequence to be applied in preparing for the environmental assessment report, and in developing operational control and environmental protections measures. Therefore, an objective of the EIA is to ensure that, during the planning phase, full attention is paid to each of the following, with the aim of eliminating or mitigating environmental damage:

- identifying risks and potential impacts of proposed activities;
- applying procedural controls;
- reducing or eliminating risks whenever possible;
- minimising mitigation costs.

The guideline also provides general steps for conducting an EIA, as follows:

- scoping – define the ecosystem, the zone of disturbance likely to be produced by the activity, and the relevant land use;

- assessment – predict impacts and identify mitigation measures;
- consultation – consultation and coordination with the NOC Health, Safety and Environment department is carried out during scoping and assessment;
- follow-up – ensure measures to be implemented.

The continued focus on the importance of assessing the impact of risks related to individual health and safety, as well as the environment, is also clear in Libyan law at the national level (Law No. 15/2003 and Law No. 93/1976). Details of both decrees will be provided in the next subsections.

#### 5.6.1.2 Law No. 15/2003

In addition to the rules and procedures of the NOC regarding HSE policies and guidelines, the government also recognised the importance of these policies through the Law of Protection and Improvement of the Libyan Environment (Law No. 15/2003) ("Law on Environmental Protection," 2003). This law replaced the previous Law No. 7/1982 on the protection of the environment. Law No. 15/2003 consists of eleven main chapters and a total of 79 articles. The aim of this law was:

- to control the environment for the purpose of protecting it from pollution and improving it, as the environment is home to mankind and all other living creatures;
- finding appropriate ways to measure pollution, working to maintain the balance of the natural environment and preventing and combating pollution and the various forms of damage resulting from it;
- improving the framework and conditions of life, and developing practical plans and programs for that purpose;
- promoting sustainable development, benefiting from natural resources and making optimum use of them.

#### 5.6.1.3 Law No 93/1976

While Law No. 15/2003 focused on the protection and improvement of the environment, Law No. 93/1976 ("Law on Industrial Security and Labour Safety," 1976) was concerned with Industrial Security and Labour Safety. The law consisted of 22 articles. It stressed that the employer (regardless of industry) shall be obliged to take all the precautions necessary to protect workers and others present at the workplace from all workplace hazards, workplace injuries and diseases that might occur.

The two laws mentioned above stressed the importance of identifying, assessing and putting in place all the precautions necessary to protect workers as well as the environment. To this end, they can be considered to have mandated some sort of project risk management practices; however, again it seems that their only focus was on risks related to health, safety and the environment, as discussed previously in section 5.6.1.

### 5.6.2 The Projects and maintenance department of the NOC

The department of projects and maintenance is one of the most important departments within the NOC, because the department is responsible for all projects within the oil and gas industry in Libya. Project risk management practices are therefore relevant to its daily project management activities. The aim of this department is outlined in its governing documents (NOC, 2016) as follows:

- monitoring and follow-up for regular capital projects and oil company development;
- co-ordinating with oil companies regarding the rationalisation of regular capital and development budgets;
- conducting site visits for all projects;
- monitoring and follow-up on companies' responses to technical inquiries and notes;
- monitoring and follow-up with companies regarding improvement to the environmental status of oil fields;
- following up with companies with regard to a more rapid reduction of gas burning at production facilities;
- following up on maintenance work and construction by oil companies;
- participating in committees and accident teams assigned by the NOC to investigate all accidents and problems that occur in oil fields and other facilities of oil companies;

- participating in studies and development committees such as:
    - the natural gas committee.
    - the asset and asset management committee;
    - a committee studying the quantities of gas burned in hydrocarbon production;
    - a committee studying the alternatives available regarding water exploitation in hydrocarbon production;
    - a committee studying the development of discovered and undeveloped hydrocarbon reserves.

However, reviewing the current project risk management practices within the department, the found no systematic official approach, guidelines or steps to manage projects in general or no conduct project risk management practices in particular. By contrast, the only focus or practices ready to be followed are those related to HSE risks in projects, as previously discussed in section 5.6.1.

Accordingly, one could argue that, without proper project risk management practices in place, the performance of many projects in the Libyan oil and gas sector could be jeopardised, especially given the difficult security and political situation in the country where project risk management should be given high importance. The next sections will outline current capital and major development projects, as well as the performance of already executed projects.

### 5.6.3 Projects and project performance

#### 5.6.3.1 Capital projects

According to the NOC official reports (NOC, 2016), there are over 560 projects already committed (budgets approved) since 2010. Many of these projects have already started. Most of these are expected to be completed between 2015 and 2020. Over 200 of these projects are ‘new’ projects, recommended for the NOC’s approval by its operating companies (subsidiaries) in 2016. Figures 5-16 and 5-17 present these projects, both those already approved and those recently proposed projects, according to their distribution among the NOC’s subsidiaries. Typically, the NOC’s annual approved budget for these projects is over 500 Million US dollars. The projects aim to achieve the following:

• maintain production facilities;

• maintain oil and gas distribution and export pipelines and tank farms;

• reduce gas burning (flaring) to make more of it available for utilisation;

• undertake small to medium power generation projects;

• undertake projects related to HSE.

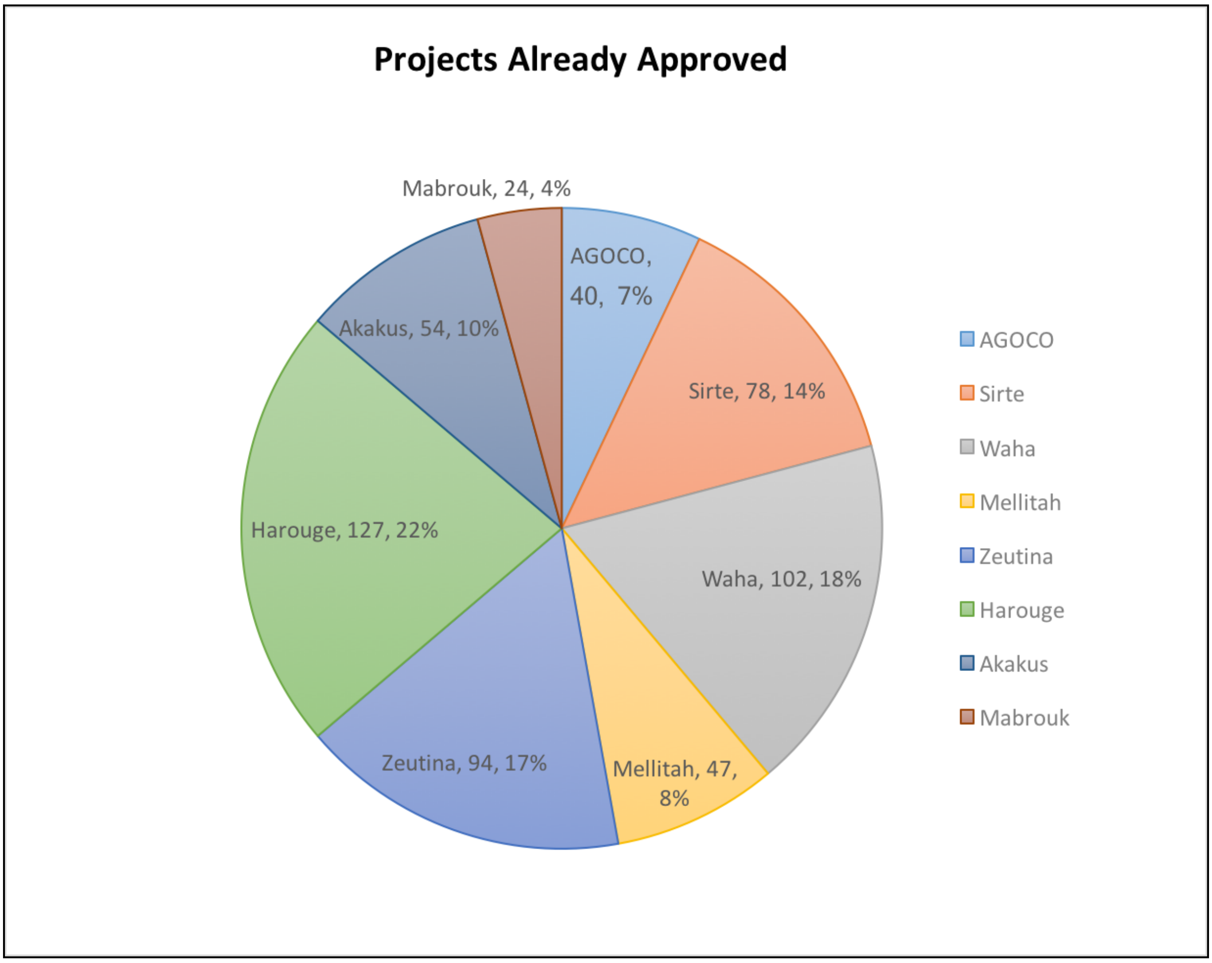



Figure 5-16 Oil and gas projects already approved by the NOC (NOC, 2016).

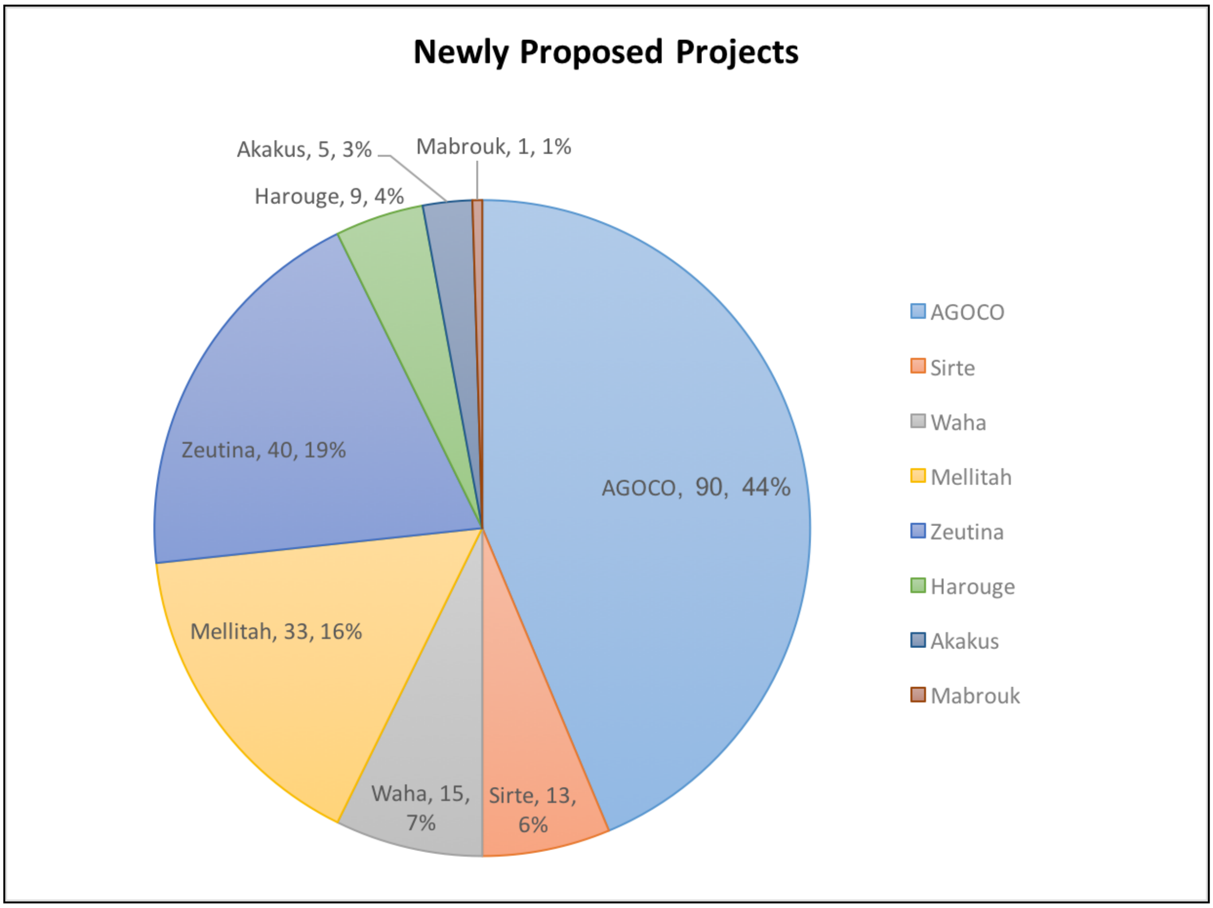



Figure 5-17 Newly proposed projects waiting for approval by the NOC (NOC, 2016)

#### 5.6.3.2 Major development projects

On the other hand, in terms of large-scale developments, there are a total of 56 “major” projects. Typically, the NOC has approved an annual budget for these projects of up to 1.7 billion US dollars (with over 10 billion dollars to be spent in the period 2015-2020). Figure 5-18 presents these major projects according to their distribution among the NOC’s subsidiaries. In general, these projects target the following:

- development of discovered oil fields to increase reserves and production;
- redevelopment (revamping/upgrading) of producing fields;
- development of gas discoveries and gas utilisation projects;
- increasing electric power production capacity in the fields.

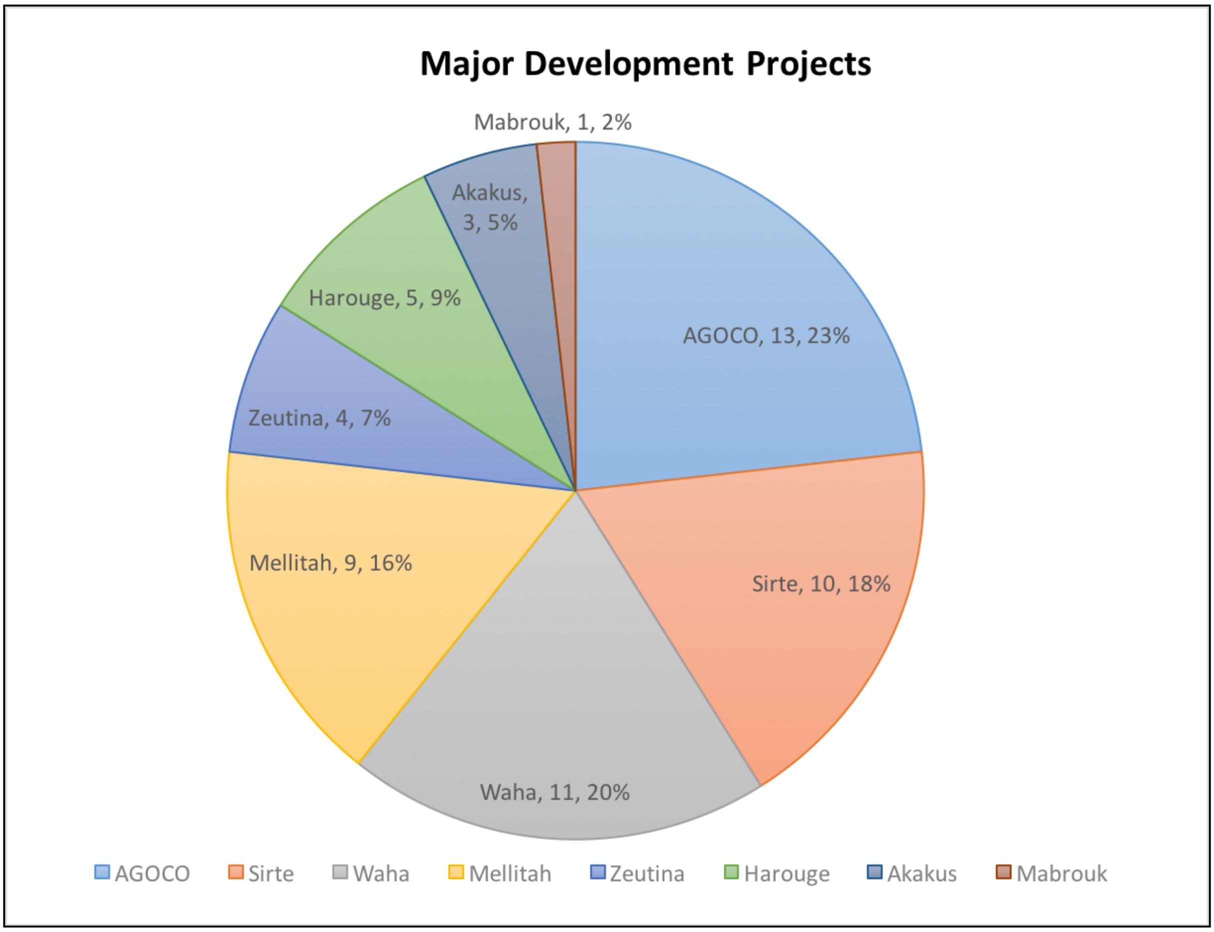
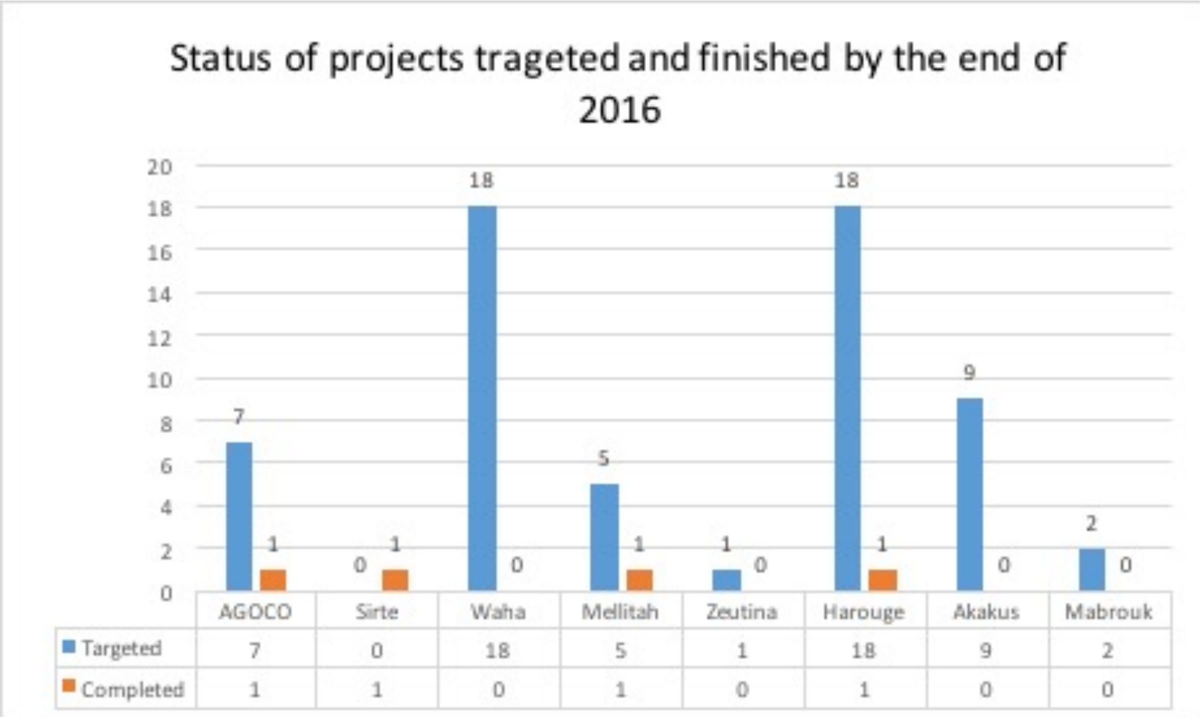



Figure 5-18 Major projects according to their distribution among the NOC's subsidiaries (NOC, 2016)

**5.6.3.3 Project performance**

According to internal reports (NOC, 2016) the NOC has conducted on the current status of existing projects within the Libyan oil and gas industry, the performance of these projects is not promising. Figure 5-19 shows the projects targeted and finished by the end of 2016. It is clear that more than 95% of projects were not delivered on time, which naturally has an effect on the budget as well, notably because many of these projects are executed by international contractors and the NOC is liable for any costs arising from delays.




| | AGOCO | Sirte | Waha | Mellitah | Zeutina | Harouge | Akakus | Mabrouk |
|---|---|---|---|---|---|---|---|---|
| Targeted | 7 | 0 | 18 | 5 | 1 | 18 | 9 | 2 |
| Completed | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |

Figure 5-19 Projects targeted and finished by the end of 2016 (NOC, 2016).

