Development of Performance Measurement Model for Oil Operations: A Study of Libyan Oil Companies

A Thesis Submitted for the Degree of Doctor of Philosophy

By

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ABSTRACT

Petroleum practices involve high capital infrastructure together with complex production process for which performance measures can support examination of production within the petroleum industrial phases. The focus of this research is the performance measurement of existing and future petroleum operations. This study aims to develop a model to evaluate the employment of performance measurement in state-owned as well as private petroleum firms within the Libyan context to recognize existing activities as well as their influence on performance management. This research highlights some resources of firms including asset management and partnerships that influence their operations to acquire and multiply knowledge and technology, leading to more successful processes and better performance. This research aims to provide a model that comprises factors that may influence Libyan firms' performance including exploration, drilling, production, reserves, technology upgrades and health, safety and environment.

This research employed a mixed method of quantitative and qualitative approaches with a dominant quantitative method, correlation and regression tests were conducted .A questionnaire survey was conducted in 17 Libyan oil firms including public, joint venture and private firms, 85 valid questionnaires were analyzed by using SPSS (V.18).

The findings of this research revealed that firms may enhance their ability to acquire, assimilate, and exploit knowledge and technology by the utilization of asset management as well as partners. Further, factors including exploration, production, reserves, technology upgrades and health, safety and environment were found to significantly influence the firms' performance whereas, drilling was found not to be a predictor to the firms' performance.

Finally, the model analysis and survey evaluation highlighted the practices of oil operations and their role in firms' performance, and the proposed model explains which operation practices positively impact the firms' performance, which can be taken up as a guiding map for petroleum companies for aiding them to make valuable decision that leads to higher performance.

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I dedicate this thesis

For my great father, may Allah forgive him

For my wonderful mother, may Allah protect her

For my fabulous brothers and sister,

For my beloved wife, my son Omar and my daughter Farah...

For their love and support

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

BAM	British Academy Management
Bbl/d	Barrels per day
BCF	Billion cubic feet
E & P	Exploration and production
HSE	Health, safety and environment
ICMR	International Conference on Manufacturing Research
IEA	International Energy Agency
IOCs	International oil companies
KPIs	Key performance indicators
LNG	Liquefied natural gas
MGT	Management
NG	Natural gas
NOCs	National oil companies
O & G	Oil & gas
OPEC	Organization of Petroleum Exporting Countries
OSCs	Oil services companies
PMA	Performance Measurement Association
R & D	Research and development
SPSS	Statistical Package for the Social Sciences
WLGP	Western Libyan Gas Project

DECLARATION

This work was produced by the author unless otherwise stated and duly acknowledged.

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CHAPTER 1: INTRODUCTION

1.1 Research Background

Libya has one of the largest levels of hydrocarbon resources that remain untapped, with hydrocarbon-containing structures on a geological level. Libya has been shown to have crude oil reserves of around 48 billion barrels as per January 2013, which is supposed to be the largest bequest within the African continent, responsible for around 38% of the total of Africa and ninth biggest on a global level.

This study represents an original attempt to identify the criteria for performance management split down into more practical practices that can be used to reasonably evaluate the performances of the firm within the oil sector. The model in this study focuses on how the firm can optimize their chances of improved performance while investing on their internal resources and external knowledge.

The asset management, partnership and the oil operations theories within a firm is integrated within the proposed model for the first time in this study. This is likely to enhance the firms' chances of improved performances and accessing external knowledge and expertise.

A number of industries have devised and employed conceptual frameworks together with measurement structures so as to enumerate, evaluate and administer their performance. Increasing competition in the globalised business environment together with greater customer requirements pushed the petroleum industry to generate novel ideas to measure its performance ahead outside the present financial performance measures (Tordo et al, 2011). Interests on performance measurement in the petroleum industry have gone up significantly over the last few decades. Oil practices engage high scales of capital tools together with greater capacity production courses, which performance measures can support by observing production levels within the petroleum industry.

Scholars such as Keegan et al (1989) and Neely (1998) identified the area of performance management as very significant when detecting performance management together with its constructions. The diverse appropriate performance measures were highlighted by Dumond (1994), revealing that the research work conducted previously in respect to performance management reached dissimilar conclusions, as it was likely that such researches would be

giving feedback functions by offering the enterprise significant data with respect to the organizational business framework.

The studies in the field of performance have emphasized performance measurement together with themes, for instance the right choice and execution of performance measures. Neely (1999) pointed out a revolution in performance measurement, which is getting more and more contemporary, moved by causes such as varying types of work, entrepreneurial parts, exterior demands together with higher competition, especially improvement plans, influence of information technology as well as quality rewards. Radnor & Barnes (2007) stated that the performance literature highlights a range of topic fields giving distinctly more focus to concerns of performance measures as well as management, such as in operations management. Certainly the different and disjointed literature regarding performance measure is an area of great research interest, reflected in the development of the Performance Measurement Association (PMA) by Cambridge University.

To carry out correct evaluations together with development of schemes for development, performance management is greatly significant (Kincaid, 1994). Performance management implementation is greatly significant as far as the explanation of improving performance is related because it aids in creating schemes for making decisions for short and long term benefits (Lebas, 1995). Bititci et al (1997) argue that performance measure is frequently recognized as a fundamental mechanism concerning performance management. It gives and engages the complete important relevant data for taking decisions associated with organizational performance.

Performance measurement has now been a point of substantial interest for many years. Conventionally, organizations have measured performance in terms of finance, such as income and returns etc.; consequently, fiscal scales of performance remained the individual measures of organizational success. However, Kaplan & Norton (1992) stated that performance scales based on fiscal indices cannot handle topical changes in industries, especially because of the appearance of novel technologies together with strong competition. Figure (1.1) illustrates the performance measurement system design approach by Neely et al, (2000).

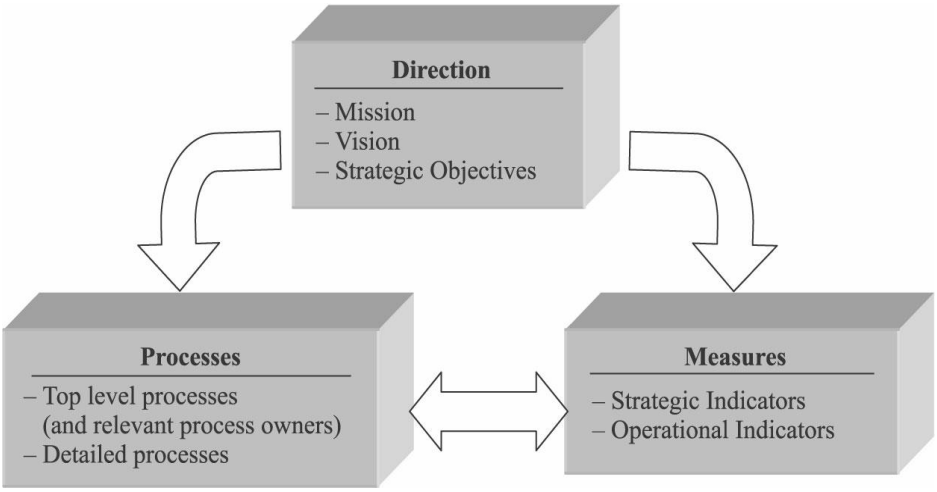


Figure 1.1: Performance measurement design approach

Source: Neely et al (2000)

Bititci et al (2005) revealed the expansion from explaining worldwide citations on humanizing performance to express performance measure configurations together with schemes as highlighted by Folan and Browne (2005), which involves the issues of implementation together with extending performance management structures for the attainment of maximum performance at the organizational level.

Neely (1997) stated that although periodicals have long shown suitable performance measures, academics are now emphasizing the effects of performance dimension upon performance. However, Davis & Albright (2004) argued that research works in this emerging field, checking for quantitative relations between specific measures as well as performance outputs, have shown inconsistent outcomes. For Halachmi (2005), fundamental expansion in the performance literature concerns not only performance measure, but also performance management. An expansion of features of performance together with unit of inspection examined has also taken place in the topical study. According to Radnor & Barnes (2007), the majority of current work has explored the performance measurement of the enterprise among others, and this study attracted on modern-day interest in the examination of the performance of oil enterprises.

1.2 Research Motivations

Existing studies have shown the significance of performance measure together with performance management of enterprises, products and procedures. However, the literature

in the field is rather patchy and yet growing, presenting a lack of lucidity concerning numerous notions. Particularly, there has been great stress on the requirement of performance measure as well as management of petroleum enterprises in the course of the exploration as well as production phases. Stevens (2008) pointed that the emphasis on calculating the performance of petroleum enterprises is a fundamental field of interest for enterprises practically, as well as for academic purposes. An additional fundamental concern appearing in the literature of performance is not only the requirement of performance measurement, but getting a complete comprehension of the effects of performance measurement as well as management.

Pulling these concerns from the current literature proposes that there are prospects to examine how the performance of petroleum enterprises is measured and managed, especially as there is a necessity to conduct study for the examination of whether these procedures are valuable.

1.3 Performance Measurement and Analysis

Hoque & James (2000) conducted research on the association among performance measurement procedures together with their financial performance by making use of balanced scorecard. They found a positive association between both variables. However, Perera et al (1997) showed a negative connection between performance measure procedures together with their financial performance. In the same manner, Ittner et al (2003a) showed different results as they also conducted research by employing balanced scorecard but found out no relationship between measurement procedures together with their financial performance.

State-owned as well as private enterprises are concerned in the development as well as use of efficient performance measures as well as administrative structures. In this context, Slavic et al (2014) found that enterprises could only attain better performance by means of the expansion as well as execution of greater performance structures. However, Lebas (1995) found that different kinds of users greatly affect the choice of performance measures; users such as administrators, controllers as well as customers require diverse measures for distinct reasons.

Performance management is deemed to be a fundamental segment of an enterprise with multifaceted practices (e.g. manufacturing institutions), including quantifying practices. The procedure is employed to determine performance at a range of stages involving single level, entrepreneurial level, as well as ecological level (Homburg et al, 2012).

1.3.1 Background to performance measurement and management

Neely et al (1995) defined a performance measurement as the bunch of metrics employed to enumerate the effectiveness as well as efficiency of practices. There are a number of causes for the measurement of performance, for instance Andersen & Fagerhaug (2002) stated the motives for evaluating performance include offering administration as well as workers feedback on the activity they do. The resultant reaction from employees can produce several potentially helpful outcomes, such as positive reinforcement and improved job satisfaction (and thus productivity) among workers, and suggestions for improvement from frontline employees that can facilitate the enterprise to acquire continuous improvement.