Therefore, it is clear that the NOC has a large number of important projects presently underway and planned for the future as part of its development goals. However, it is also clear that the current performance of many of the projects in the oil and gas industry in Libya are not very promising, which could be rooted in the lack of effective project risk management practices. To this end, training and development would be essential in establishing an effective project risk management process within the industry. The next section will therefore focus on the availability of training programmes for project risk management.

### 5.6.4 Training for project risk management

The Libyan oil and gas sector is keen to encourage and assist employees to improve their skill level, in accordance with their specialisation, in order to increase their competence and skills within their current jobs and in light of future transfer or promotion to new roles according to sectoral plans and strategies. This objective is clearly stated in the training and development regulations of the NOC (NOC, 2013). Therefore, these regulations establish goals to be taken into consideration, as follows:

- provide personnel capable of carrying out and supporting tasks essential to oil and gas activities;
- develop the efficiency and capacity of the workforce of the NOC and its subsidiary companies in line with developments in the oil and gas sector and in order to raise the level of production and related scientific knowledge;
- ensure the availability of personnel qualified to lead operations and implement specialised projects;
- provide for the requirements of labour turnover and to compensate for losses in the sector's workforce;
- meet the labour requirements of future development plans and newly arising projects;
- achieve the Libyanisation of roles currently held by non-Libyans;
- cooperate with international companies to transfer advanced technologies into the Libyan oil and gas sector.

This regulation states that departmental managers are responsible for providing their employees with the training necessary, in accordance with an approved training plan. The department of human resource development sets an annual training and development plan in cooperation with each departmental manager. The preparation of this plan begins on the first of June and ends at the end of August of each year and is submitted to the NOC at the beginning of September for consideration and adoption – if approved, the execution of the plan should start in January of the following year. The regulation states that during the preparation of the plan the following requirements must be met:

- focusing on training and development programs that can be implemented locally inside or outside the company and in cooperation with specialised educational and training institutions or through cooperation and exchanges between companies, without resorting to training abroad except where training is not possible locally;
- clarifying the training and development objectives of each trainee (the employee's intended career path), indicating whether training is intended to raise the level of employee performance and accuracy, thus increasing

production, whether training is focused on new workplace systems or whether training aims to prepare the trainee for another job, by transfer or promotion;

- determine thing appropriate duration of training that does not affect operational requirements;
- establishing the training subjects or topics, locations (locally or abroad) and duration, for candidates included in the plan;
- estimating the budget to implement the plan.
- carrying out a comprehensive and complete evaluation of the plan for the previous year, to identify lessons learned which can be used to prepare the next year's plan;
- taking into account the general training and developments directives issued by the NOC from time to time.

While these points provide general statements establishing the emphasis the NOC puts on its training and development programmes, nevertheless, it does clearly mandate any training on project risk management, while the regulations do state clearly that departmental managers are responsible for providing their employees with the training required. By reviewing the departmental plans, the researcher concluded that in fact there is a lack of training provided on project risk management.

#### 5.6.4.1 Law No 77/2008

In line with the NOC’s training and development regulations, law No, 77/2008 ("Training and development regulations," 2008) is a Libyan state decree establishing training and development requirements for all businesses directly financed by the country’s public treasury (including the NOC). This law supported the previously established law No. 97/1990. Law No 77/2008 (“Training and development regulations,” 2008) defined training as follows: *‘To prepare, qualify and raise the efficiency of individuals by providing them with abilities, skills and change in their behaviour to fill a quantitative or qualitative deficiency in the general administrative units.*’ (p.1). It also set the following training aims to be achieved:

- increasing the skills and knowledge of the trainee, and providing him or her with the pillars that would qualify him or her to be promoted to higher positions;
- ensuring effective work performance while filling gaps between performance standards determined by managers and the actual performance of employees;
- reducing work turnover and reducing industrial accidents caused by the inefficiency and the technical and skills limitations of employees;
- raising the morale of trainees and motivating them to work and to contribute to increased production;
- improving the behaviour of trainees, enabling them to use different methods in performing their business activities;
- reducing workplace accidents;
- ensuring the continuity and stability of the organisation.

Similar to the NOC training regulations (discussed in section 5.6.4), law No. 77/2008 does not explicitly mandate training in project risk management, but it establishes the goals and importance of training as increasing the knowledge and skill levels of all employees to ensure more effective performance.

However, as Libya's national income almost fully relies on the revenues from hydrocarbon production, budgets for training on project risk management, and other resources that support the effective implementation of project risk management practices, are limited to the budget available. The next two next sections (5.6.5 and 5.6.6) therefore provide additional detail on Libya's hydrocarbon production and revenues, as well as the documenting the consequences and effects of interruptions of hydrocarbons production.

## 5.6.5 Oil and gas production

### 5.6.5.1 Crude oil production

According to the Libyan Audit Bureau (LAB) 2016 (LAB, 2016) annual report, the quantities of crude oil produced during 2016 were dramatically less than in previous years, reaching more than a 77% decline compared to 2012. The quantities of crude oil produced between 01/01/2016 and 30/11/2016 totalled 119,134,030 barrels, representing approximately 22% of 2012 oil production levels. Therefore, the amount of this oil production deficit between 1/1/2016 and 30/11/2016 reached a total of 375,196,971 barrels. Table 5-5 below outlines the production of crude oil from 2012 to 2016.

Table 5-5 Production of crude oil from 2012 to 2016 (LAB, 2016)

| **Year** | **Production (barrels)** | **Daily targeted production (1000 barrel)** | **Actual average daily production (1000 barrel/day)** | **Percentage change from previous year** |
|---|---|---|---|---|
| 2012 | 530,697,677 | 1,470 | 1,449 | - |
| 2013 | 362,527,682 | 1,700 | 993 | (41%) |
| 2014 | 175,161,756 | 1,752 | 480 | (52%) |
| 2015 | 124,537408 | 1,470 | 410 | (29%) |
| 2016* | 119,134,030 | 1,000 | 355 | (3%) |
| *from 01/01/2016 until 30/11/2016 | | | | |

#### 5.6.5.2 Natural and condensate gas production

According to the LAB (2016) annual report, the production of natural gas during the period from 1/1/2016 to 30/11/2016 was about 705,181.5 million cubic feet, while the production of condensate gas reached 18,592,085 barrels between 1/1/2016 and 30/11/2016. Table 5-6 outlines the production of natural and condensate gas for the years from 2012 to 2016. It can be noted from the table that the gas production was not effected dramatically when compared with the production of crude oil.

Table 5-6 Production of natural and condensate gas for the years from 2012 to 2016.

| **Product** | **Units** | **2012** | **2013** | **2014** | **2015** | **2016*** |
|---|---|---|---|---|---|---|
| Natural Gas | Million Cubic Feet | 861,270.8 | 807,885.9 | 741,779.0 | 787,293.06 | 705,181.5 |
| Condensate Gas | Barrels | 21,560,865 | 19,626,880 | 18,524,638 | 19,429,854 | 18,592,085 |
| *from 01/01/2016 until 30/11/2016 | | | | | | |

### 5.6.6 Oil and gas revenues

The total revenue obtained from the sale of crude oil, gas and petroleum derivatives reached $4,736,111,167 (US) in 2016, showing a decline in the total revenues compared to previous years. Table 5-7 shows the revenues from 2012 to 2016 according to the marketing department at the NOC (LAB, 2016).

Table 5-7 Oil and gas revenues for 2012–2016 (LAB, 2016)

| Year | Amount in millions of USD | | | | | Total revenue (USD) |
|---|---|---|---|---|---|---|
| | Crude Oil | Gas | Products | Petrochemicals | Plastics | |
| 2012 | 40,644 | 2,984 | 1,964 | 116 | 3 | 45,710,799,359 |
| 2013 | 31,525 | 3,041 | 1,312 | 150 | 10 | 36,037,828,182 |
| 2014 | 11,748 | 2,758 | 793 | 109 | 0 | 15,408,283,506 |
| 2015 | 5,456 | 1,645 | 442 | 67 | 0 | 7,608,810,027 |
| 2016 | 3,715 | 540 | 408 | 33 | 0 | 4,736,111,167 |

From the above tables, it is clear that oil and gas revenues have dropped dramatically between 2012 and 2016, as a result of low global oil prices during the recent two years, as well as the closure of oil fields and ports which have caused the country to produce and bring to market fewer hydrocarbons (see section 5.6.5). The effect of the closure of oil and gas fields and ports will be discussed in greater detail in the following section.

### 5.6.7 Effects of the closure of oil and gas fields and ports on the Libyan oil and gas industry

The Libyan economy is highly dependent on oil and gas operations, which contribute up to 95% of national income. The main reason for the deterioration of the country's economic situation is the significant decline in oil and gas exports. This decline resulted from the closure of oil and gas fields and ports by the Libyan Petroleum Facilities Guards (PFG) since mid-2013, limiting the country's ability to export hydrocarbons and thereby reducing the economic returns for oil and gas production (LAB, 2016).

#### 5.6.7.1 Estimated financial losses due to the interruption of hydrocarbon production

The value of losses in accruing to the production of oil and gas and their derivatives in Libya, between the beginning of the closure of oil fields and ports in mid-2013 until the end of 2016, is estimated at about 107.2 billion dollars US. The main reason for this loss, according to the LAB, is the closure of the fields and ports by the PFG, as well as other reasons presented in Table 5-8 and Figure 5-20 below:

Table 5-8 Causes and total losses of fields and ports closure (LAB, 2016)

| **Cause of losses** | **Total losses** | | **Percentage** |
|---|---|---|---|
| | **Quantity (million barrels)** | **Value (billion dollars US)** | |
| PFG | 1,125 | 80.25 | 75% |
| Strikes | 210 | 14.98 | 14% |
| Armed militias | 120 | 8.56 | 8% |
| Technical problems | 45 | 3.21 | 3% |
| **Total** | **1,500** | **107** | **100%** |

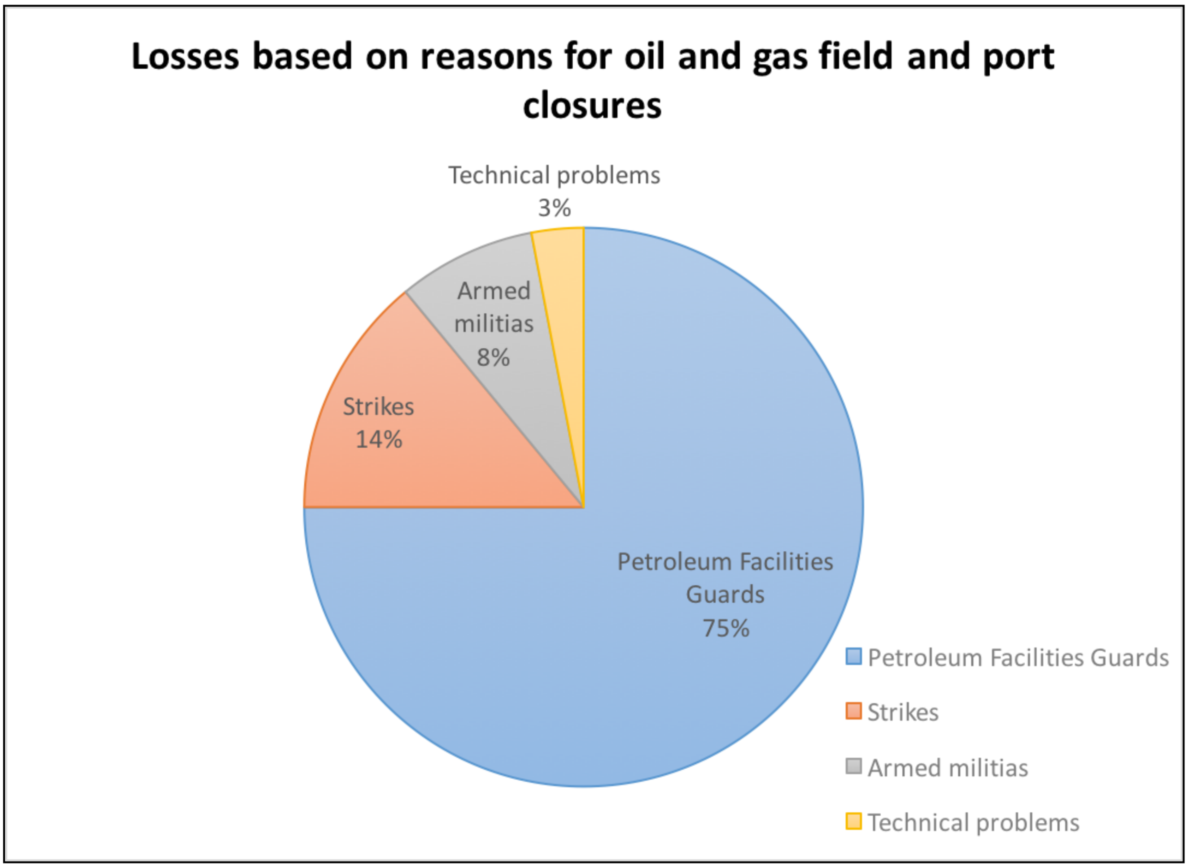



Figure 5-20 Reasons for oil and gas field and port closures (LAB, 2016).

According to the LAB 2016 report, the effects of the closure of many oil and gas fields and ports was not limited to the financial revenues of the country, but affected other aspects of the industry, including:

- exploration;
- production costs;
- sustainable development;
- global market share.

Each of these aspects will influence the implementation of project risk management directly or indirectly (as will be discussed in Chapter 6). The following subsections introduce details concerning each of these aspects.

**5.6.7.2 The effect on exploration**

Between the 2000 and 2010, Libya increased its hydrocarbon reserves by approximately 12 billion barrels, as a result of drilling exploration activities. These activities are important, as they compensate for the volume of hydrocarbons being extracted over the years. However, due to the country's unstable security and political status, these activities have decreased sharply since mid-2014, a time when *force majeure* was declared and approximately 20 exploration companies left the country. Figure 5-21 represents exploration drilling activities from 2011 to 2016.

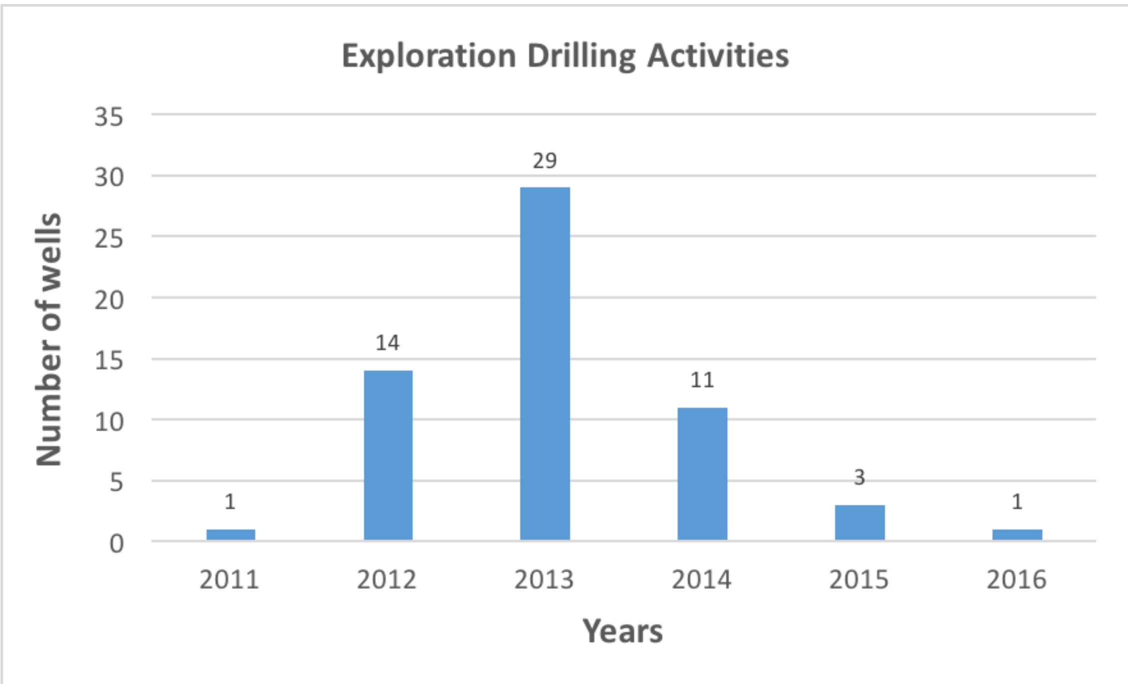



Figure 5-21 Exploration drilling activities from 2011 to 2016 (LAB, 2016)

#### 5.6.7.3 The effect on production costs

In the year of 2010 the average cost to produce one barrel of oil in Libya was about 4 dollars US; this number more than doubled to about 8.8 US dollars during the Libyan revolution (2011). Soon afterwards, the figure decreased again to normal (2010) production cost. However, since many oil and gas fields and ports were closed in mid-2013, the cost of remaining production has increased dramatically to reach more than 18 dollars US per barrel.

#### 5.6.7.4 The effect on sustainable development

Many international companies have agreements with the NOC, in which these companies contribute to projects, training and rehabilitation programs in coordination with NOC requirements. However, most of these companies were affected by the security situation in the country and stopped or suspended their projects and training programmes.

#### 5.6.7.5 The effect on global market share

Libya contributes significantly to the fulfilment of the world's oil and gas requirements; many counties, especially in Europe, have entered long-term contractual agreements to secure their supply of Libyan hydrocarbons. The interruption in exports to these markets have lead these buyers to find alternative sources of oil and gas to compensate for the Libyan oil and gas market share. As a consequence, even if Libyan oil and gas production were to resume its normal rate of production, it would be difficult for the country to restore its reputation and market share, which could lead to further losses as the NOC attempted to sell hydrocarbons at preferential rates, leading in turn to further financial losses which would not have happened if risk management practices were in place.

The above sections show that the closure of many oil and gas fields and ports have affected the oil and gas sector in Libya dramatically, having a direct impact on the country's revenues which indirectly influence the implementation of project risk management practices. The next section will provide a summary of the main challenges that the Libyan oil and gas industry faced.