Academics such as O'Sullivan et al (2004) emphatically presented initiatives for performance measurement and pointed out several primary performance indicators: material characteristics of project, sponsorship and support, knowing stakeholders together with improvement and lastly project progresses. Yuan et al (2009) identified that when the fundamental performance indicators are documented, established, and scrutinized then an open performance measurement will be practical. Cable & Davis (2004) argued that documentations of primary performance indicators together with the functioning of performance measurement play a significant part in the attainment of organizational goals and objectives.

1.3.2 Performance management in general

Bititci et al (1997) found that organizational performance should be examined in light of its commercial and operational scheme as well as objectives as it is the primary step for the procedure of performance management. The primary target of this is to present a practical, closed-circle control structure whereby the business together with operational schemes are utilized in business procedure, practices and assignments and then the reaction is attained by means of a performance measurement structure. In this way, Schalkwyk (1998) state

that this procedure backs up as well as synchronizes the course of methodical administration, taking decisions as well as undertaking action within the enterprise.

The determination of the organizational success for the attainment of their targets and fulfilment of policies is done by mean of procedure of performance measurement. Kagioglou et al (2001) explained that this is because in this procedure the yields of entrepreneurial policies together with functional policies are measured in numbers to examine the performance of enterprise. This is the reason why Bititci et al (1997) found that the structure of performance measurement is similar to the information system, which is the centre of examining organizational performance as well as measure.

According to the context of business environment, wherein organizations compete on the basis of non-financial factors, they need information on how well they are performing across a broader spectrum of dimensions, not only financial but also operational (Cable & Davis, 2004)

Academics such as Amaratunga et al (2000) and Sommerville & Robertson (2000) pointed out the criticism against traditional structures of performance measurement, which is greatly dependent upon fiscal measures (i.e. effectiveness, investment returns, output, sale per work and many others). According to Kagioglu et al (2001), enterprises that are reliant upon fiscal measures are only able to identify performance in the past, and they are incapable of determining factors for the consistent attainment of improved performance over the long term. However, Love & Holt (2000) proposed that the extent of the process of performance measurement of business organization should be expanded by including important driving elements that affect the organizational performance in the future. In the framework of corporate environment where the competition in the markets, enterprises need data regarding the different dimensions of performance including operational factors, not just financial ones as shown in Figure (1.2).

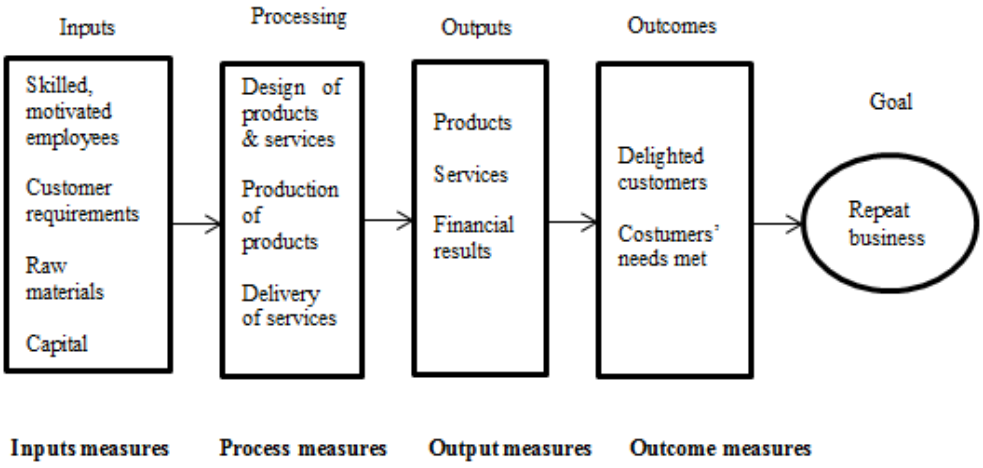


Figure 1.2: The Inputs, processes, outputs, outcomes framework

Source: Broun (1996)

1.3.3 Performance management in the oil industry

Neely (1999) revealed that the measurement regarding the performance of organizational activities both successful or failure ones are necessary not only to determine the organization's position in the market or industry but also to improve its performance in future against its competitors. As stated earlier that the performance management and measurement is a wide concept involving plenty of fundamental indicators for performance, such as success criteria for projects, and all such indicators are equally applicable to measure the performance of petroleum and oil enterprises whether national or international.

Auty (1990) states that the petroleum industry was usually taken as primary expansion for the growth in the general economic welfare not only in developing countries but also in developed countries due to its fundamental connections with other industries. In this regard, the role of state-owned petroleum firms is more emphatic than private ones because the former are not only materially connected with all other industries, they are also financially integrated with them (Stevens, 2004). Like other sectors and industries, the ups and downs of the oil and gas (O & G) industry is related to quite a number of financial and political elements. However, currently, the power and influence of state-owned O & G companies is greater than that of private oil firms due to their fundamental importance within nations, and the operations of private oil companies are correspondingly declining at the expense of state power and control. One reason behind this dominance is the control

of national petroleum firms over the natural reserves, which directly meet the supply of petroleum whereas private petroleum efirms do not have this kind of control over the resources (Victor, 2007; Jaffe & Soligo, 2007).

1.4 Creating Value in O & G

The O & G industry generates value by connecting a number of elements in the petroleum industry chain, from capital foundation to production, processes, shipping and ultimately to the market as showing in Figure (1.3) (Stevens, 2008). Resource foundation is a natural gift, but converting this into reserves together with manufacturing requires finance and endeavour. The production ties in with the value chain and is related with recovery as well as production expenditures elements, and they have technological and administrative features; the same goes for the dispensation as well as transportation phases of the chain supply. Although conventionally the value of O & G products are not concentrated at the source of production, even in state-owned oil firms, state-owned O & G companies usually work with control of expenditures and efficiency and thus are directly responsible for value creation (Eller et al, 2011).

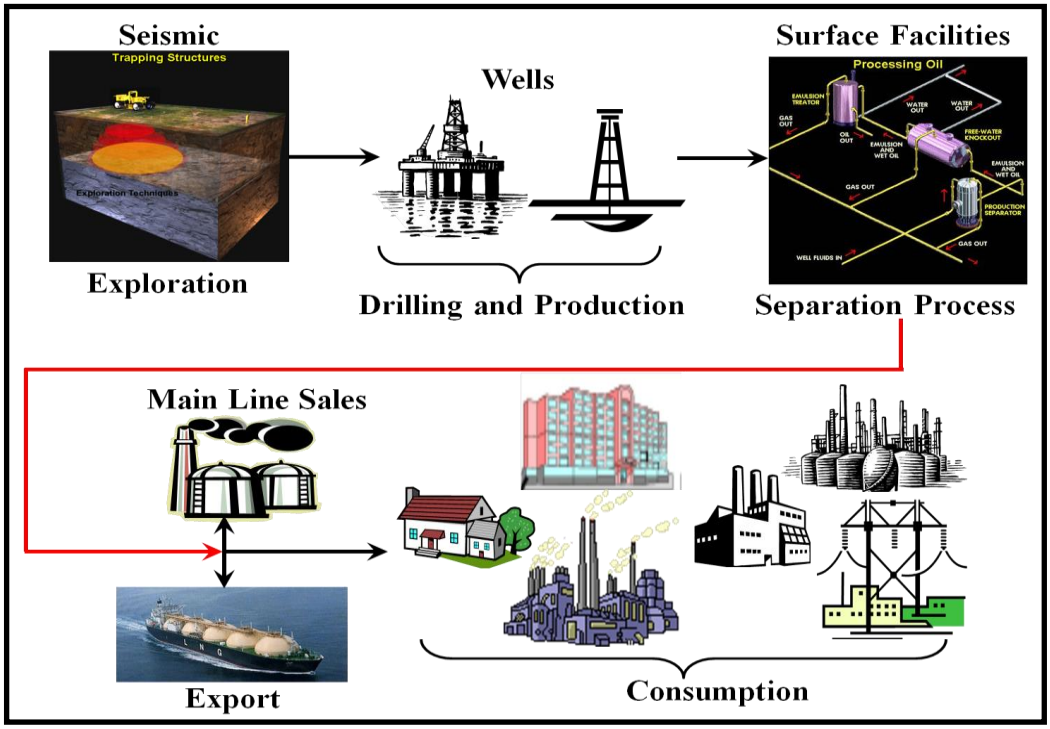


Figure 1.3: O & G life cycle

Source: Global Methane Initiative (2013)

1.4.1 National oil companies

National oil companies are organizations that were established during the mid-twentieth century by governments in different states to direct petroleum reserves that satisfy the demand for liquefied fuel (CEE, 2007). Jaffe & Soligo (2007) observed that the O & G sector is one of the most significant factors upon which national economies are reliant worldwide, particularly for O & G exporters. State-owned O & G firms control about seventy-seven percent of the extracted petroleum reserves in the world, which accounts for more than eleven-hundred billion barrels. These unearthed resources are under the authority of the state-owned oil companies without any contribution by the international petroleum firms. Further, he states most of top state-owned firms are present in developing countries and they comprise a significant cohort of enterprises on the global scale.

Including the hydrocarbons division, state-owned oil firms also have great influence over other industries, especially in terms of electricity generation, which is the reason why their power in the state is greater than any other industry of the country. One of the reasons why the number of international oil companies is less than the state-owned petroleum firms in gaining access to the hydrocarbon resources is the restriction of the government on allowing international companies to own their O & G reserves directly, which creates operational issues and undermines performance in competitive markets to meet the demands of the customers and consumers (Tordo, 2007).

1.5 Research Aim, Objectives and Questions

Research aim

To examine the changing drivers of oil operations in Libya and their strategic importance and the associated evolution of operational performance and metrics for oil companies.

This research aim can be achieved by pursuing the following objectives.

Research objectives

1. To demonstrate that research into oil production can benefit from identifying the changing context and drivers and the required performance of key operations and associated metrics.

2. To investigate and develop a conceptual framework for performance measures of current and future oil operations and the associated asset management for field operations.

3. To empirically identify the factors affecting the oil firm' performance.

4. To validate the conceptual framework by evaluating it in the context of the deployment of applications using performance management technologies or any other method appropriate.

Research questions

1. What aspects of oil operations have the greatest influence on performance?

2. To what extent do asset management and partnerships influence oil operations?

3. What level of influence do the firms' objectives have on performance?

4. What are the characteristics of oil firms in Libya in terms of oil operations?

1.6 Structure of the Thesis

- Chapter one is the introductory chapter, which includes the research motivation, aims and objectives, and the thesis structure.