## 5.6.8 Challenges

The oil and gas sector suffers from problems, technical challenges and financial difficulties that limit the implementation of its plans and programs. These challenges result from the institutional division and the entanglement of many parties in the affairs of the NOC, in addition to the intervention of the PFG in its production and its subsequent impact on technical operations of the sector. The main challenge is the security and political situation of the country, which has affected the country's oil and gas industry significantly, as noted in official reports offered by the 2016 audit bureau (LAB, 2016). This report summarised the reality of the Libyan oil and gas sector, as follows:

- the appointment of large numbers of unskilled workers in the oil and gas sector, resulting in lower efficiency and higher production costs;
- long delays in many fields that resulted in the deterioration of surface equipment due to corrosion, as well as the depletion of oil and gas distribution networks;
- many oilfields and ports have been shut down as a result of multiple problems, leading to huge financial losses for the NOC.
- Libya's share of the world's crude oil has decreased in favour of other producing countries;
- the sector was exposed to direct financial losses due to the closing of ports and oil and gas fields and the suspension of exports that could have been made between 2013 and 2016.

The above points summarise the main challenges that the oil and gas industry is facing. In response, the NOC must reforms certain aspects of its practices; the next section will provide an explanation of such requirements.

## 5.6.9 The NOC's needs for reform

The NOC recognises the importance of the need for continuous improvement and development within the Libyan oil and gas industry. These improvements should include the implementation of effective project risk management policies and procedures. The following needs will be mentioned in relation to the development of project risk management practises. As Libya starts to increase its production again, a variety of organisational and technology needs will arise in the immediate future, in the following areas (Hawisa, 2015):

#### 5.6.9.1 Corporate reforms and reengineering requirements

- Develop and document comprehensive policies, procedures and control.
- Develop and empower the board, management and other decision-making structures.
- Improve transparency.
- Improve record keeping, document management and data structures.
- Establish effective enabling functions, including:
    - Finance and accounting;
    - Procurement and supply chain;
    - IT.

#### 5.6.9.2 HR requirements

- Establish effective HR functions including training for HR staff.
- Define and implement a talent management strategy covering local talent, contractor management and leadership succession.
- Build a capability and a competency development framework (including core, technical and leadership competencies).
- Define and implement learning solutions including the design and delivery of a targeted training programme.
- Develop and implement employee rewards and incentives and engagement and retention schemes.
- Define and implement employee communications and change management plans.
- Develop appropriate job description and competency profiles.

#### 5.6.9.3 Technology needs

##### 5.6.9.3.1 Offshore field development

- Innovative capabilities - offshore mega projects development require technologies that deal with:

    - Optimising value in the field with particular attention to possible trade-offs between investment and operating cost;
    - Special alloy materials;
    - Special attention to platform/subsea design.
- Project management know-how (including liaison with vendors, construction yards, certification authorities, etc...) – NOC companies expect to be involved in the following markets/technologies:
    - Design engineering;
    - Equipment manufacture;
    - Offshore drilling;
    - Offshore pipelines and umbilical;
    - Jacket and topside construction**;**
    - Offshore installation.
- Propriety platform design.
- Proven track record in engineering and construction.

**5.6.9.3.2 Onshore field development**

- Strong process engineering capabilities (for example: Mellitah plant is expected to be one of the world's largest and hence specific engineering expertise will be required).
- Propriety technologies (sweetening, etc.).
- Project management (planning, IT tools, etc.; some are schedule-driven projects related to gas contracts that contain specific penalties based on an agreed-upon start-up date)

**5.6.9.4 Security of oil fields needs**

Oil field theft, vandalism, and pipeline right-of-way intrusions are issues that have haunted and still haunt the energy sector. Oil fields make easy targets due to their remote locations. A rapid expansion in communication and monitoring technologies in the last 10 years has created many options for improving security around the fields. Of course, this subject is highly specialised and needs to be discussed by experts in the right forum. Generally, however, technical reports by specialised companies have highlighted various ways technology can increase oilfields security, including:

- remote surveillance;
- gate control;
- leak monitoring and prevention.

The NOC moved to improve the security of the oil fields very early. In 2010, a comprehensive program was proposed by the Oil Facilities Guard to the NOC. The proposal was discussed thoroughly with NOC operators, and a list of over 60 projects was generated covering all the fields in Libya, to fulfil the objectives set by the Oil Facilities Guard. This program was approved with an estimated budget of 170 million dollars US, and partial execution of the program began in 2010. These projects included:

- security fences;
- surveillance systems;
- systems for detection of explosives;
- guard towers;
- security guard houses.

This concludes the presentation of the findings from the document review. The entire discussion was structured to fulfil the objectives of this research project as a whole, and to enhance the findings derived from analysis of the semi-structured interviews. Overall, these sections have provided detailed information about the project risk management practices and training policies inscribed in the NOC's policies and national laws. It provided additional documentation of challenges the Libyan oil and gas industry currently faces, as well as addressing the needs for reforms within the NOC in order to establish effective project risk management processes.

## 5.7 Summary

This chapter began by providing an overview of the case study under investigation (the NOC of Libya) and its importance to the Libyan oil and gas sector. The main aim of this research project has been to investigate the current project risk management practices in the Libyan oil and gas industry. Semi-structured interviews were the main method used to collect data in pursuit of this objective, along with a review of documentary evidence to support the findings arrived at from analysis of the interviews. The chapter was divided into five main sections, the first four presenting the main findings from the semi-structured interviews. These findings were derived from the analysis of interview transcripts, with the help of NVivo 11 software. Finally, a fifth section presented findings derived from analysis of documentary sources.

The analysis of qualitative data and organisation of the chapter were based on fulfilling the objectives of this research project. The next chapter will discuss these findings further, in order to fulfil the final research objective, namely to establish a set of recommendations to enhance the effectiveness of project risk management processes in the Libyan oil and gas industry.

# Chapter 6 DISCUSSION

## 6.1 Introduction

Chapter 5 presented the primary findings from the semi-structured interviews conducted and supported by a detailed document review to achieve the objectives of this research. This chapter is structured as follows:

- First, it will discuss the findings presented in chapter 5 and reflect upon the available literature on project risk management.
- Second, it will establish a set of recommendations for effective project risk management within the Libyan oil and gas industry.
- Third, it will validate the set of recommendations.

## 6.2 Definition of risk

Participants were asked about their understanding of the concept of 'risk'. As indicated in chapter 5 section 5.2.1.1, the term was viewed differently by different participants. A majority of participants perceived risk as representing an uncertain situation, potential negative impact or threat that could affect the project or system. The differences in the ways in which risk is perceived aligns with the academic literature; for example, Haimes (2009) believed that although a significant amount of literature has defined risk and uncertainty, researchers and academic authors have not agreed on a single definition of either term. In addition, the topics of risk and risk management have been studied in numerous disciplines, including economics, management, strategic management and project management, which only adds to the confusion (Ehsan, 2013).

While each participant thought of a risk as a threat, none of them defined it as an opportunity. According to the PMBOK's standard definition, risk can be seen as both a threat and an opportunity: *'Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost and quality'* (PMI, 2013). In other words, risk may have a positive impact on the project, such as a decrease in material cost, which could lower the overall cost of the project.

## 6.3 Project management/project risk management awareness and maturity level within the NOC

### 6.3.1 Project management awareness

The interviews conducted for this research generally indicated that the maturity level of the Libyan oil and gas industry concerning project management and project risk management are below international standards and procedures (see section 5.2.1.2.1). One participant summarised this phenomenon: *'In Libya, and in the oil and gas industry, the culture and the understanding of the concept of project management is not available; if this concept is not presented, then I wouldn't be surprised about the lack of understanding of the topic of project risk management'.* This is echoed in the literature; Sawalim (2015) spoke about his experience as a project manager in the NOC, arguing that the situation now is the same as it was before the civil war in 2011. In addition, Sawalim (2015) claimed that new practices have not yet been developed, so managers still follow the old approach to project management. However, as the oil and gas industry is a dynamic sector driven by technological change, one could argue that thriving in a fast-paced environment requires adherence to international project management procedures. Both Badiru and Osisanya (2013) and El-Reedy (2016) support this argument, stating that project management practices will continue to be developed and the pressure to adopt new methods to handle this rapid development within the industry will increase. The authors stress the need for a consistent and effective technologically driven project management approach because projects within the oil and gas industry are dynamic and complex. However, according to Abouen, Ahmed, and Aouad (2008), the Libyan oil and gas industry fails to meet project management standards. The authors indicate that, in this industry, there is a lack of strategic methodologies by which to adapt project management approaches as well as educational and strategic issues regarding the development of the project manager profession.

Based on the above discussion and the interview findings, it is clear that there is a lack of awareness in the Libyan oil and gas industry regarding project management and its international standards. According to PMI (2013), project management is an important concept as it allows for the systematic usage of knowledge, skills, tools and techniques in order to achieve project objectives. Due to the dynamic and complex nature of oil and gas projects, it is important for the Libyan oil and gas industry to keep up to date with project management science. Hence, project management practices must be well documented and included within the NOC's strategic vision, policies and management.

### 6.3.2 Project risk management awareness

Professional bodies such as the PMI and APM recognise risk management as a core element of the overall project management procedure/process in order to successfully complete any project. However, according to the findings from the interviews (see section 5.2.1.2) and a careful and detailed documentary review (see section 5.6.1), it was clear that there is no structured, written project risk management procedure or framework, nor there is a clear definition of the concept of project management.

With slight differences in the level of detail, scholars and professional bodies generally agree that the project risk management process consists of five steps: 1) risk identification, 2) risk assessment, 3) risk classification, 4) risk mitigation and 5) risk control. According to the PMBOK (PMI, 2013), a structured project risk management process includes five procedures: 'e.g. project risk planning, project risk identification, project risk analysis (quantitative and qualitative), project risk response and project risk control'. However, this research clearly shows that the NOC does not follow these steps, nor does it have a written policy or procedure to allow for effective management of project risks. In practice, risk management is limited to the knowledge and experience of the project manager or project engineer: '*what I mean is: if you were an experienced project manager, you may have some feelings about what might affect the budget, schedule or quality, you find yourself (as a project manager) independently solving these issues on your own terms, without really applying a coherent approach … we do not have this at all'* (see section 5.2.1.2.2). Therefore, identification and assessment of project risks within the Libyan oil and gas industry are mainly based on the efforts of project managers and their teams, not a regulated framework. Project managers must make an effort to implement and facilitate project risk management using a formulated procedure because project risk management is a valuable aspect of project management, increasing the value of other project management processes and offering decision-making support when it is employed with good practice values (PMI, 2009).

## 6.4 Current project risk management practices within the NOC

As discussed in section 6.3, there is no systematic approach guiding project risk management practices within the Libyan oil and gas industry. However, some of the interviewees mentioned that, although they do not follow a systematic written process, the practices recommended in project management literature are applied: '*for many of our projects, we make sure to identify and assess any obstacles that affect the execution of the project or limit the completion rate; we take these issues into consideration and we address them, but we do not follow a systematic written approach'.* In addition, the data findings (see section 5.2.1.2.2 and 5.2.1.2.3) show that most project risk management practices are focused on health-, safety- and environment-related risks and that risks are often transferred to the contractors executing the project via a contract strategy. The interviews also revealed that all project risk management practices in the oil and gas industry focus on identification and assessment of risks and omit the other steps of the project risk management process (i.e. risk planning, risk monitoring and risk control). These practices will be discussed in the following subsections.

### 6.4.1 Sole focus on HSE risk assessment

Some interviewees (see section 5.2.1.2.2) believed that project risk management practices in the Libyan oil and gas industry are limited to identification and assessment of risks related to health, safety and the environment and do not include other risk factors that might have a negative or positive impact on the project. This hypothesis is supported by the NOC's policies, which in turn are supported by national laws and regulations (see section 5.6.1). These documents provide general guidelines for risk assessment and, in line with the interviewees, emphasise the importance of identifying and assessing only risks that could have an impact on

HSE, including those that affect human health, safety and security or the environment (see section 5.6.1.1-3). Project managers within the Nigerian oil and gas industry also tend to prioritise management of risks related to health, safety and environment (Zuofa and Ochieng, 2014). However, project risk management should include planning, identification, assessment, monitoring and control of any risks that might hinder the project, as discussed in previous sections.

### 6.4.2 Contract strategy (risk transfer)

According to the interviewees (see 5.2.1.2.3), many oil and gas projects in Libya are EPC contracts. Oil and gas contracts allocate responsibilities, assignments and risks, and therefore each party understands their duties regarding risk management (Schramm, Meißner, & Weidinger, 2010). EPC contracts are the most common in the oil and gas industry. There are several types of such contracts: EPC, EPC with long lead Items, Engineering, procurement and construction management (EPCM) and progressive lump sum (PLS). Depending on the company's level of willingness to take/share risks, the owner will decide which contract strategy is most suitable. The link between contract strategy and parties' involvement in risks is illustrated in figure 6-1.

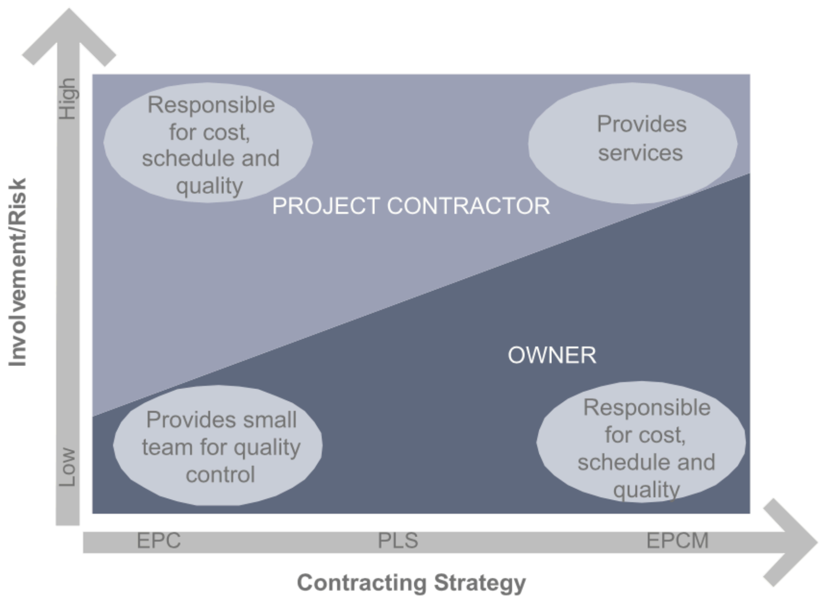



Figure 6-1 Contract strategy vs. risk management involvement

The NOC's management tends to allow the contractor to manage all project risks. Therefore, in many cases, Libyan managers take risk management for granted. However, Krane, Olsson, and Rolstadås (2012) argue that project managers are still responsible for managing project and contractual risks, especially during the early stages of the project. One reason for the poor performance of oil and gas projects is the fact that owners sometimes neglect to delegate and specify contractors' roles and responsibilities (Elliot, 2005). According to the National Research Council (Council, 2005), the owner of the project is responsible for managing all project risks because he or she ultimately decides whether to go ahead with the project and thus is responsible for identifying, assessing, mitigating, controlling and monitoring project risks. Although, in EPC contracts, most of the risk is transferred to the contractor, Bali and Apte (2014) stress that it is important for all project stakeholders (including the owner) to participate in project risk management to ensure successful completion of the project. Therefore, the NOC should support all parties' early involvement in risk management.

## 6.5 Individuals involved in the project risk management process within the NOC

Effective project risk management requires the involvement of all project team members in order to ensure that all risks are identified, assessed and controlled. According to the Practice Standard for Project Risk Management published by PMI (2009), project risk management is an essential part of all project management activities/processes (Olsson, 2007), and hence all stakeholders who are interested in achieving the project's objectives should participate in the project management process. However, this research (see section 5.2.2) has revealed a variety of opinions regarding the involvement of different individuals (e.g. project engineers/manager, experienced and qualified individuals, members of the HSE department and external consultants) in risk management for projects within the Libyan oil and gas industry, and it was clear that not all stakeholders participate in the project risk management process. Several authors (Ekung & Effiong, 2014; Krane et al., 2012; Loosemore & Phua, 2010; PMI, 2009) note the importance of early stakeholder involvement in the project risk management process. Handfield, Primo, and Oliveira (2015) believe that early involvement allows for the identification of more project risks, leading to a better project outcome.

Although the project manager is responsible for bringing together all stakeholders in the project risk management process (PMI, 2009, 2013), none of the respondents in this research noted the importance of stakeholder engagement. Within the NOC, the effectiveness of project managers appears to be limited, possibly due to the fact that stakeholders' roles and responsibilities in projects are not clearly written or outlined. The PMI (2009) clearly states the project manager's duties:

- Ensure the support of senior management for project risk management.
- Promote, encourage and participate in all project risk management procedures.
- Work with all project stakeholders to define an accepted level of risk for the project.
- Frequently update important stakeholders on the status of risks and develop strategic proposals to keep risk at an acceptable level.
- Supervise subcontractors' risk management.
- Establish a risk management plan.
- Support open and honest communication about risk within the project team and among stakeholders.
- Ensure that any identified risks that are outside the control and authority of the project manager are reported to senior managers.
- Approve project risk responses and related activities before their execution.
- Monitor the effectiveness and efficiency of risk management practices.
- Review the effectiveness of risk responses and document the lessons learned during the risk management process.

In addition to these responsibilities, the project manager must have excellent team formation, leadership, communication, organisation, flexibility and technological skills (Meredith & Mantel, 2009).

In order to establish an effective project risk management process within the NOC, it is important to engage everyone in the process and make sure that the project manager knows his/her role.

## 6.6 Developing a project risk management policy and assigning roles and responsibilities

Developing a project risk management policy requires the contribution of every business unit within the organisation. However, the management board/top manager of an organisation is ultimately responsible for promoting, developing and enforcing the policy (Council, 2005; IRM, 2002). According to the Institute of Risk Management (IRM, 2002), risk management policies must consider the organisation's tolerance for risk and attitude towards risk management, in addition, the policy should clearly assign stakeholders certain roles and responsibilities regarding risk management within the organisation as well as ensure accountability (PMI, 2009).

To summarise, in order to effectively establish a risk management policy, the following should occur:

- Involvement of top managers/management board of the organisation in the risk management process
- Allocation of roles and responsibilities within the organisation
- Apportionment of suitable resources for training to increase all stakeholders' awareness of risk management (IRM, 2002).

Although the management board/top manager is responsible for developing a policy to ensure effective risk management, other individuals within the organisation remain accountable for day to day activities. The table below summarises the roles of the management board/top manager as well as the role of business units within the organisation regarding the establishment of an effective project risk management process.

Table 6-1 Role of management board/top manager vs. the role of business units in establishing an effective risk management process (adopted from IRM, 2002 and PMI, 2009).

| Role of management board/top management | Role of the business units |
|---|---|
| Identify the organisation's strategic focus to establish and structure an effective risk management environment and procedure. | Manage daily risks. |
| Ensure that the risks are accepted by the organisation. | Include risk management objectives in their business and promote risk awareness within each unit. |
| Ensure that any unaccepted risks are managed effectively. | Ensure that risk management is a topic consistently discussed in management meetings. |
| Consider the organisation's capabilities to reduce the probability and impact of any risk on the business. | Ensure that risk management is addressed in the project (e.g. during the conceptual stage) and performed throughout all stages of the project. |
| Reflect on the effectiveness of the risk management process. | |

According to Collier, Berry, and Burke (2007), the greatest challenge regarding risk management stems from the attitude of senior management. In their investigation of risk management practices in UK companies, the authors found heuristic methods of risk management to be more prevalent than systems-based approaches. Additionally, subjective methods accentuating the role of human actors over analytical methods and empirical techniques were more likely to determine how organisations approached risk.