- Chapter two reviews the related literature in the field of the performance management, operation management and oil operations.

- Chapter three presents the conceptual framework and the factors extracted from the related performance management and oil operations literature, and also provides the related hypotheses.

- Chapter four describes the research methodology and approach and presents the different research paradigms, the questionnaire design, the pilot study, the research design, and the related research procedure.

- Chapter five presents the empirical survey findings of the demographic characteristics, including ownership type, firms' size, scope of operation, respondent work experience, respondents' qualifications and firms' objectives. Also, it reports the effect of ownership, size and scope of operation on the model factors as well as on the firms' performance.

- **Chapter six** reports on the empirical findings from the model testing, including reliability test, normality test and all the different tests conducted, such as correlation and regression analysis.

- **Chapter seven** reports on discussing the empirical findings in the context of the existing literature.

-**Chapter eight** reflects on the thesis, describing the key limitations of the work and its contribution for practitioners, and it suggests areas for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Performance Measurement and Management

Performance management can be defined as a closed loop system involving the development of policies and strategies and receiving feedback from different levels for managing business performance. A performance measurement system is an information system at the heart of the performance management process. The effective functioning of the performance management system (PMS) is necessary for the efficient functioning of the organization (Neely et al, 1995; Smith, 2005).

Amaratunga et al (2000) defined performance management as a process that involves the quantification of efficiency and effectiveness of an action. It can be concluded from these definitions that performance management is the process involving determining how organizations and individuals could achieve their objectives successfully. The definition of performance management consists of a combination of criteria, different levels of analysis, a specific perspective, time frame, and the use of different measurement systems (Mithas et al, 2011).

Performance measurement is the heart and soul of performance management process. The process provides data that is collected, analyzed and reported to make sound business decisions. The process directs the business function by justifying expenditures and documenting progress towards objectives. The process is also helpful in identifying the strengths and weaknesses of an organization (Folan & Browne, 2005; Neely et al, 2005).

Performance measures tell organizations about products, services and processes. Performance management process allows organizations understand, manage, and improve functions of an organization. Effective PMSs are helpful in understanding how well an organization is performing, how it is meeting goals, how customers are satisfied and the control of processes (Neely, 1998; Neely, 2007).

PMSs are also helpful in making intelligent decisions. Performance measures are used for directing business functions and justifying expenditures of an organization. The performance management processes are helpful in providing an on-going assessment of

current organizational processes. They also play a vital role in driving organizational performance (Neely, 2007; Taticchi et al, 2010).

In a nutshell, performance measurement systems are successful when they are aligned with the mission, vision and values of an organization. The performance measures of an organization give life to the mission, vision and strategy of an organization. These measures provide focus that allows employees to determine how they contribute towards the success of an organization and expectations of stakeholders (Bourne & Bourne, 2009; Lavy et al, 2010).

According to Bourne et al (2005) & Ittner et al (2003a), Performance measures can be grouped into several categories, including effectiveness, efficiency, quality, timeliness, productivity and safety. The effectiveness of an organization is an important measure that indicates the degree to which processes are aligned with requirements. Efficiency is another important measure indicating the degree to which processes produce the required output at minimum cost. Quality is another important measure that determines the degree to which products or services meet the requirements of customers and ensure their satisfaction. Timeliness measures whether work was performed in a timely fashion or not. It is important to develop criteria that define the timeliness of work. The timeliness criteria are based on the requirements of customers. Productivity is the value added by processes, while safety dimension measures the health of an organization and its environment (Neely et al, 2005).

2.1.1 Performance measures (metrics) and indicators (KPIs)

Performance metrics are indicators of performance that are used for the purpose of comparison between organizations. Performance metrics provide an essential platform for comparison. With the help of performance metrics and indicators, firms can also seek improvements (Folan & Browne, 2005; Neely et al, 1995). The compatible and authentic performance metrics facilitate the understanding of driving forces that assist in creating facilities in an efficient manner. The selection of proper factors can influence the performance of an organization significantly. Therefore, performance indicators and metrics are vital for the evaluation of an organization’s performance (Choi et al, 2013; Gomes et al, 2004).

Performance metrics can define the performance objectives of an organization in a clear and quantifiable manner. The metrics relate to the objective of performance evaluation. They can be used for the purpose of determining the progress of an organization towards it goals(Cable & Davis, 2004; O'Sullivan et al, 2004). According to Yuan et al (2009), key performance indicators (KPIs) can be identified from four major perspectives including physical characteristics, financing, innovation and project processes. The genuine performance management of an organization is only possible through the identification and monitoring of KPIs.

The development of performance measurement metrics is the first step in benchmarking process. Performance metrics assist in establishing frameworks that serve as guidance for decision making. The authentic and compatible performance indicators could be easily transformed into strategies (Ho et al, 2000).

Amaratunga and Baldry (2003) categorized KPIs into several principles including internal processes, learning and growth and financial implications. The financial indicators of an organization offer financial appraisal of its performance. The indicators like operating costs, ground-keeping costs and others provide an estimate of expenses incurred by an organization.

The physical indicators of an organization's performance include the physical condition of its facilities, availability of space, accessibility of site and resource consumption. The physical indicators cover the physical condition of an organization. The state of the physical condition of an organization is expressed through qualitative and quantitative indicators. The functional indicators of an organization measure the space of a building and support facilities etc. The indicators also determine how well functional attributes are contributing towards the superior performance of an organization (Deru & Torcellini, 2005; Marr et al, 2004).

Performance measures can be defined as characteristics that are used for the purpose of evaluation. Performance measures can be defined as vital signs quantifying how well different activities can achieve specified goals (Spendolini, 1992). Samson & Lema (2002) have important insights about performance indicators. According to these researchers, performance indicators are measurable characteristics used by organizations for tracking the performance of products, operations, services and processes. The effectiveness of a

PMS depends on various indicators, which are used to define an organization's performance from different perspectives (Lavy et al, 2010).

The arguments of Abernethy et al (2013) suggest that it is important for firms to design these measures and indicators in such a manner that they relate to the performance management perspective an organization aims to adopt.

2.1.2 Why manage performance?

According to David et al (2001), the importance of performance management is that it provides important information regarding the effectiveness of an organization. Performance management is also necessary because it allows organizations to compare their performance with similar organizations (i.e. to remain competitive). The modern global economy comprises an intensely competitive environment in which performance measurement is critical for the success of businesses. Performance management is necessary in this era for aligning organizational activities, resources and processes with firm objectives. Performance management focuses on long-term goals and cultivates a strategic view of the organization. Performance management is used in benchmarking, standard setting, and comparison of an organization's practices with other organizations (Bopurne & Bourne, 2011; Lebas, 1995; Marr et al, 2004; Neely et al, 1995).

2.1.3 Operational aspects of performance

With different developments taking place in the field of performance management, research has progressed from using single measure of performance to broad operational measures. As suggested by Bull (2007), the value or success of an organization could be described in terms of its efficiency and effectiveness. The Balance scorecard approach has traditionally been the key to organizational success, but the use of only financial measures is not appropriate for measuring performance in contemporary organizations (Davis & Albright, 2004).

According to Slack et al (2007), the focus of measurement on operations management is on various parameters that help in conceptualizing performance. The most common operations management concepts include quality, cost, and speed. These concepts are supplemented with flexibility and dependability.

It has been argued by Chenhall & Langfield-Smith (2007) that performance can be perceived differently by customers and suppliers. The literature conceptualizes operational aspects at different transformation processes that occur in an organization; for instance, delivery to the customers and timely delivery from suppliers. The operational aspect of performance also includes product innovation, process innovation, supply chain management (SCM) and improvements and supply networks.

2.1.4 The current challenge

The literature on performance management has progressed from providing recommendations to formulating framework for performance management frameworks and systems. Performance management has always been viewed as a major instrument used for integrating all information related to managing performance ((Flapper et al, 1996; Bititci et al, 2005; Neely, 2005).

Performance management is facing the challenge of developing and using systems embedded in organizational processes. The current perspectives on performance management do not provide deep insight into issues that are part of organizational routines. The organizational processes must be the key objective of performance management initiatives. In order to achieve this goal, it is important to clarify two concepts. First of all, it is important to identify how different organizational processes related to performance. Second, it is important to determine how organizational processes could be affected. There is no denying the fact that PMS has an effect on the performance of an organization. However the actual mechanism of those effects is unknown (Marr & Schiuma, 2003; Neely, 2005; Folan & Broune, 2005; Kennerley & Neely, 2002).

2.1.5 The effects of PMS

The PMS of an organization has an effect on various organizational systems. Performance management has a significant effect on the management control system of an organization. The control function of an organization ensures that various business processes remain aligned with the objectives of a business (Neely, 2005).

The PMS plays a key role in controlling organizational performance. There are four components of management control system including planning, measurement, rewards and control. Planning takes place before actions while feedback and rewards occur once actions are taken. Measurement plays dual role of learning and information providing. With the

help of measurement, information about performance is communicated to the management (Bourne et al, 2004; Simons et al, 2000).

Performance management also has an effect on management accounting. The development of new accounting frameworks has increased the scope of accounting. The recent contributions into the field of management accounting suggest that performance management in this field allows the measurement of intangibles (Askim, 2004; Chenhall, 2005; Johanson et al., 2001a). Performance management can therefore be used in management accounting and management control systems in different ways. In management control systems, performance management could be used to provide information about past performance. It also contributes towards providing information and direction about future performance. The process of performance management affects management accounting by measuring intangibles (Smith, 2005).

2.1.6 The performance measurement revolution/evolution

The performance measurement process has evolved over time. Many organizations have started to utilize technology for performance management, such as implementing automated data collection process for effective performance measurement. The use of technology is not limited to data collection but organizations have also started to use technology for generating and publishing customer service reports. There are various IT support tools that have been developed for performance measurement (Davenport & Harris, 2007).

The revolution in performance measurement has also occurred in terms of language used in business reports. Prior to the 2000s there was no trend of publishing non-financial information; however, firms have recently become explicit about linking financial and non-financial dimensions of performance (Kaplan & Norton, 2004).

The intense level of competition has also resulted in the evolution of performance management. Organizations have started to actively differentiate themselves from competitors in terms of flexibility, innovation, service quality and customization because in the competitive environment, value offered by organizations holds significant importance. Businesses need information related to both financial and non-financial performance. The traditional measures of performance management do not provide this

information. Therefore, businesses have been forced to change their performance measures (Kaplan & Norton, 2004; Lynch & Cross, 1991; Tangen, 2004).