Atamna (2013) studied Libyan senior managers' perceptions of strategic management within the NOC, concluding that there is a lack of systematic strategic management approaches. Further, awareness of the topic was relatively limited in terms of strategy formulation and implementation, especially at the board level. Many times, decisions within the NOC were based on the political directives of the decision maker.

This research argues that the management board/top manager is responsible for developing and implementing the organisation's risk management policy. The participants also indicated that the HSE department and NOC subsidiaries were involved in this process. As discussed previously in this section, although the management board/top manager assumes the ultimate responsibility for risk management, other business units also play a role in this process. Some interviewees mentioned the role of the HSE department, validating the previous argument that the risk management practices within the NOC only relate to HSE risk assessment (see section 6.4.1). However, as shown in table 6-1, it can be argued that all business units within the NOC and the management board/top manager must make work to develop an effective project risk management policy and assign all stakeholders roles and responsibilities.

## 6.7 Training on project risk management

The interviewees had different opinions regarding the availability of training on project risk management within the NOC (see section 5.2.4). Thus, training is not standardised. Analysis of documents such as NOC's training and development policies and Libyan State Law No 77/2008 (see section 5.6.4 and 5.6.4.1) reveals the importance and objective of training all employees in order to improve their ability to support the daily operations of the Libyan oil and gas industry. In many cases, training only focused on technical engineering topics.

Although the analysed documents do not clearly outline the best training programme for project risk management, they emphasise that each department within an organisation should do whatever is necessary to remain abreast of current technologies within the industry. The findings of this research align with those of Khalil and Lees (2008), who investigated the NOC's overseas training programmes and concluded that, although a substantial amount of money is allocated for overseas training, more qualified and experienced personnel are needed to develop effective training plans within the Libyan oil and gas industry. The authors stress the importance of the management board's responsibility to frequently update training programmes and development strategies in order to meet the challenges and the fast technological changes of the twenty-first century (Khalil & Lees, 2008).

Training is an integral part of effective project risk management; without it, project risk management process will not be followed. Many authors stress the importance of including training in risk management policies, including, Chileshe and Kikwasi (2014) and Papadaki et al. (2014). According to Papadaki et al. (2014), training is essential for enhancing the effectiveness of project risk management, and personalised training for those at all levels in the organisation will help facilitate a risk-aware culture. In addition, training ensures that all project teams share a language within the project, which leads to a better communication (Papadaki et al., 2014). Further, educating senior managers about the concept of project risk management will lead them to more effectively apply it (Papadaki et al., 2014). According to Papadaki et al. (2014), top-down leadership is needed to maximise the benefits of project risk management.

The above discussion shows that training is an essential part of an effective project risk management process within any organisation. However, there is a lack of clear training and development strategies within the Libyan oil and gas industry. Hence, the NOC should implement a risk management training plan at all levels and integrate this plan into its strategy and budget.

## 6.8 Project risk management tools and techniques

### 6.8.1 Currently used tools and techniques within the NOC

Participants in this study were asked to identify the most commonly used tools and techniques in the Libyan oil and gas industry. Due to the lack of a written framework or procedure for project risk management, all the tools and techniques are solely based on the prior knowledge and experience of the project manager or engineer and his/her team. All interviewees were shown various tools and techniques used to evaluate project risks, including brainstorming, a risk matrix, HAZID, HAZOP, lessons learned, expert judgment, workplace risk assessment, QRA and MCSs (see section 5.3.1). According to participants, the most common techniques are brainstorming sessions and risk matrices, while the least common is MCS.

The literature describes different tools and techniques used to support project risk management (see section 3.5.7) by helping decision-makers make effective decisions with regards to planning, identifying, assessing, controlling and monitoring project risks (PMI, 2009; PMI, 2013). Any project risk management process requires tools for its execution (Cagliano et al., 2015; Raz & Michael, 2001). However, the situations in which each tool/technique will be used depend on the data and information that is presented (e.g. quantitative tools/techniques will depend on numerical information, while qualitative tools/techniques rely on qualitative data and will show outcomes in the form of recommendations) (PMI, 2013). Often, the appropriate tool/technique in a given situation will depend on the feature of each tool/technique as well as the degree of innovation, size, life cycle phase, complexity or required information associated with a project (APM, 2004; Cagliano et al., 2015; Chapman and Ward, 2003; PMI, 2013).

No risk management tool/technique fits every stage of the risk management process; good outcomes are achieved when different tools are used for different stages (Cagliano et al., 2015; PMI, 2013). Figure 6-2 shows the tools/techniques that are best suited for each phase of risk management and the project's life cycle.

**Risk management process phases**

| Risk management process phases | Conceptualisation | Planning | Execution |
|---|---|---|---|
| **Risk Monitoring and Control** | | | **Review of the outcomes gained from the tool/techniques previously used** |
| **Risk Response** | | **5,9,10,12,13,15,17,19, 22,27,28,29,30** | **1,2,3,9,19,27** |
| **Quantitative risk analysis** | **5,8,13** | **5,8,9,10,11,13,14,17,18, 19,20,21,23,26,27** | |
| **Qualitative risk analysis** | **8,10,13,28** | **1,2,3,4,6,8,10,11,13,17,18,19,22,23,25,26,28** | |
| **Risk Identification** | **1,4,6,10,11,12,19, 24,28,30,32** | **1,2,3,4,6,7,8,10,11,12, 15,16,17,18,19,22,23, 24,25,28,29,30,31,32** | |

**Phases of a project life cycle**

**Keys:**

1. Brainstorming
2. Cause and effect diagram
3. Change Analysis
4. Checklist
5. Decision Tree Analysis
6. Delphi
7. Event and Causal Factor Charting
8. Event Tree Analysis
9. Expected Monetary Value
10. Expert Judgement
11. Fault Tree Analysis
12. Failure Mode and Effects Analysis
25. Risk Mapping, Risk Matrix, Probability and Impact Matrix
26. Risk Probability and Impact Assessment, Risk Ranking/Risk Index
27. Sensitivity Analysis

13. Failure Mode and Effects Criticality Analysis
14. Fuzzy Logic
15. HAZOP
16. Hazard Review
17. Human Reliability Assessment
18. Incident Reporting
19. Interviews
20. Monte Carlo
21. Pareto Analysis
22. Preliminary Hazard Analysis
23. Risk Breakdown Matrix
24. Risk Breakdown Structure
28. SWOT Analysis
29. SWIFT Analysis
30. What-if Analysis
31. 5 Whys Technique
32. Lessons Learned

Figure 6-2 The best tools/techniques for each phase of risk management and the project life cycle (Cagliano et al., 2015)

This finding echoes previous literature. Many scholars believe that, despite the many available tools, the majority of project risk management practices only use risk-ranking tools (e.g. risk matrix) (Cagliano et al., 2015; Mojtahedi et al., 2010; Osabutey et al., 2013; Whitfield, 2015). Only simple techniques are used to evaluate risks within the Libyan oil and gas industry, possibly because the industry does not appreciate the value of proper project risk management practices. One reason for this, according to Ahlemann, El Arbi, Kaiser, and Heck (2013), is that risk management practices are associated with several issues, such as limited acceptance, limited effectiveness and unclear application. Ibbs and Kwak (2000) and Zwikael and Globerson (2006) confirm that risk management practices are infrequently applied in many projects, even large, complex projects. Cagliano et al. (2015) and del Cano and de la Cruz (2002) also note that corporate maturity regarding risk management is necessary for stakeholders to select and make use of the most appropriate tool/technique to effectively manage project risks. As mentioned previously, the NOC's maturity level is still very low; thus, it is necessary to increase the company's awareness of the importance of risk management.

The interviews reveal that only the simple tools are used in the Libyan oil and gas industry, and they mainly focus on identification and assessment of hazards that will affect the safety of employees and the surrounding environment. Due to the lack of a clear risk management framework and guidelines regarding which tools/techniques should be used within the NOC, it is very difficult to appreciate the true benefit of the process. One could argue that project risk management is a continuous and iterative process that must be conducted throughout different project life cycles, as shown in figure 6-2 above.

The NOC seems to only focus on identification and assessment of risks, not the full project risk management cycle. However, Hillson (2014) believes that the risk response phase must receive the same attention, budget and timeframe as other phases of the project risk management. Each stage of the risk management process requires different information, and hence different tool/techniques must be utilised.

### 6.8.2 Limitations of common tools and techniques

The interviewees indicated that most commonly used tools and techniques within the NOC have some limitations, including knowledge, project size and the type and accuracy of input data. These findings were echoed in the academic literature; some authors criticise the effectiveness with which current tools and techniques support the project risk management process. For example, Hillson (2014) claims that, since project risks are managed by people and not machines, there is a need to understand the effect of human psychology on the risk management process, concerning the decision maker's attitude towards risk, in order to avoid any bias in the outcomes.

As mentioned by a number of participants, the decision-makers user's prior experience and knowledge affect which tool/technique they choose, which in turn affects the accuracy, availability and efficacy of the input data, in line with the findings of Cagliano et al. (2015) and Taroun (2014). A number of participants also mentioned that there is a lack of knowledge and experience regarding project risk management within the NOC. Thus, one could conclude that individuals within the NOC lack the prior skills and experience needed to effectively use tools/techniques.

Salazar-Aramayo et al. (2013) claims that modern projects are more challenging and harder to understand than projects in the past due to the progressive, systemic nature of project risk uncertainty. Since current tools/techniques cannot solve this issue, the author calls for further research to address the problem. Some interviewees mentioned that the tools/techniques used in a given project will depend on its size and complexity. The literature confirms these findings (PMI, 2009; PMI, 2013).

Hence, although the different tools/techniques that are available help the user to make an informed decision regarding management of different types of risks within a project, within the NOC, their effectiveness is dependent upon the user's familiarity and experience with applying them. Therefore, for users to benefit from tools/techniques within the Libyan context, they must understand when to apply them at different phases of the project life cycle. In addition, the user must be comfortable and confident using them.

## 6.9 Project risk management and project performance

### 6.9.1 Project success definition

The interviewees defined the term 'project success' in various ways (see section 5.3.2.1.1). These findings are also reflected in the literature; Beleiu, Crisan, and Nistor (2015), Hussein, Ahmad, and Zidane (2015) and Sudhakar (2016) indicate that there are issues related to the definition of project success and that various stakeholders view success in various ways (Table 6-2). According to the PMI (2013), project success '*should be measured in terms of completing the project within the constraints of scope, time, cost, quality, resources, and risk as approved between the project managers and senior management*'. Therefore, the success of the project is determined based on whether the project objectives are achieved on time, within budget and to the predefined quality. This definition agrees with some of the findings from the interviews. It is also important to mention that, in many cases, the project is considered successful if the project management is successful (Bodicha, 2015; Sudhakar, 2016). However, de Wit (1988) emphasises the importance of differentiating between these two types of success; many times, good project management does not lead to a successful project.

Table 6-2 Challenges regarding the definition of project success (Ahemed & Zidane, 2015)

| Risk factor | Meaning |
|---|---|
| Unrealistic | Use of optimistic or pessimistic targets in the formulation of success criteria. |
| Ambiguous | Use of ambiguous/soft criteria that might be interpreted differently |
| Narrow | Success criteria contain a limited set of criteria that focuses only on project management effort. |
| Diverse | Having conflicting or competing criteria in order to accommodate the multiplicity and diversity of stakeholders. |
| Alike | Lack of order or rating of each success criteria. That is all criteria are considered equally important |
| Incomplete | Failing to identify all success criteria due to lack of knowledge about stakeholders |

Ramos and Mota (2016) assume that different project stakeholders (e.g. senior managers, project manager, team members) will have diverse opinions regarding project success. Hence, projects that might be regarded as a success by the project manager may not be seen as such by the senior management. To this end, it can be argued that there is no absolute success. Baker, Murphy, and Fisher (2008) refer to this as the 'perceived success of the project', which may change periodically. Therefore, it is important that all stakeholders agree on a definition of project success (PMI, 2013).

Different authors have tried to build models to measure project success. However, there is no agreed upon definition for the term (see section 3.5.8.1). For example, Lim and Mohamed (1999) believe that project success is seen either on a macro or micro level. Atkinson (1999) divided project success into two stages: the delivery stage and post-delivery stage. Shenhar (1997) identified four dimensions of project success: project efficiency, impact on customer, business success and preparing for the future. Chan and Chan (2004) proposed a combined framework for measuring project success (see section 3.5.8.1).

The fact that different participants and authors have different definitions of project success could indicate that there is an issue regarding the delivery of projects within the industry; the fact that different stakeholders have different opinions of success may lead to conflicts. Hence, there is a need to set clear project success criteria within the NOC. These criteria should be agreed upon by the different stakeholders from the initial phases of the project. Early stakeholder engagement in this process will further assist in avoiding any conflicts that might arise during or after completion of the project.

### 6.9.2 The link between project risk management and project success

This section investigates the relationship between project risk management and project success (regardless of how one defines it, as, according to many participants, success is usually related to meeting project objectives). The definition of project success used by the participants does not neglect the importance of other factors, however, one could argue that it is difficult to assume how project success within the NOC without a clear documented definition.

The Libyan government depends heavily on the oil and gas industry for revenue, and a certain number of projects must be executed in order to meet the government's demands. Such projects are well documented within the NOC's plans, with total 10 billion dollars to be spent from 2015 to 2020 (see sections 5.6.3.1-2). However, many oil and gas projects within the Libyan oil and gas industry do not end positively (see section 5.6.3.3), which may be linked to poor project risk management practices (see section 5.3.2.1.2).

The benefits of applying these practices have been well documented (see sections 3.5.3 and 3.5.8). For example, de Carvalho and Rabechini (2015) and Firmenich (2017) have argued that applying project risk management practices has a positive influence on project success and emphasise the important role a risk manager can play in achieving positive project outcomes. Therefore, ensuring the implementation of project risk management practices within the NOC can be expected to produce desirable results.

When participants were asked about the effectiveness of project risk management and the tools and techniques they use to identify and evaluate project risks, a majority stated that applying these practices could enhance project performance. According to one participant: '*Of course it [applying the techniques to evaluate project risks] does improve the success rate of the project because you will have a plan in advance'*. Similarly, de Carvalho and Rabechini (2015) argued that applying project risk management practices could have a positive influence on project success and emphasised the importance of an risk manager for the project and the positive impact such a manager could have on the project's outcome.

Although participants reported that applying project risk management practices could improve project performance, the actual implementation of these practices remains challenging in the Libyan oil and gas industry. This might be rooted in the national or organisational culture of Libya: *'we are not using the science of risk management as part of the management of our projects; we are not using it at all, even our culture does not support this!'* Liu, Meng, et al. (2015) support this argument, claiming that project risks are viewed and managed differently in different cultures, including corporate cultures (Liu et al., 2013). Summerill, Pollard, and Smith (2010) found that a proactive organisational culture could improve the project risk management process. Therefore, organisational culture plays an important role in successful implementation of project risk management practices within the Libyan oil and gas industry. Creating the right organisational environment and increasing awareness of project risk management within the NOC could promote successful delivery of its projects.

It can be argued that the oil and gas industry in Libya faced—and is still facing—many problems that limit successful delivery of its projects, including issues related to project risk management, which is significant for project management. Project risk management is one of the ten knowledge areas of the PMI's PMBOK. If the project manager complies with these ten areas, the project will be successful (PMI, 2013). Yet, according to Cervone (2006), not all project managers appreciate the true value of risk management. This may be because some authors doubt the impact of project risk management practices on project performance (Zwikael & Ahn, 2011).

## 6.10 Challenges that limit effective implementation of project risk management within the NOC

### 6.10.1 Lack of knowledge and experience regarding project risk management

The majority of interviewees indicated that a lack of knowledge and experience regarding project management—and project risk management in particular—are the main challenge in projects within the NOC (see sections 5.4.1, 6.3.1 and 6.3.2). In this context, 'knowledge' is defined as what employees know about project management and project risk management.

Elliot (2005) found that the lack of individuals experienced in risk management caused many oil and gas projects to perform poorly. Similarly, Zuofa and Ochieng (2014) concluded that there is limited risk management literacy within the Nigerian oil and gas industry, which is one of the main issues affecting implementation of successful project risk management. Further, according to the PMI (2013), project management is defined as '*the application of knowledge, skills, tools and techniques to project activities to meet the project requirements*'. Thus, knowledge and experience are important factors affecting whether the project objectives are achieved.

Papadaki et al. (2014), PMI (2009) and the National Research Council (2005) argue that, in addition to an appropriate level of education, decision makers must have the enough knowledge and skills related to project management to ensure the efficacy of the project risk management process. According to the interviewees, one reason for the lack of knowledge and experience within the NOC is the Libyan culture. To ensure effective implementation of project risk management practices within the NOC, there is a need to increase all decision-makers knowledge about project management and project risk management.

### 6.10.2 Lack of support from top/senior management

The interviewees stressed that top/senior management also suffers from a lack of knowledge and experience within the Libyan oil and gas industry, which limits effective implementation of project risk management practices within the NOC (see sections 5.4.1 and 5.4.2). Hillson (2011), Yaraghi and Langhe (2011) and PMI (2009) argue that, in addition to appropriate risk management processes, dedicated risk management resources and a risk-aware organisational culture, the support and leadership of top/senior management play an important role in a project’s success. Similarly, Papadaki et al. (2014) stress the importance of senior management support and knowledge during the risk management process. Therefore, top/senior management is responsible for ensuring the implementation of a risk management culture among all owners, project managers, contractors and organisation employees (Council, 2005). In order to ensure effective project risk management practices within the NOC and the Libyan oil and gas industry, senior management should be obliged to support and commit to enforcement of these practices.

### 6.10.3 Resistance to change

The oil and gas industry is quickly growing, and new technologies are being developed every day. To stay up to date, organisations often have to replace or update project management practices in order to increase their business performance, reduce costs or improve current processes (Pardo del Val & Martínez Fuentes, 2003; Price & Chahal, 2006). Change can be defined as replacing the old with the new (De Jager, 2001). However, change is not easy, especially when one must convince people to leave behind what they are familiar with and face new, uncertain situations (de Jager, 2001). Resistance to change is usually seen as a problem (Lundy and Morin, 2013). For example, according to the interviewees, resistance to change within the NOC limits the effectiveness of project risk management practices.

Egan and Fjermestad (2005) summarised the main causes for resistance to change:

- Unwillingness to leave things that are familiar.
- Lack of communication and no clear strategy defining why change is important.
- Loss of power or influence.
- Variations in how work is completed.
- Change might require substantial investment, which the organisation may not be willing to make.