2.1.7 Role and purpose of performance measurement and performance management

According to Radnor & Barnes (2007), future performance measurement and management research must investigate how different processes drive performance improvement. Neely and Al Najjar (2006) highlighted the learning role of performance management. The performance management process plays a key role in research and development activities.

Bull (2007) presented his argument on the role and purpose of performance management, which says that performance management contributes towards three dimensions of an organization including efficiency, efficacy and effectiveness. Performance measurement and management systems also play a key role in communicating a modern and efficient image of organizations. The PMS of an organization is a reflection of an organization's effectiveness. The other roles of performance management in an organization include disseminating strategy, supporting decision-making, motivating personnel, supporting incentive schemes, reducing risk and checking the timeliness of progress (Franco & Bourne, 2005; Neely et al, 2005).

2.1.8. Balanced scorecard

Balance scorecard is a strategic approach used for performance management and avoid over relying on financial measures developed by Kaplan & Norton (1992). Balance Scorecard consists of financial measures, which show the results of different actions taken by an organization, complemented by internal processes, operational measures, customer satisfaction, organization's innovation and improvement. The development of this approach has successfully overcome weaknesses associated with previous approaches (Kaplan & Norton, 2004).

The balance scorecard approach, as shown in Figure (2.1), in addition to being a measurement system is also a management system that allows organizations to clarify their vision and strategy. The approach is also useful in providing feedback on different internal and external processes of an organization.

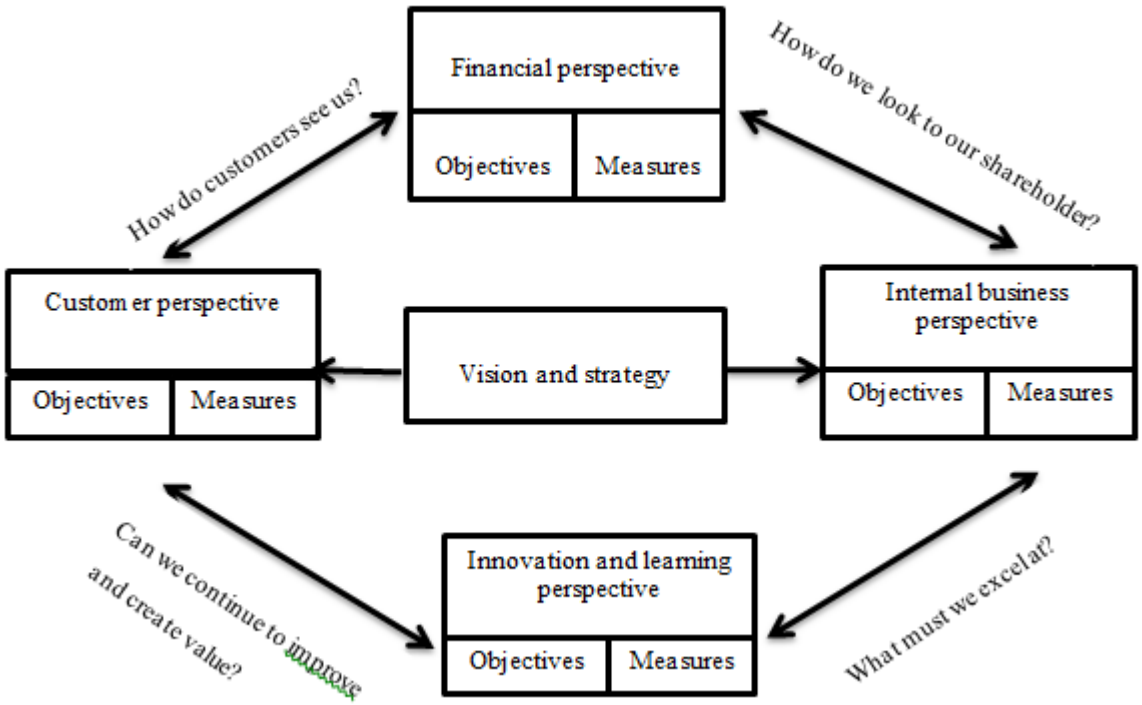


Figure 2.1: Balance scorecard

Source: Kaplan & Norton (1992)

Balance scorecard can also be defined as a measurement framework that consists of strategic, operational and financial measures. The aim of this concept is to align the core values of an organization with customer satisfaction, operational objectives, expectations and values of shareholders, and competencies and objectives of employees. The use of this approach allows managers to evaluate the performance of an organization from multiple perspectives (Kaplan & Norton, 1996; Malina, & Selto, 2001; Olve et al 1999), According to Kaplan & Norton (1992), balance scorecard is a multidimensional framework used for describing, implementing and managing organizational strategy by linking various objectives and measures. The use of this approach augments the traditional financial measures with performance benchmarks.

Balance scorecard provides a balance between the short- and long-term objectives of an organization by translating vision into specific goals and communicating the strategy of an organization with the expectations of employees. The approach also ensures integration between strategic planning and budgeting (Kaplan & Norton, 2004). The following are the four building blocks of balance scorecard.