As mentioned in the literature, resistance to change is related to challenges regarding the development of an effective project risk management practice (see section 3.5.9). Typically, people resist change due to fear of losing old habits, as in the NOC, as some interviewees mentioned. However, change is important to remain up to date with the latest advances. Lundy and Morin (2013) identified factors associated with resistance to change and proposed several solutions:

- Clear communication strategy (e.g. clear intention/vision).
- Engaging leadership style.
- Continuous monitoring of feedback received from impacted people by change.
- Allocation of sufficient resources (e.g. time, funds, tools and proper human resources).
- People should be included as part of the solution to build a sense of ownership.
- Clear change management plan and implementation strategy.
- Clear leadership, commitment and involvement by top management.

- Clear project management approach, including transparency strategies within different departments.
- Clear, organised training.
- Knowledge and experience related to project management and strategies of change.
- Project manager's ability to empower self-awareness, participate in engaging communication, have a positive influence, be emotionally resilient and serve as a motivator.
- Clear definitions of roles and responsibilities.

It is important to consider these points when implementing change within the NOC to ensure the effectiveness of project risk management and avoid resistance to change. It is also important for people to recognise the value of change through clear leadership that engages everyone within the NOC with a strong open communication strategy that clearly defines employees' roles and responsibilities.

### 6.10.4 Lack of structured training plans

The lack of structured training plans and programmes related to project risk management was mentioned by a number of interviewees and discussed in this chapter (see section 6.7). It is clear that, in order to effectively manage project risk within the NOC, there should a proper training plan (see section 6.7). Therefore, there must be clear, structured training plans within the NOC in general and for project risk management in particular to increase the effectiveness of project risk management.

### 6.10.5 Lack of coordination

According to International Organization for Standardization (ISO) 10006, cited in Rodney, Ducq, Breysse, and Ledoux (2015), a project is defined as '*a unique process, which consists of a set of coordinated and controlled activities with start dates and end dates, undertaken to achieve an objective conforming to specific requirements such as time, cost and resources constraints'.* Thus, coordination is important in order to achieve the objectives of the project. However, within the NOC, a number of interviewees noted the lack of coordination between individuals and departments.

Thamhain (2013) argues that, in order to establish a strong and effective project risk management process within an organisation, there must be comprehensive participation and collaboration within all divisions of the project team and its setting. One form of effective coordination is communication channels between everyone involved in the project. According to PMI (2009), open and honest communication contributes to effective project risk management throughout the process. PMI (2009) also stresses that everyone should be involved in the risk management process to ensure the spread of transparent and honest information within the team. Many other authors (Jha & Iyer, 2006; Motiar Rahman & Kumaraswamy, 2005; Yaraghi & Langhe, 2011) note the importance of coordination and communication between individuals for increasing project performance.

Coordination and communication are important factors determining the efficacy of project risk management within the Libyan oil and gas industry. Thus, the project manager and his team should ensure the spread of information to support the project risk management process, and there should be a strong relationship between all team members, including decision-makers and top managers within the NOC.

### 6.10.6 Lack of management system

According to the ISO (2017), an organisation management system is defined as *'the way in which an organization manages the inter-related parts of its business in order to achieve its objectives. These objectives can relate to a number of different topics, including product or service quality, operational efficiency, environmental performance, health and safety in the workplace and many more*'. Further, according to UKAS (2017), a management system is a framework of processes and procedures used to ensure that an organisation can complete all the tasks required to achieve its objectives.

A management system is important as it increases the organisation's efficiency and ability to achieve its objectives. However, two interviewees indicated that people within the NOC and in the Libyan oil and gas industry do not appreciate the benefits of this system, especially at the top management level. Due to the lack of a proper project risk management system/framework within the NOC that stipulates the procedures to follow and all stakeholders' roles and responsibilities, one could argue that it is very difficult to effectively manage project risk within the NOC.

### 6.10.7 Libya's unstable political situation

The current political and security situation in Libya has influenced every aspect of the oil and gas business. Probably the most obvious challenge is the closure of many oil and gas ports, which limits the country's ability to export its vast hydrocarbon reserves and reduces the country's revenue, among other factors. These factors, of course, limit the effectiveness of the project risk management process. This will be discussed in detail in the following subsections.

#### 6.10.7.1 Limited financial resources

The main reason for the lack of financial resources within the NOC is due to the ongoing unstable security and political situation in Libya, which has resulted in the closure of several oil and gas fields and ports and thus affected the entire country's economy, according to the interviewees (see section 5.4.7.1). Section 5.6.5 indicates that the rate of production of oil and gas has decreased sharply since mid-2013 (see tables 5-5 and 5-6), which has in turn led to a sharp decrease in Libya's revenues from around \$36 billion in 2013 to around \$4.7 billion in 2016. The LAB (see section 5.6.7.1) estimates that the interruption of oil and gas production from mid-2013 to the end of 2016 resulted in losses of around \$107.2 billion.

Closure of oil and gas fields and ports not only decreases the production of hydrocarbons but also indirectly influences the financial returns of Libya due to, for example, the decline in drilling exploration activities (see figure 5-21), increase in the cost of hydrocarbon production (see section 5.6.7.3), effects on training and sustainable development programmes (see section 5.6.7.4) and the difficulty of restoring the country's global market share (see section 5.6.7.5). Surprisingly, these losses are not due to technical problems. The LAB identified that PGF share is due to the most loss (75%), while 14% is due to strikes, 8% is due to armed militia attacks and 3% is due to technical problems (see table 5-8 and figure 5-20).

Of course, limited financial resources affect all aspects of the industry, including training plans and budgets for different business activities. To this end, as mentioned previously, in order to achieve an effective project risk management process, there should be a dedicated budget to support training and provide resources throughout the process. However, one could argue that, due to Libya's limited financial resources, the NOC's spending would be priorities for other business activities. Therefore, there is a need to ensure that project risk management is implemented effectively in order to identify, assess, monitor and control threats as well as identify opportunities within the NOC.

#### 6.10.7.2 Departure of companies and experts

Project risk must be managed by knowledgeable and experienced individuals (PMI, 2009). A number of interviewees noted that, as a result of Libya's unstable political situation, many experienced contractors as well as knowledgeable, experienced individuals (both Libyans and non-Libyans) have had to leave the country, which has created a huge shortage of skilled labourers that can conduct and complete projects efficiently; according to the LAB (2016), as a result of the current country's situation, many positions within the oil and gas industry have been filled by non-specialised labourers, resulting in low efficiency and high production costs (see section 5.6.8). As mentioned previously, an effective project risk management process requires skilled individuals with the proper leadership style.

The dearth of skilled workers within the Libyan oil and gas industry limits the effectiveness of the project risk management process. Hence, the safe return of experienced companies and workers must be ensured in order to support successful implementation of the project risk management process.

#### 6.10.7.3 Access to field locations

A number of interviewees stated that, due to the closure of many oil and gas fields and ports by PFGs, people, including personnel, have limited access to these locations, which could lead to incomplete information gathering. Obviously, identification and management of project risks rely on the availability of accurate information. As mentioned previously, communication is important for effective implementation of project risk management. Therefore, without access to these facilities, one could argue that the effectiveness of project risk management will be limited. As one of the interviewees mentioned, oil and gas field and port zones should not be involved in political conflicts in order to keep these locations safe and secure and ensure the safe travel and transport of personnel conducting their daily routines and managing their projects.

#### 6.10.4.4 Corruption

According to the literature and two interviewees (see section 5.4.7.5), corruption limits the effectiveness of project risk management because decisions are based on favouritism and personal interests, which causes unqualified personnel to rise to unsuitable positions or unqualified contractors to be selected for projects. Handfield et al. (2015), who studied the role of effective relationship management in large oil and gas projects, claim that corrupt contract awards lead to poor performance of the project. FeftaWijaya, Supriyono, and Shariha (2016), who compared corruption in Libya during and after Ghaddafi's rule, concluded that while corruption still exists in the country, the scale of corruption has transformed from projects, contracts and budgets during Ghaddafi's rule to a larger portion of the population and medium level administrations after he was ousted. In both periods, FetaWijaya et al. (2016) argue, corruption had similar causes:

- No real motivation or leadership to fight corruption.
- Lack of press and media freedom.
- Lack of an effective judicial regime and abuse of law.
- Lack of civil society organisations.
- Nepotism and favouritism.
- Weak security and political situation.

According to Bardhan (1997) and Kaufmann (1997), although the word 'corruption' can mean different things in various contexts and cultures, in the majority of cases, it is associated with ethical failure, and it can be generally referred to as the use of public office for self-contained benefits. Corruption can lead to low policy effectiveness, increased risk in local and foreign investments and reduction of economic growth, which could reduce governmental revenue when officials accept bribes (FeftaWijaya et al., 2016; Gupta, Davoodi, & Tiongson, 2000; Tanzi & Davoodi, 1998). In Libya, corruption is a major problem that has led to slow socio-economic development within the country and the 'brain drain' of many scientists and experts. Corruption in Libya could be due to the constant changes in administrative frameworks and legislations, which have not followed advances in the field of public administration (FetaWijaya et al., 2016). According to Transparency International (Transparency.org, 2017), a global non-governmental organisation that ranks countries according to their corruption score, in 2016 Libya ranked 170th out of 176 countries in corruption. Table 6-3 summarises the country's rankings from 2010 to 2016 according to Transparency (2017).

Table 6-3 Libya's corruption score from 2010 to 2016.

| Year | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** |
|---|---|---|---|---|---|---|---|
| Ranking | 146th | 168th | 160th | 172nd | 166th | 161st | 170th |
| Out of (countries) | 178 | 183 | 176 | 177 | 175 | 168 | 176 |

One way of fighting corruption is through the establishment of a code of conduct (or 'corporate codes' or 'code of ethics') (Sullivan, Wilson, & Nadgrodkiewicz, 2013; Worldbank.org, 2005). According to the International Federation of Accountants (IFAC) (IFAC, 2007), the code of conduct is defined, *'Principles, values, standards, or rules of behaviour that guide the decisions, procedures and systems of an organisation in a way that (a) contributes to the welfare of its key stakeholders, and (b) respects the rights of all constituents affected by its operations.'* (p.5). Therefore, a code of conduct can decrease corruption, as it offers a clear point of reference for organisational ethical principles in a single document. In many cases, these code of conducts have a well-defined series of punishments if any employee is found to be violating them (Transparency.org, 2012). In general, there are three discrete ways to make effective use of a code of conduct for dealing with corruption, which include:

drafting the code, implementing the code and enforcing the code (Worldbank.org, 2005).

Thus, it is clear that corruption is a major problem in Libya that limits the effectiveness of project risk management. Therefore, to ensure effective project risk management practices, there should be open and transparent communication channels throughout the project management process within the NOC, this can be achieved by establishing a strong code of conduct to minimise corruption.

## 6.11 Recommendations for developing an effective project risk management practice within the NOC

The aim of this section is to provide general recommendations for an effective project risk management process within the NOC in Libya. As mentioned previously in this study and in the literature, project risk management is an important topic. Many authors and participants in this research appreciate the value of project risk management practices and their relationship to project success. However, it has been shown that the NOC lacks a structured written approach to and awareness of risk management. Thus, there is a need to effectively raise the NOC's awareness of project risk management and address the importance of this issue.

In order to increase the validity and reliability of this research and arrive at a strong conclusion, the researcher used the above discussion as the basis in which these recommendations were formed. In addition, the researcher also utilised the use of the three different sources of evidence (triangulation): academic literature synthesis, semi-structured interviews and a review of documents that are related to the case study and support the interview results. The details of each will be described as learning outcomes that support creation of a set of recommendations.

**Findings from the literature:**

- The definitions of 'risk', 'project management' and 'project risk management' are not agreed upon (see sections 3.2, 3.4.2.1 and 3.5.2).

- Project risk management is important as it allows for systematic identification, assessment, monitoring and control of project risks to reduce their threats and increase their opportunities (see section 3.5.3).
- Different frameworks and guidelines for project risk management are available to help and direct organisations to apply project risk management practices in order to ensure project success (see section 3.5.6).
- The literature describes several tools and techniques used to support the project risk management process (see section 3.5.7).
- Although in many cases these tools and techniques are effective, they have certain limitations (see section 3.5.7.2).
- Although the relationship between project risk management and improved project performance is still ambiguous, a number of authors point out the positive relationships between them (see section 3.5.8)
- The project performance within the oil and gas industry is not very promising as projects may fail due to poor project risk management practices (see section 3.6).
- Although a number of studies have examined project risk management within the oil and gas industry in different contexts, no studies have explored the topic in the Libyan context (see section 3.7).
- Implementation of project risk management is not easy, and many organisations face various challenges when trying to enforce these practices (see section 3.5.9).
- There are critical success factors that help implement effective project risk management (see section 3.5.10).

**Findings of the semi-structured interviews:**

- There is no agreed-upon definition of ‘risk’ (see section 5.2.1.1).
- Awareness and implementation of project management and project risk management is limited (see section 5.2.1.2).
- There is no comprehensive written systematic approach to project risk management (see section 5.2.1.2.1).
- The board of directors, NOC subsidiaries and the HSE department are responsible for creating a project risk management policy (see section 5.2.3).

- The availability of specific project risk management training is limited (see section 5.2.4).
- A limited number of risk identification and assessment tools and techniques are used (see section 5.3.1).
- It is widely believed that application of project risk management practices can improve poor project performance within the Libyan oil and gas industry (see section 5.3.2).
- Lack of knowledge and experience, resistance to change, lack of top management support, lack of training plans, lack of a written project risk management framework and lack of coordination and cooperation limit the effectiveness of project risk management within the Libyan oil and gas industry (see section 5.4).
- The unstable political situation of Libya has directly and indirectly influenced the implementation of effective project risk management practices (see section 5.4.7).

**Findings of the review of documents related to the case study:**

- There is no definition or written framework of risk or project risk management (see section 5.6.1)
- Only risks related to HSE are emphasised (see sections 5.6.1, 5.6.1.1, 5.6.1.2, 5.6.1.3)
- The availability of specific project risk management training is limited (see section 5.6.4)
- Project performance within the Libyan oil and gas industry is low as many projects fail to meet their deadlines (see section 5.6.3.3)
- Hydrocarbon production has decreased sharply in Libya (see section 5.6.5) due to the unstable political situation and closure of many oil and gas fields and ports, which lead to lower revenues (see section 5.6.6)
- The closure of oil and gas fields and ports has had a negative effect on the country and the NOC, limiting their ability to perform effective project risk management practices (see section 5.6.7)

- The prevalence of unskilled workers in the oil and gas sector is considered a major challenge that limits the effectiveness of project risk management (see section 5.6.8)
- The NOC needs various corporate and HR reforms (see section 5.6.9.1, 5.6.9.2) as well as technological (see section 5.6.9.3) and security reforms (see section 5.6.9.4)

Since project risk management is everyone's responsibly, everyone should be accountable for successful implementation of the process. As the NOC's organisational structure is hierarchical (see figure 5-1), the recommendations for effective project risk management are based on three levels of employees (see figure 6-3): 1) the board of directors, 2) executives and general department directors and 3) lower managers, including managers of departments involving projects, such as the maintenance and human resource development departments; project managers; and project teams.

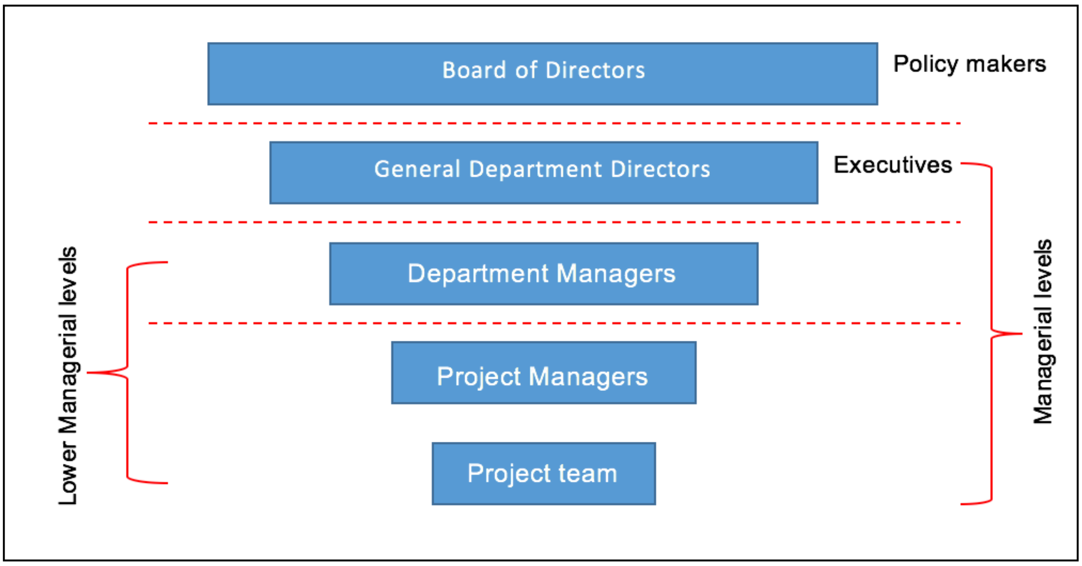



Figure 6-3 Recommendations for effective project risk management based on the hierarchical structure of the NOC.

The next sections will present the recommendations for all three groups.

**Recommendations for the NOC's board of directors**

- Establish the NOC's strategic vision and mission for short- and long-term development.

- Determine and enforce a management system that identifies the NOC's policies and sets clear roles and responsibilities regarding project risk management in order to achieve the company's objectives.
- Identify the NOC's strategic focus to establish and structure an effective risk management culture and procedure.
- Ensure continuous support and commitment to all business units.
- Consider the organisation's capabilities to reduce the probability and impact of any risk on the business.
- Ensure the secure and safe travel of all employees from and to all oil and gas fields and ports by promoting the establishment of security fences, surveillance systems, guard towers and security checkpoints.
- Delegate authority to executives and department managers to implement effective project risk management policies that align with the NOC's goals.
- Ensure that information about risk is effectively communicated to the management board and the rest of the organisation.
- Regularly review the effectiveness of project risk management policies and update them as necessary.
- Define clear success criteria at both the organisation and project level.
- Determine monitoring criteria and ensure the effectiveness of internal controls.
- Improve transparency and fight corruption by establishing and enforcing an effective code of conduct.
- Review and approve training and development plans, especially those related to project risk management.
- Cooperate with international companies experienced in the transfer of advanced technology to the oil and gas sector, especially technology related to project management and project risk management.
- Establish a clear change management plan and implementation strategy.

**Recommendations for NOC executives**

- Monitor execution of the risk management framework and process in accordance with the NOC's policy.

- Provide visible leadership, promote risk awareness and communicate the value of risk management within the NOC.
- Conduct all activities in line with the code of conduct.
- Provide advice and guidance regarding management of risks and approve strategies and plans to manage significant risks.
- Allocate sufficient resources to the risk management process.
- Regularly review and report to the board of directors the effectiveness of the risk management process.
- Ensure effective communication of information about risk between departments and the management board.

**Recommendations for lower managers within the NOC**

**Department level (all business units)**

- Ensure effective execution of the risk management framework and process in accordance with the NOC's policy.
- Conduct all activities in line with the code of conduct.
- Manage daily risks.
- Ensure that risk management objectives are considered by all business units and promote risk awareness in each department.
- Ensure that risk management is consistently discussed in management meetings.
- Make sure that risk management practices are included early in the project (e.g. the conceptual stage) and performed throughout all stages of the project.
- Regularly inform and update executives about the effectiveness of project risk management.
- Ensure the proper allocation of resources for project risk management.
- Improve record keeping, document management and data structure.
- Enhance collaboration, coordination and communication between all departments when conducting the project risk management process.
- Facilitate and monitor the implementation of a change management strategy.

***Specific recommendations for project and maintenance departments***

- Ensure effective execution of the project risk management framework and process in accordance with the NOC's policy.
- Ensure that risk management activities, including monitoring, review and reporting, are performed in a timely manner.
- Conduct all activities in line with the code of conduct.
- Ensure individual awareness, commitment and responsibility regarding project risk management.
- Regularly inform and update executives about the effectiveness of project risk management.
- Ensure that risk management practices are included early in the project (e.g. the conceptual stage) and performed throughout all stages of the project.
- Reduce contractor risk by only appointing qualified and experienced contractors to projects.
- Ensure the participation of all stakeholders in the project risk management process.
- Enhance collaboration, coordination and communication in a common language between all departments when conducting the project risk management process.
- Create clear project success criteria agreed upon by all stakeholders early in the project.
- Monitor and follow up on the effectiveness of project risk management.
- Ensure the proper allocation of resources for project risk management.
- Visit the sites of all projects in order to gain the maximum amount of information to support project risk management.
- Regularly review and monitor feedback on the effectiveness of the project risk management process.
- Facilitate and monitor the implementation of a change management strategy.

***Specific recommendations for general departments involved in human resource development***

- Conduct all activities in line with the code of conduct.
- Establish effective HR functions, including training for HR staff.

- Develop a fair recruitment policy that is based on fairness and equal opportunity.
- Set clear employee selection criteria.
- Train and develop all employees regarding project risk management.
- Develop and implement employee rewards, incentives and engagement and retention schemes for successful, effective implementation of project risk management practices.
- Create a clear job description and competency profiles.
- Cooperate with international companies experienced in the transfer of advanced technology to the oil and gas sector, especially technology regarding project management and project risk management.

**Recommendations for project managers**

- Ensure senior management's support of the project risk management process.
- Conduct all activities in line with the code of conduct.
- Promote, encourage and participate in all project risk management procedures.
- Engage all project stakeholders in defining the acceptable level of risk for the project.
- Frequently update important stakeholders on the status of risk and listen to their proposals for strategic actions to keep risk within an acceptable level.
- Supervise subcontractors' risk management.
- Establish a risk management plan.
- Support open and honest communication about risk among the project team and stakeholders.
- Ensure that any identified risks outside the control and authority of the project manager are reported to senior management.
- Approve project risk responses and related activities before their execution.
- Monitor the effectiveness and efficiency of risk management practices.
- Review the effectiveness of risk responses and document the lessons learned.

- Give identification and assessment of project risk opportunities the same level of importance as identifying and assessing threats.

**Recommendations for project team members**

- Conduct all activities in line with the code of conduct.
- Contribute to the overall goals of the project.
- Utilise knowledge and skills in order to perform effective project risk management.
- Attend and utilise the lessons learned in project risk management training and development programmes.
- Recognise and appreciate the benefits of project risk management.
- Collaborate and coordinate with all team members and the project manager during all project risk management activities.
- Honestly communicate any information about project risks to all other team members, including the project manager.
- Regularly report and update the project manager on the status of project risks.

## 6.12 Validation of the recommendations

In section 6.11, the researcher proposed a set of recommendations based on this discussion chapter, literature review, interviews and document review. In order to increase the validity and reliability of these recommendations, the researcher conducted further interviews to verify the clarity, consistency and applicability of these recommendations in practice. Key participants in the NOC who were affected by application of those recommendations were targeted for interviews. The researcher selected three participants: the advisor to the board of directors and two project managers. For ethical considerations, each interviewee was assigned a code, as presented in table 6-4. The participants were purposely selected based on their intensive experience and their direct involvement with oil and gas projects in Libya. Participants also showed great interest during the data collection stage for further participation in the validation stage.

Table 6-4 Participants for the validation process.

| Participants | Code |
|---|---|
| Board of Directors Advisor | EXP5 |
| Project Manager | EXP4 |
| Project Manager | EXP10 |

The individuals were approached and asked to confirm that the proposed recommendations to effectively implement project risk management practices would clearly enhance the potential of all organisations to successfully adopt these practices. Figure 6-4 shows the validation process. All the other figures are also presented to clarify the final recommendations and practices regarding the full project risk management system developed by the researcher and validated by the three participants.

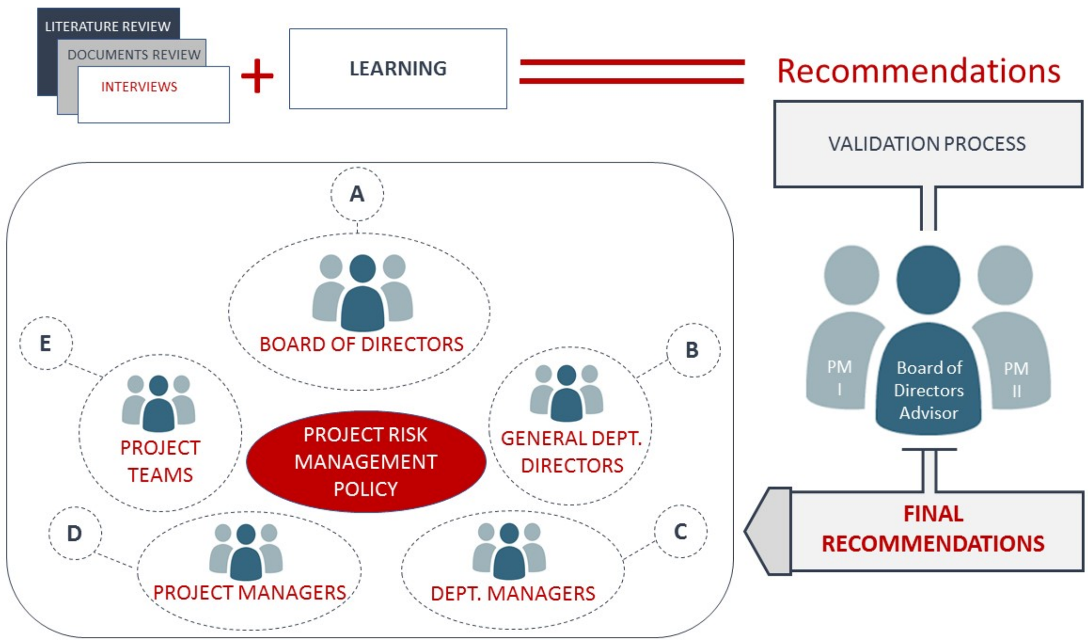



Figure 6-4 Process for validating the recommendations.

The participants selected for the validation process generally agreed with the given recommendations and all mentioned that establishing effective codes of ethics and conduct, spreading a risk management culture and clarifying all organisational policies are the most important steps that should be considered and followed by those at all levels in the organisational hierarchy. Precise business measures, roles and responsibilities regarding the implementation of project risk management are needed to achieve the NOC’s objectives. The participants recommended slight changes to the recommendations, including changing the graphical presentation of the recommendations, generalising fundamental practices to all levels of authority, merging some core recommendations, changing the terms of some practices. The following sections will address these suggestions.

### 6.12.1 Final recommendations for the board of directors of the NOC

The advisor to the board of directors (EXP5) agreed with the recommendation to establish a strategic vision and mission for both short- and long-term development. However, EXP5 suggested some strategies for support and motivation, such as continuous development training plans. The two project managers (EXP5 and EXP10) addressed a very important aspect of risk management practices: establishing a risk response criterion. Such a criterion with different risk controls would be much more effective than relying on the acceptance criteria; would make project managers aware of all types of risk and capable of understanding and controlling the impact of risk on the business; and would result in various changes in business-related plans and procedures. EXP5 added that use of the existing audit department is highly recommended to confirm minor and major changes at all levels in the organisational hierarchy of the NOC. This will contribute to the production of well-organised business plans and monitoring practices. The final recommendations for the NOC’s board of directors are presented in figure 6-5.

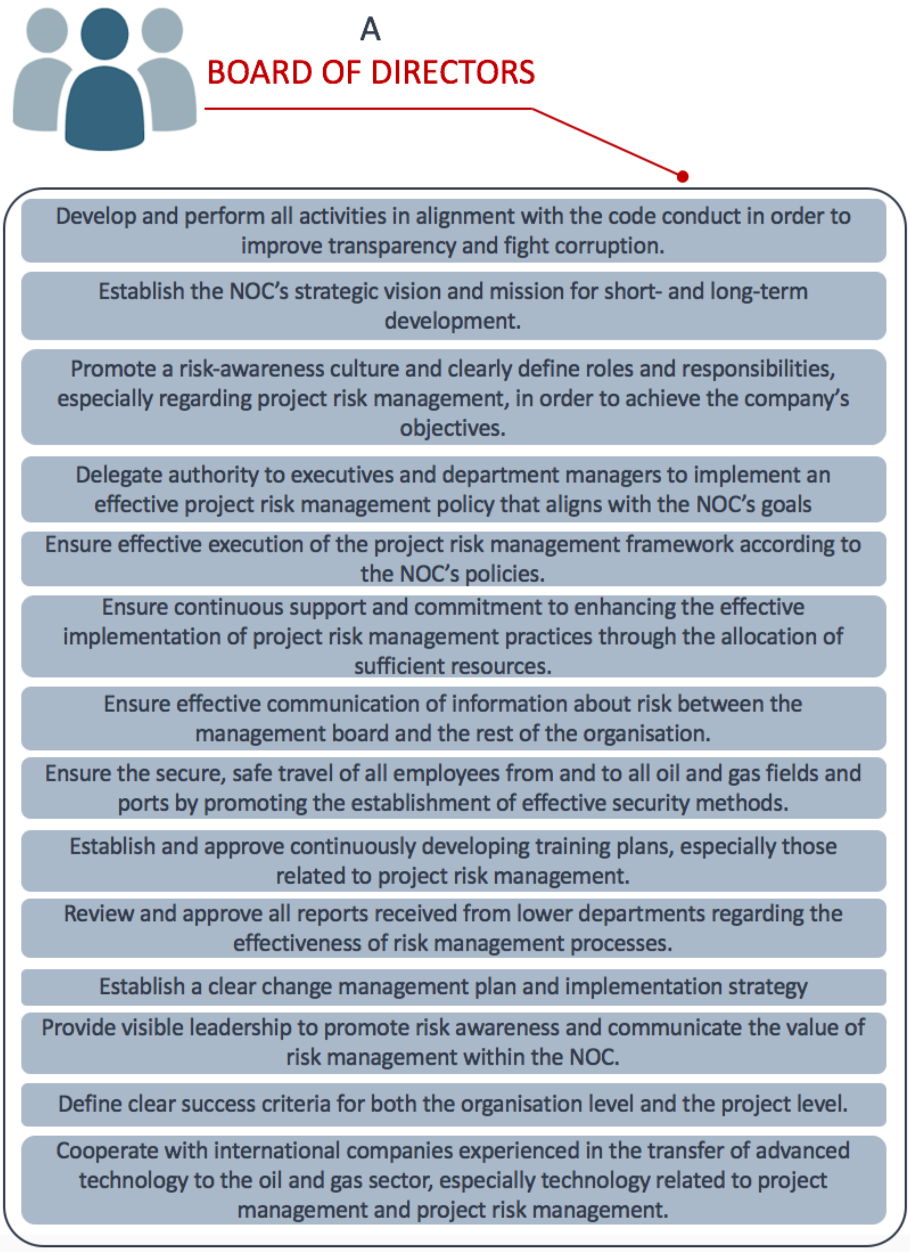



Figure 6-5 Final recommendations for the board of directors.

### 6.12.2 Final recommendations for general department directors/executives within the NOC

All participants have discussed general department managers at length as they are considered key in all departments. As a result of this discussion, the three participants noted that the most important aspect of all the recommendations; is to create ethical and cultural alignment in all core and significant business activities.

The suggestion to establish strategies regarding awareness of and guidance for risk management was addressed by all participants to further increase their accountability for business processes. In addition, based on their own experience with managing people, EXP4 claimed that information management and communication strategies should be regularly presented to all departments through continuous training sessions. This will ensure effective information exchange internally (between department members (and externally (between departments). The final recommendations for general department directors within the NOC are presented in figure 6-6

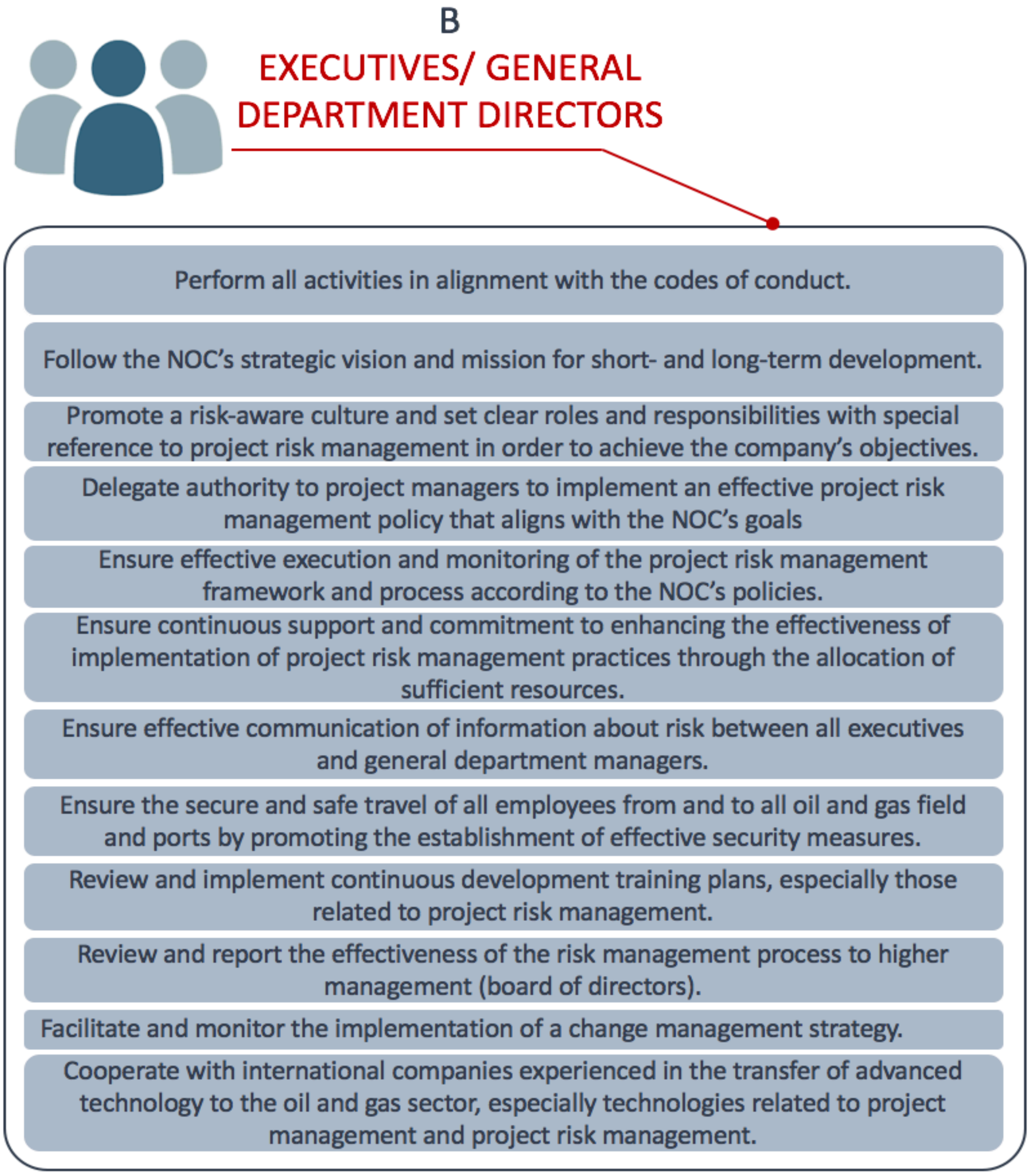



Figure 6-6 Final recommendations for executives/general department directors

### 6.12.3 Final recommendations for department managers within the NOC

All recommendations proposed for department managers have generally been agreed upon. However, in the opinion of all interviewees, the recommendations for those at this level of authority must be presented in a clear graphical format. Participants have suggested keeping all the general recommendations for all departments and then addressing only the focus points for the project management and the maintenance and human resources departments without repeating the general ones in each of them. Clear, un-repetitive recommendations for those two departments will bring department managers' attention to those key recommendations. Figure 6-7 shows the exact division of all business units' final recommendations as well as the final recommendations for the two specific departments.

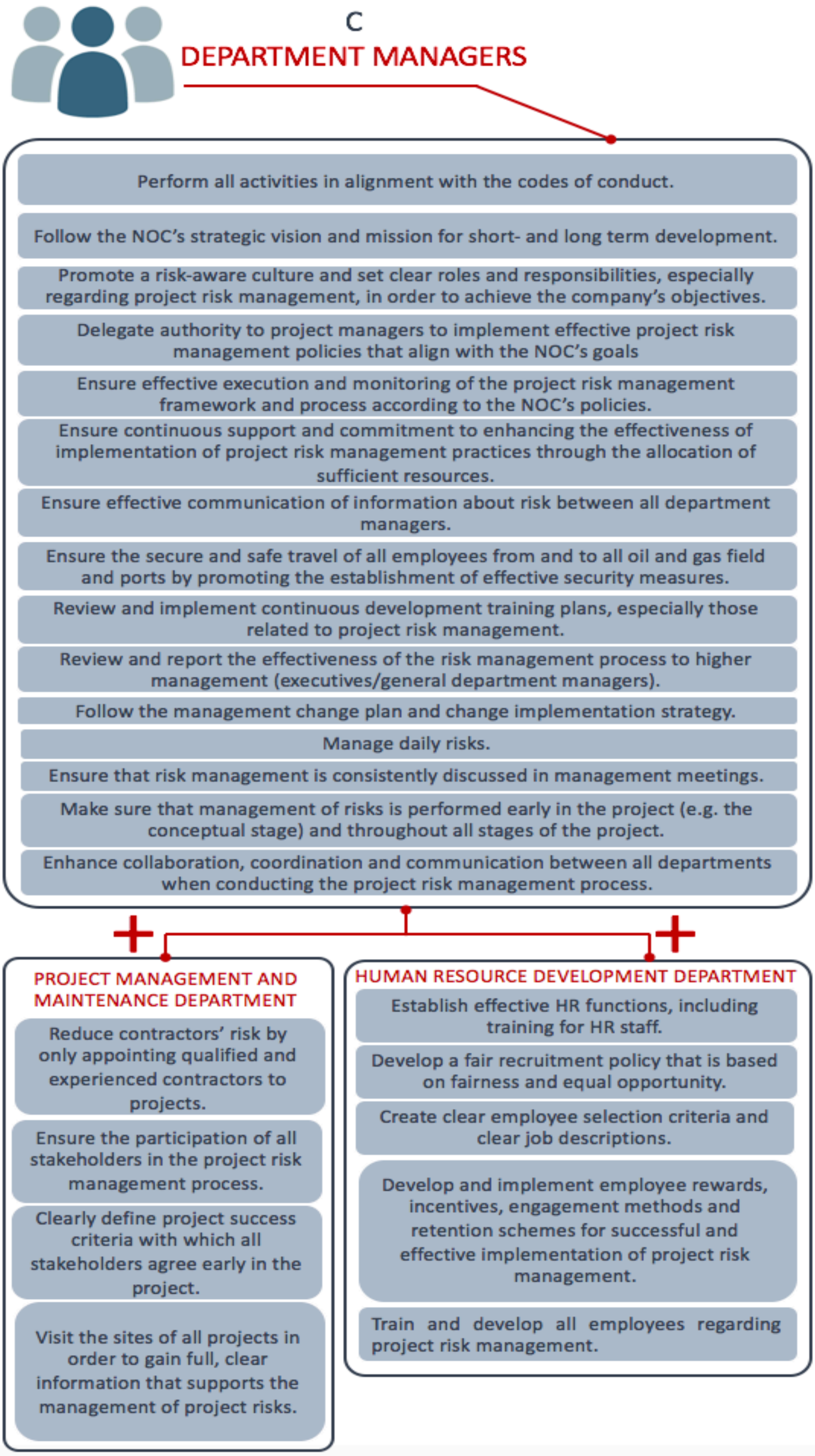



Figure 6-7 Final recommendations for all business units and for two specific departments.

### 6.12.4 Final recommendations for project managers within the NOC

All participants agreed on the recommendations for project managers. However, it was suggested that some terms be changed to further clarify the meaning of proposed recommendations. The term ‘support’ in point 1 was changed to ‘engagement’ because the ‘support’ of senior management does not indicate a full understanding of all project processes. When all senior managers and stakeholders engage in each activity, the amount of awareness of all project risk management processes will be increased. Also, specifying from whom the senior management and audit department should receive regular reports on all identified risks that are outside their control will save the executive department time. EXP5 suggested further improving the recommendations by specifying a clear strategy for allocating tasks, roles and responsibilities and promoting fairness among all team members. Figure 6-8 shows the final recommendations for project managers.

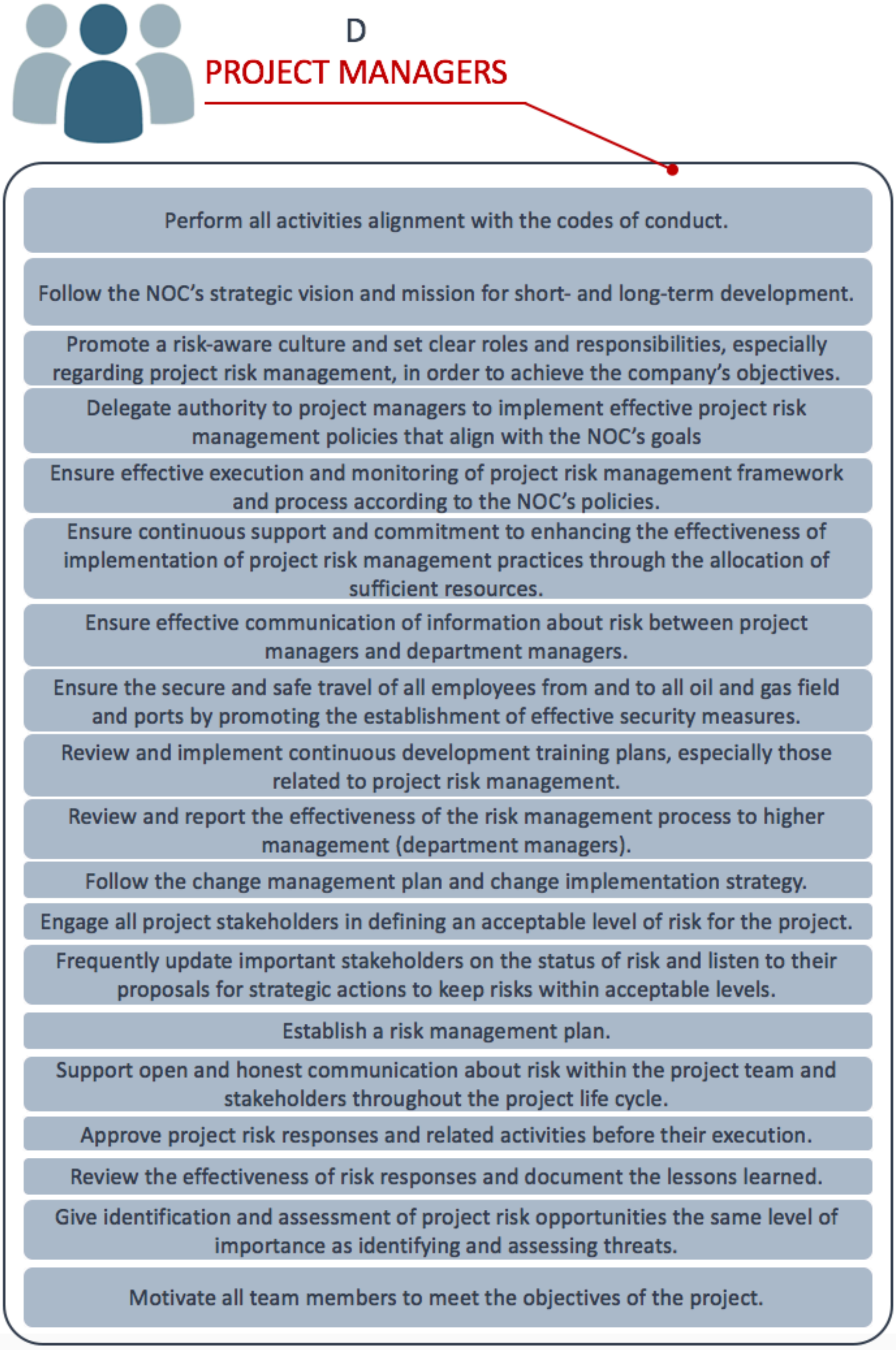



Figure 6-8 Final recommendations for project managers.

### 6.12.5 Final recommendations for project team members within the NOC

In regards to team members, participants have widely accepted all proposed recommendations. However, EXP5 suggested that the project manager fairly delegate tasks, roles and responsibilities among team members. The success of this recommendation will be determined by team members' willingness to precisely follow and accept those tasks and effectively consider them in an integrated effort to achieve the project's goals. This will increase team efficiency and trustworthiness, increasing the likelihood of successful project delivery. Figure 6-9 shows the final recommendations for project team members.

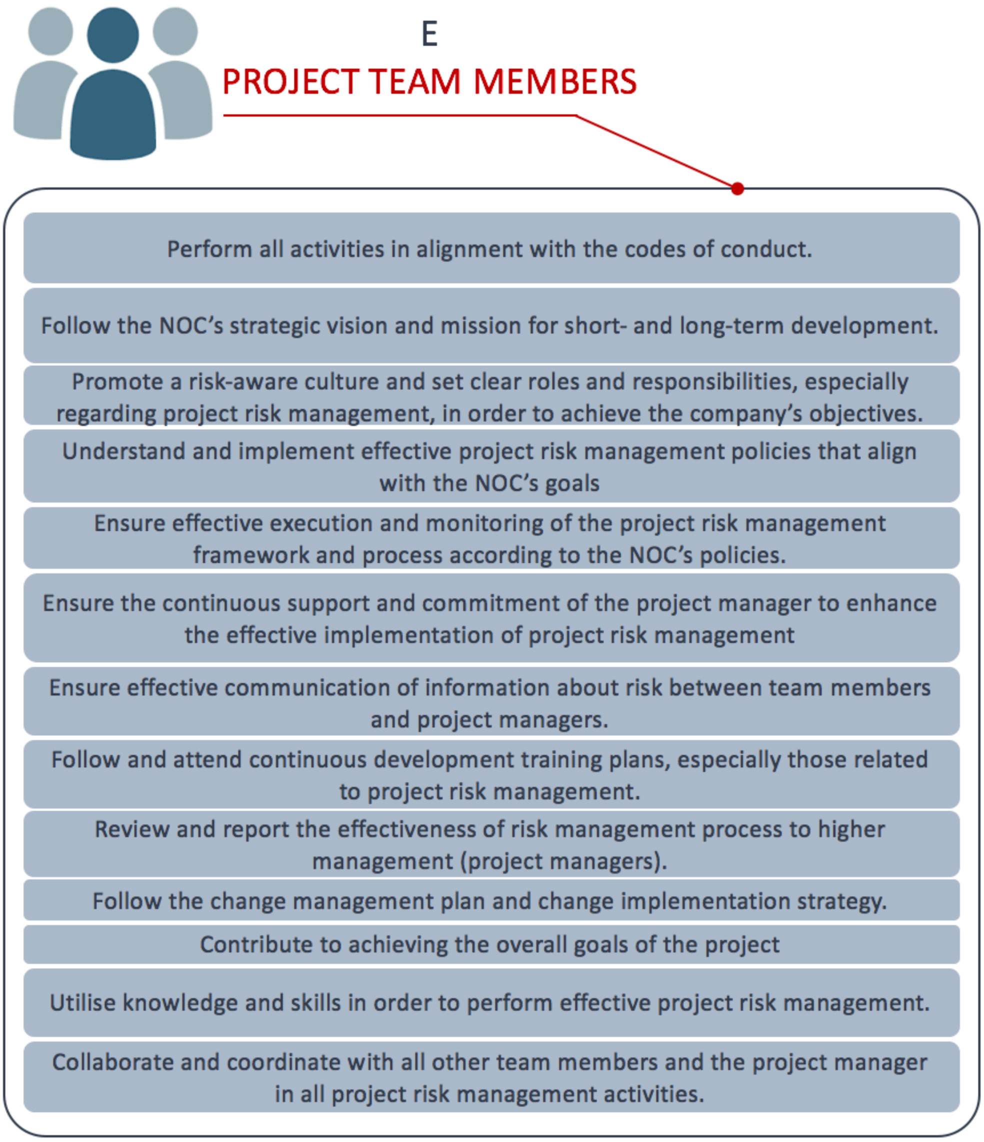



Figure 6-9 Final recommendations for project team members.

## 6.13 Summary

This chapter discussed the findings of the data analysis presented in chapter 5 of this thesis. The different themes of the semi-structured interviews presented in chapter 5 were supported by a document review, which was synthetically discussed in this chapter, and academic literature. By doing so, the researcher used different sources of evidence (triangulation) to enhance the quality of the research and further strengthen the arguments being discussed. This definitely increased the reliability and validity of the results. This chapter also presented a set of recommendations for effective project risk management practices. Such recommendations were based on and targeted different managerial levels within the NOC. Finally, these recommendations were validated to further enhance the quality of the research.

# Chapter 7 Conclusion

## 7.1 Introduction

Chapters 2 to 6 of this thesis discuss the achievement of the aim and objectives of the research. Chapter 2 provides an overview of the study and discusses the importance of the oil and gas industry in general and presents detailed information on the significance and challenges of the industry in the Libyan context in particular. Chapter 3 synthesises the main issues pursued in the research through a comprehensive review of the literature on project risk management. Chapter 4 describes the research methodology, specifically the research philosophies, approaches, strategies and data collection and analysis procedures that are most appropriate for addressing the research problem. Chapter 5 presents the results derived from the analysis of semi-structured interviews and the review of related documents discussed in Chapter 6. The outcomes of the discussion in Chapter 6 were used to develop a set of recommendations that were also validated and presented at the end of the chapter. This chapter, which summarises and concludes the thesis, is organised as follows:

- It provides an outline of the achievement of the study objectives.
- It presents the implications of this research for theory and practice.
- It sets out the research limitations.
- It provides suggestions regarding further areas of study.

## 7.2 Achievement of Study Objectives

As outlined in Chapter 1, this study investigated the project risk management practices in the Libyan oil and gas industry to enhance such process in the country. This direction was driven by the significance of the study area and the lack of related studies recognised from the synthetic literature review (See Section 1.2.). To accomplish the aim, the following objectives were pursued:

- To critically review the concept and importance of effective project risk management practices with particular reference to the oil and gas industry;
- To investigate the awareness of risk and project risk management in the Libyan oil and gas industry;
- To examine the current practices of project risk management in the Libyan oil and gas industry;
- To evaluate the challenges that influence the development of effective project risk management practices in the Libyan oil and gas industry;
- To develop recommendations for enhancing project risk management practices in the Libyan oil and gas industry.

The following sections feature a reassessment of each research objective to evaluate the degree to which every objective has been satisfied.

### 7.2.1 Research objective 1: To critically review the concept and importance of effective project risk management practices with particular reference to the oil and gas industry

To accomplish this objective, the researcher conducted a detailed and comprehensive literature review, which is discussed in Chapters 2 and 3. First, an overview of the oil and gas industry and the manner by which it operates was derived (Chapter 2). Obtaining an overview of the industry is important as the context of the research lies within this sector. Second, a detailed and synthesised review of the literature on project risk management was conducted (Chapter 3). Before referring to project risk management practices in the industry, the researcher defined the concepts of risk (Section 3.2), risk management (Section 3.3), projects (Section 3.4.1), project management (Sections 3.4.2 and 3.4.2.1) and project risk management (Sections 3.5.1 and 3.5.2). In general, no standardised definitions of these concepts exist, as reflected by the outlined sections of Chapter 3.

Project risk management is widely practised in different industries, including the oil and gas industry, mainly because this process aids the rapid identification, assessment, monitoring and control of different events that may negatively (threats) or positively (opportunities) affect a project. The benefits of project risk management are detailed in Section 3.5.3. Despite having slight differences in level of detail, scholars and professionals generally agree on the steps involved in project risk management. These steps are risk identification, risk analysis/assessment, risk response/mitigation and risk control.

Different professional bodies, such as the PMI (Section 3.5.6.1), APM (Section 3.5.6.2) and BSI (Sections 3.5.6.3 and 3.5.6.4), recognise the fact that project risk management is a valuable constituent of the good practices of project management. Accordingly, these organisations developed their own guidelines and approaches to project risk management, as described in Section 3.5.6. Despite slight differences, all these frameworks are designed to provide organisations with good practices and guidelines on how to implement project risk management. Part of such process is the adoption of different available tools and techniques that facilitate project risk management (See Section 3.5.7.).

We can argue that all the aforementioned good practices are implemented in the hope of improving project performance, but the relationship between these issues has not been definitively determined. This deficiency is evident in the disagreement amongst many scholars on the positive relationship between the implementation of project risk management and perceived project success (Section 3.5.8). Such disagreement can be attributed to the absence of a clear definition of what project success is (See Section 3.5.8.1.) or to the challenges that confront different organisations as they implement good and effective project risk management practices (See Section 3.5.9.). Chapter 3 describes the critical success factors for implementing an effective project risk management process (See Section 3.5.10.).

With particular reference to the oil and gas industry, different scholars have looked into the application of project risk management, and many have developed different frameworks (e.g. IRM, RMR and ERM) in the hope of improving project performance in the sector. These initiatives were prompted by deficient performance in many of the industry’s projects as a result of poor project risk management practices (See Section 3.6.). This poor performance of oil and gas projects is also evident within the Libyan context (See Section 3.6.1). However, despite the importance of the concept of project risk management in enhancing project performance, the detailed literature review indicated that there are no previous studies have been carried out on the topic in the Libyan oil and gas industry. Hence, this has been identified as a knowledge gap that is addressed by this study, which further justifies the importance of conducting the study.

### 7.2.2 Research objective 2: To investigate the awareness of risk and project risk management in the Libyan oil and gas industry

The literature review indicated a lack of research on project risk management in the oil and gas industry of Libya. In this regard, the second objective was realised by combining two sources of evidence: semi-structured interviews and document reviews (Chapter 5). The interview outcomes showed that no agreed-upon definition of risk exists. All the respondents viewed risk as a negative issue that exerts unpleasant consequences. In reality, risk can be regarded as both a positive and negative factor, but none of the interviewees believed this to be the case in the Libyan context. The review of the documents also revealed the absence of a documented definition of risk in the NOC. Project management is the umbrella that encompasses all project management practices, including project risk management, but the interviewees indicated that awareness of such concepts and related appropriate science is absent in the NOC (See Section 5.2.1.2.).

### 7.2.3 Research objective 3: To examine the current practices of project risk management in the Libyan oil and gas industry

Similar to the second objective, this objective was achieved on the basis of the semi-structured interviews and document reviews. The interview results revealed that no clearly written and documented systematic framework for project risk management exists in the NOC (Section 5.2.1.2.1). A number of the interviewees expressed the belief that risk management practices in the Libyan oil and gas industry are applied only for the purpose of identifying and assessing risks that are related to HSE and not for the systematic identification, assessment, monitoring and control of different project risks. These issues are thoroughly discussed in the different frameworks developed by professional project management organisations (See Section 3.5.6.). The review of relevant documents, such as NOC policies (Sections 5.6.1 and 5.6.1.1) and national laws (Sections 5.6.1.2 and 5.6.1.3), confirmed the findings from the interviews: risk management in the Libyan oil and gas industry focuses only on risks that affect the health and safety of workers and the environment.

Some of the respondents expressed an unfavourable evaluation of risk project management, but a number of them believed that such practices are implicitly applied. An example is the planning stage of projects, during which practitioners establish contingency plans for scheduling or costs. Nevertheless, the interviewees acknowledged that such efforts are based on the prior knowledge and experiences of project managers rather than a written framework. Another strategy through which project risk management can be implemented in the NOC is the transfer of risks to contractors, as presented in Section 5.2.1.2.3.

Fully understanding the project risk management practices currently implemented in the Libyan oil and gas industry necessitates the examination of different tools and techniques that are intended to facilitate the process. The interview findings illuminated a variety of such tools and techniques (See Section 5.3.), with brainstorming and the creation of risk matrices being the most popular. Yet again, however, these tools and techniques are used in the Libyan industry to identify and assess HSE-related risks. Most of the participants observed limitations in the use of these tools and techniques, including individual experience and knowledge, accuracy of input data and size and type of project (See Section 5.3.3).

The ultimate aim of project risk management is to increase the success rates of projects. This observation corresponds with a belief within the NOC that project risk management practices enhances project performance, as demonstrated by the agreement amongst a number of participants that these practices effectively reduce project failure and increase project success rate (See Section 5.3.2.). The document reviews indicated inferior performance in many oil and gas projects (See Section 5.6.3.3). This performance, according to the interviewees, could be rooted in the lack of project risk management practices in the industry.

### 7.2.4 Research objective 4: To evaluate the challenges that influence the development of effective project risk management in the Libyan oil and gas industry

For this objective, as well, the semi-structured interviews and document reviews played an important role in achievement. Establishing project risk management is difficult, as discussed the literature review chapter. The interview results showed that the Libyan oil and gas industry is confronted with various challenges that negatively influence the development of effective project risk management. These challenges include the lack of knowledge and experience amongst practitioners (Section 5.4.1), the lack of support from senior management (Section 5.4.2), resistance to change (Section 5.4.3), the lack of structured training plans (Section 5.4.4), the lack of coordination and cooperation (Section 5.4.5), the lack of a management system (e.g. a project risk management framework) (Section 5.4.6) and the unstable security and political situation in the country (Section 5.4.7).

The document reviews supported the above-mentioned findings, pointing specifically to challenges that directly and indirectly influence the successful implementation of project risk management practices in the NOC. These were outlined in different sections of Chapter 5, including Section 5.6.8. Perhaps the most frequently recurring theme in the document reviews is the effect of the unstable security and political situation in the country and its consequences on the industry. This problem has also affected the implementation of an effective project risk management process because it has constrained financial resources (See Section 5.6.6). This effect stems primarily from the closure of many oil and gas fields and ports, which in turn, has reduced hydrocarbon production (See Section 5.6.5) and financial returns (See Section 5.6.6). The effects of such closure on the Libyan oil and gas industry include financial losses due to the interruption of hydrocarbon production (Section 5.6.7.1), effects on exploration activities (Section 5.6.7.2), effects on production costs (Section 5.6.7.3), effects on sustainable development (Section 5.6.7.4) and effects on global market share (Section 5.6.7.5). All these challenges impede access to field locations and limit funds, which both affect the satisfaction of minimal requirements for establishing an effective project risk management process. Some of these requirements are training on project risk management budgets, accurate communication of risks from field locations and risk management resources.

### 7.2.5 Research objective 5: To develop recommendations for enhancing project risk management in the Libyan oil and gas industry

The final objective was achieved by integrating all the previous objectives (1–4). Chapter 6 presents the recommendations for developing an effective project risk management process in the NOC (Section 6.11). In general, the recommendations were based on three organisational authorial levels, namely, (1) the board of directors in the NOC; (2) the executive level, specifically general department directors; and (3) the lower managerial level, which encompasses department managers, with particular reference to projects and maintenance departments and the general departments of human resource development, project management and project teams in the NOC. In the opinion of the researcher, because risk management is the responsibility of all NOC employees and because of the hierarchical organisational structure of the NOC (Figure 5.1), providing recommendations that are targeted specifically towards each of the groups enumerated above can enhance the successful implementation of the recommendations.

To increase the validity and reliability of the recommendations, the researcher conducted additional interviews to verify the outcomes of the recommendations and their clarity, consistency and applicability in practice. Key participants in the NOC were targeted, and these individuals are those who will be affected by the application of the recommendations. The researcher ensured the selection of a total of three participants, namely, the board of directors' advisor and two project managers. The final recommendations were then presented to each authorial level in the NOC (See Section 6.12.1-5).

Overall, the researcher fulfilled all the objectives (as detailed in Section 7.2) and the aim of this study. On the basis of the ongoing academic debate about the positive relationship between implementing project risk management practices and project success (See Section 3.5.8.), the research findings (Chapter 5) and the discussion of the results, which advanced the formulation of recommendations (Chapter 6), this research concluded that the implementation of project risk management practices potentially decreases project failure in the Libyan oil and gas industry and, hence, increases project success.

## 7.3 Contribution to Knowledge

This research contributes to theory and practice in several ways.

### 7.3.1 Contribution to theory

- In terms of global project risk management, this research adds to the current body of knowledge on the process. The literature review was carried out to identify previous studies on the topic in relation to the oil and gas industry in Libya. However, such studies are lacking. The current research fills this void, expanding the understanding of project risk management practices and the scope of the oil and gas project management literature by recognising the important positive effects of project risk management practices on project performance.

- This research used a qualitative methodology to fulfil the aim and objectives. The same methodology can be applied in explorations of similar problems in other contexts and countries.

- This research outlined the challenges that affect the successful implementation of project risk management in the Libyan oil and gas industry from a theoretical point of view. It provides a useful discussion of how to overcome the challenges in light of limited publications on the Libyan context.

- This study proposed useful recommendations for implementing effective project risk management in the Libyan oil and gas industry. These insights add significantly to the academic literature as they can be further investigated in similar research contexts.

### 7.3.2 Contribution to practice

- The recommendations for implementing effective project risk management in the NOC (Chapter 6) can be used to increase awareness of the concept.
- The recommendations were categorised and targeted specifically towards three managerial levels in the NOC, thereby increasing the chances of the successful implementation of project risk management. Precise and detailed recommendations were provided for each group.
- The ultimate aim of the recommendations is to enhance performance in Libyan oil and gas projects. Such performance can be achieved with the implementation of the recommendations in practice. Practical application is important because the country is experiencing difficult political and security risks, which influence other types of project risks. Libya relies heavily on the oil and gas industry as the main contributor to its income.
- The findings also serve as a valuable guide not only for people who work in the NOC and are directly involved in daily project management but also for academics and researchers who are interested in further reviewing the recommendations and enhancing project risk management in the Libyan oil and gas industry.

## 7.4 Limitations

Similar to any other research, the current work has a number of limitations. First, careful attention was paid to enhance research reliability and validity (See Section 4.14.), but one of the major constraints occurred during the fieldwork primarily because of the current unsafe and insecure situation of Libya. Such situation limited the ability of the researcher to travel and interact with the interviewees for face-to-face discussions. Second, given the data restriction imposed by the NOC and the researcher’s inability to travel, only partial access to documental information was possible. The third limitation revolves around the research’s design, that is, a single qualitative case study, which suffers from potential issues regarding the external validity of research findings. Fourth, because this research focused on the project risk management practices in the oil and gas industry in Libya, the generated recommendations may need to be modified for applicability to other countries or contexts. Finally, the study may be limited in terms of the longitudinal effects of implementing the recommendations on project risk management in the case industry and their assessed effects on projects. Nevertheless, the researcher validated the recommendations and their effects by specifically targeting individuals with long-term experience and involvement in oil and gas projects in the Libyan oil and gas industry (Section 6.12).

## 7.5 Further Studies

This section identifies further research directions that were underlined through the work conducted for this thesis. Although this study successfully achieved the aim and objectives (Chapter 1), more explorations are needed to inquire into the other aspects of project risk management. Suggestions regarding such investigations were based on the personal views of the researcher.

One of the key areas identified for further study are the effects of a project manager's soft skills on the implementation of an effective project risk management process. An interesting dimension for exploration is the extent to which these abilities can influence practices in the Libyan oil and gas industry. On the positive basis of the feedback received on the recommendations, however, (Section 7.5) one of the limitations of this study is the non-implementation of the recommendations in risk management practices for live projects. Therefore, further research should be conducted to examine the effects of the recommendations on project success. This study adopted a fixed unit of analysis, that is, project risk management practices in the NOC. Future studies can focus on a different unit of analysis, such as the individuals carrying out the work. Finally, because the recommendations were confirmed to be beneficial to Libya's oil and gas industry, the current research design and results can be applied and tested in countries of a similar context.

# Publications

Elhoush, R and Kulatunga, U 2017, Investigation into the Current Project Risk Management Practices within the Libyan Oil and Gas Industry, in: The 6th World Construction Symposium 2017, 30th June-2nd July, Sri Lanka.

Elhoush, R and Kulatunga, U 2017, Effectiveness of project risk management: A study within the Libyan oil and gas industry, 13th International Postgraduate Research Conference, 14th-15th September, University of Salford, UK

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# Appendix A

**Semi-structured interview guideline**

**Introduction**

The aim of this interview is to understand the interviewee's perspective about issues related to project risk management practices in the Libyan oil and gas industry as well as the interaction between both phenomena in the studied context. This research is an independent academic study.

The data collected from the interviews will help the researcher understand the current issues and concepts of project risk management practices within the Libyan context. Accordingly, there are no right or wrong an answer for the upcoming questions, instead, it is a matter of reflecting the interviewee's experience with the phenomena.

**Your rights**

All information which is collected about you during the course of the research will be kept strictly confidential, and any information about your name, role and address will be removed so that you cannot be recognised. If you have any questions as a result of reading this information sheet, you may query the researcher at any time. You may decide to stop being a part of the research study at any time without explanation. You have the right to ask that any data you have supplied to that point be withdrawn or destroyed. You have the right to omit or refuse to answer or respond to any question that is asked of you. You have the right to have your questions about the procedures answered.

**Section one: Background information**

1. What is your job title?
2. How long you have been working in your organisation for?
3. Which department do you belong to?

**Section two: Project risk management**

4. What do you understand by the term "risk"? How does your department define risk?

5. Could you please tell me more about the risk management process in your department? Do you follow structured risk management practices (e.g. risk identification, analysis, monitor and control)? Have you implemented a risk management framework?

6. Could you please tell me who is involved in the project risk management process within your organization? Do you employ external consultants or have in-house employees? What characteristics (age, qualification, experience, seniority, etc.) of an individual do you think are important to perform this process?

7. Does your department/organization provide and facilitate training and development initiatives for developing effective project risk management practices? If so, is it done on regular basis?

8. Who is responsible for setting the project risk management policies and process of your organization? Could you please explain the role and support of top management in this process?

**Section three: Risk management tools and techniques**

9. What are the main tools and techniques currently used to evaluate project risks (e.g. brainstorming, check list, risk matrix, decision tree analysis, etc.)? Do you apply the same project risk tools and techniques for all project risk management process?

10. To what extend do you think the current tools and techniques used are effective in terms of identifying and assessing project risks and provide accurate results? How?

11. What are the limitations of the currently used project risk management tools and techniques? What are the strengths of these tools?

12. What factors do you think will influence the choice of these techniques? Please give details?

13. Do you think applying project risk management tools and techniques do improve the project success rate? How is the project success rate evaluated? Please give examples from previous projects.

**Section four: Challenges and barriers**

14. Could you please tell me about the challenges you are facing in your organization that limit the effectiveness of project risk management practices (e.g. lack of experienced personnel, limited resources, lack of top management support, technical knowledge, etc.)?

15. How does the country's security and political situation have influenced your organization and in particular limiting the effectiveness of project risk management practice? To what extend did this change influenced your organisation before and after the Libyan revolution in 2011?

16. Could you tell me your opinion of any further suggestions for developing effective project risk management process? Specifically, during the different project risk management phases?

**Thank you for taking time to conduct this interview with me.**

Contact name: Raeif Elhoush
E-mail: r.elhoush@edu.salford.ac.uk

# Appendix B

# نموذج أسئلة المقابلة

## المقدمة:

الهدف من هذه المقابلة هو فهم وجهة نظر المشاركين عن القضية المتعلقة بممارسات إدارة مخاطر المشاريع في صناعة النفط والغاز في ليبيا. الهدف الأساسي من هذا البحث هو قياس مدى ممارسة أساليب إدارة مخاطر المشاريع في مشاريع إدارات المؤسسة الوطنية للنفط التالية: إدارة الاستكشاف، إدارة الصيانة والمشاريع وإدارة الإنتاج، حيث ان بحثي يشمل كل المخاطر التي تؤثر على نجاح المشروع مثل: تلك التي تؤثر على الجدول الزمني، الميزانية والجودة.. الخ ولا يقتصر فقط على مخاطر السلامة والصحة المهنية.
البيانات التي سوف يتم جمعها من المشاركين ستساعد الباحث على فهم المشكلة الحالية ومفاهيم ممارسات إدارة مخاطر المشاريع في إطار قطاع النفط والغاز الليبي. وفقا لذلك، لا يوجد هناك إجابات صحيحة واجابات خاطئة للأسئلة فهي بالمقابل انعكاس لخبرات المشاركين.

## حقوق المشاركين:

- جميع المعلومات التي يتم جمعها من المشاركين في هذه المقابلة سوف تكون في سرية تامة.
- معلومات الأسماء والعناوين سوف يتم حذفها ولن يتم التصريح بها.
- المشترك لدية الحق في الاستفسار من الباحث عن أي سؤال يصعب عليه فهمه في أي وقت.
- المشترك لدية الحق في الانسحاب من المقابلة في أي وقت بدون ذكر مبررات.
- المشترك لدية الحق في طلب حذف أي معلومات بعد تقديمها في حال تراجع المشترك عنها.
- المشترك لدية الحق في رفض الإجابة على أي سؤال.

## القسم الأول: معلومات أساسية

1) ما هو المسمى الوظيفي للمنصب الذي تشغله؟
2) منذ متى وأنت تعمل في هذا المنصب؟
3) إلى أي قسم ينمتي هذا المنصب؟

## القسم الثاني: إدارة مخاطر المشاريع

4) ما هو مفهومك لمصطلح (المخاطر) ؟ وكيف يعرف قسمك مفهوم المخاطر؟
5) هل تستطيع اخباري بمزيد من المعلومات عن إدارة المخاطر في قسمك؟ وهل تتبعون نموذج لإدارة المخاطر مثل (تحديد المخاطر، التحليل، الرصد والمراقبة...الخ)؟ وهل لديكم إطار لإدارة المخاطر؟
6) هل تستطيع إخباري عن طبيعة الأشخاص المنخرطين في عملية إدارة المخاطر في المؤسسة التي تعمل بها؟ وهل هم خبراء وموظفين بنفس المؤسسة أم مستشارين خارجيين؟ وماهي الصفات الشخصية التي تعتقد أنها يجب أن تكون في الموظفين مثل (العمر، المؤهلات، الخبرات.... الخ) لإنجاز هذه العملية؟
7) هل المؤسسة أو القسم الذي تعمل لدية يوفر ويسهل برامج تدريب وتطوير لتطوير فاعلية إدارة مخاطر المشاريع؟ إذا كان كذلك، هل يتم ذلك على أساس منتظم؟
8) من هو المسؤول عن وضع خطة إدارة المخاطر للمنظمة؟ هل تستطيع شرح دعم ودور الإدارة العليا في هذه العملية؟

## القسم الثالث: أدوات وأساليب إدارة المخاطر

9) ما هي الأدوات الرئيسية والتقنيات المستخدمة حاليا لتقييم مخاطر المشاريع مثل (العصف الذهني(Brainstorming)، مصفوفة المخاطر(Risk matrix) ، شجرة القرار(Decision tree) . ..الخ)؟ وهل تنطبق نفس الأدوات والتقنيات على جميع المشاريع؟
10) إلى أي مدى تعتقد فاعلية الأدوات والتقنيات المستخدمة حاليا من حيث تقييم وتحليل المخاطر وإعطاء نتائج دقيقة؟
11) ما هي القيود المفروضة على أدوات وتقنيات إدارة مخاطر المشاريع المستخدمة حاليا؟ ما هي نقاط القوة في هذه الأدوات؟
12) ما هي العوامل التي تعتقد أنها تؤثر على اختيار هذه التقنيات؟
13) هل تعتقد أن تطبيق أدوات وتقنيات إدارة مخاطر المشاريع تحسن معدل نجاح المشاريع؟ كيف يتم تقييم نسبة نجاح المشاريع؟ يرجى إعطاء أمثلة من المشاريع السابقة.

## القسم الرابع: التحديات والعوائق

14) هل يمكنك اخباري عن التحديات التي تواجهها مؤسستك/إدارتك والتي تقلل من فاعلية ممارسات إدارة مخاطر المشاريع (مثل المعرفة التقنية، ندرة الموظفين من ذوي الخبرة، ندرة الموارد أو ندرة دعم الإدارة العليا ...الخ)؟

15) كيف يستطيع أمن البلاد والوضع السياسي التأثير على مؤسستك/إدارتك وعلى وجه الخصوص التقليل من فاعلية الممارسات المتبعة في إدارة مخاطر المشاريع؟ وإلى أي مدى أثرت هذه التغيرات على مؤسستك قبل وبعد الثورة الليبية في عام 2011؟

16) هل لك أن تزودني برأيك في أي اقتراحات أخرى لتطوير فاعلية إدارة مخاطر المشاريع؟ على وجه التحديد، خلال مختلف مراحل إدارة مخاطر المشاريع؟

**شاكرا لكم مجهوداتكم ووقتكم لإجراء هذه المقابلة معي.**

**مقدم الأسئلة:** الطالب/ رائف الهوش
**البريد الالكتروني:** r.elhoush@edu.salford.ac.uk

# Appendix C

## Participant Information Sheet

**STUDY TITLE:**
Investigation into the current project risk management within the Libyan oil and gas industry.

**PURPOSE OF THE STUDY:**
This project is an independent academic study. The research I wish to conduct is part of my Doctoral thesis. This research aims to investigate the current project risk management practices within the Libyan oil and gas industry and develop a set of recommendations that provides the oil and gas industry with the knowledge to perform an effective risk management process, as well as to fill in the gap of knowledge.

**PARTICIPANTS' RIGHTS:**
The researcher will invite the participant to take part in this research study. Participation in this study is entirely voluntary. If the participant has a concern about any aspect of this study, he/she has the right to contact me on the contact information outlined. The researchers will do this best to answer his/her questions and clarify any concerns before you agree to participate. The participant will then be asked to sign a consent form to show he/she agrees to take part. The participation will involve an interview of approximately between 45-50 minutes. He/she may decide to stop being a part of the research study at any time without explanation. The participant has the right to ask that any data he/she has supplied can be withdrawn or destroyed. The participant has the right to ignore or refuse to answer or respond to any question that is asked to him/her. The participant has the right to have his/her questions about the procedures answered.

**CONFIDENTIALITY:**

All information which is collected about the participant during the course of the research will be kept strictly confidential, and any information about their name and address will be removed so that you cannot be recognised. If the participant withdraws from the study the researcher will destroy all his/her tape recorded interviews.

# Appendix D

**Investigation into the current project risk management practices within the Libyan oil and gas industry**

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**CONFIDENTIALITY STATEMENT**

All responses given as part of interviews, questionnaire survey and documents will be treated with utmost confidentiality and will be available only to the researcher and supervisor of the project. Excerpts from the interviews, questionnaire and documents will be used for research publications, but under no circumstances will your name or any identifying characteristics be disclosed in such publications.

Both the participant will sign this confidentiality statement and the researcher in order to ensure that data obtained will only be used for the above research, and will not be disclosed to any other person, or be used for other purposes.

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**RESEARCH PARTICIPANT CONSENT FORM**

**Project title**: Investigation into the current project risk management practices within the Libyan oil and gas industry.

| ***Please tick the appropriate boxes*** | **Yes** | **No** |
|---|---|---|
| **Taking Part** | | |
| I have read and understood the project information sheet. | ☐ | ☐ |
| I have been given the opportunity to ask questions about the project. | ☐ | ☐ |
| I agree to take part in the project. Taking part in the project will include being interviewed and recorded (audio or video). | ☐ | ☐ |
| I understand that my taking part is voluntary; I can withdraw from the study at any time and I do not have to give any reasons for why I no longer want to take part. | ☐ | ☐ |
| **Use of the information I provide for this project only** | | |
| I understand my personal details such as phone number and address will not be revealed to people outside the project. | ☐ | ☐ |
| I understand that my words may be quoted in publications, reports, web pages, and other research outputs. | ☐ | ☐ |
| *Please choose **one** of the following two options:* | | |
| I would like my real name used in the above | ☐ | |
| I would **not** like my real name to be used in the above. | ☐ | |
| **Use of the information I provide beyond this project** | | |
| I understand that other genuine researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form. | ☐ | ☐ |

I understand that other genuine researchers may use my words in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form. ☐ ☐

## So I can use the information you provide legally

I agree to assign the copyright I hold in any materials related to this project to Raeif Elhoush. ☐ ☐

| | | | |
|---|---|---|---|
| Name of participant | [printed] | Signature | Date |
| Researcher | [printed] | Signature | Date |