Financial perspective

The financial perspective is used for answering the needs and expectations of stakeholders. The financial perspective measures profitability through net earnings after taxation (NET), return on investment (ROI), economic value added (EVA) and return on capital employed (ROCE) (Kaplan & Norton, 1992).

Customer perspective

This perspective identifies considering customers as key stakeholders. The customer perspective considers how an organization must appear to its customers and how to deliver to costumers (Kaplan & Norton, 1992).

Internal business perspective

This perspective aims to identifying value propositions in order to attract and retain customers. The aim of this approach is to satisfy the needs of shareholders by maximizing financial returns (Kaplan & Norton, 1992).

Learning and growth

This perspective answers the question of how an organization will improve and grow. In this perspective, the infrastructure of an organization is identified that needs to be built and managed to ensure long-term growth. The perspective also aims to create long-term growth and improvement through organizational procedures, systems and people (Kaplan & Norton, 1992).

Although the balance scorecard approach has proved to be useful for analyzing an organization's performance, it has been subjected to criticism. The main criticism on this approach is the narrow view of stakeholders. Despite criticisms, the approach is believed to offer the largest market penetration (Decramer et al, 2013).

2.1.9. Performance improvement approaches

Responding to competitions in the global market, companies have implemented a number of new operations strategies, techniques, and technologies to enhance the quality and performance. The following are some of the important approaches:

Total quality management (TQM)

Total quality management refers to the management methods which used to boost quality and productivity in business organizations. TQM is an inclusive management approach that works across an organization, including all employees and departments. Adopting the TQM approach makes the organisation more competitive and establishes a new culture which supports growth and longevity. Examples of this approach comprise quality circles, statistical process control and quality function deployment (Beckford, 2003).

ISO 9000

The ISO 9000 is one of quality management systems standards developed over long time and designed to help organizations ensure meeting the customers' needs and other stakeholders while meeting regulatory requirements related to a product. ISO 9000 deals with the fundamentals of quality management systems, including the eight quality management principles such as; customer focus, leadership, process approach and involvement of people (Poksinska et al, 2002).

Six Sigma

Six Sigma is a set of tools for improving the quality of process by detecting and removing the causes of faults and minimizing inconsistency in manufacturing and business processes. This will increase the performance and lead to enhancement in profits, employee confidence, and quality of products or services (Tennant, 2001).

Business process reengineering

Business process reengineering contains the fundamental restructure of essential business processes to achieve improvements in productivity, cycle times and quality. Business process reengineering intended to support organizations fundamentally reconsider how they do their work in order to improve customer service, reduce operational costs, and become competitors (Brock et al, 1997).

2.1.10 Performance management in organizations

Counet & Waal (2009) identified problems that can be encountered during the implementation of PMS. In order to study different problems, a survey was conducted with 31 experts, who were asked to give their opinions on the frequency and impact of

performance management in organizations. The results of the study showed that during the last decade, the failure rate of performance management has decreased. The performance management problems identified included a lack of commitment from the top management, low priority given to performance management and the absence of a performance management culture.

The problems identified in the study could be used by managers to prepare themselves for various performance management issues. The need for an efficient and effective PMS has been universally acknowledged over the last decade. The implementation of these systems is of paramount importance to organizations (Neely, 2007). According to Neely (1999), the changing nature of work and increasing competition has made performance measurement very topical. In this study, evidences were gathered through interviews and discussions with experts. The study has revealed that performance management evolution and revolution is attributed to the increasing need for utilizing novel approaches for performance management. The traditional measures used for performance measurement have become obsolete. Therefore, it is important to adopt the latest methods for increasing the efficiency of the process.

Neely et al (2005) also conducted a study to determine the importance of performance measurement in an organization. The focus of this research was on specific processes of performance measurement used in an organization. The research revealed that the measures of performance are inappropriate for businesses because their focus is on short-term rather than long-term goals, thus their performance measures often lack strategic focus. The measures do not provide adequate data related to flexibility and responsiveness of an organization, which are key areas in the modern era. The focus of existing PMSs is on following standards rather than focusing on continuous improvements. The existing systems followed and implemented by organizations are also ineffective in terms of providing information on the needs of customers. These findings have several important implications for managers and leaders. Organizational leaders could use these findings to understand that the existing PMSs consist of inherent weaknesses, which hinder the continuous improvement of organization. The importance of performance management in the current era could not be ignored. However, in order to utilize the full benefits of performance management, it is important to develop frameworks that overcome the weaknesses and enhance the efficiency of organizational PMS (Bourne et al, 2003).

Barnes & Hinton (2007) conducted a study on e-business performance measurement systems that indicated a large number of organizations aim to expand into e-business. In order to realize this goal, firms need considerable investment in IT, people, and processes. Therefore, it is a significant concern to determine that the PMSs are capable of justifying investments. The researchers utilized case study method in order to evaluate the performance management of 12 organizations. The research was based on qualitative data gathered from key informants from organizations. Data was also gathered from the documents published by companies. The results of this study revealed different approaches used for e-business performance measurement and indicated that it is a common concern for businesses to link e-business performance with organizational objectives.

Bourne et al (2003) conducted a study to evaluate different performance measurement designs. There are various difficulties associated with the implementation of performance measurement systems in organizations. One of the difficulties associated with performance management is the evaluation of performance drivers within an organization. The performance metrics are poorly defined and performance measurement goals of organizations are not based on the requirements of stakeholders. Their findings show the use of a large number of measures often dilutes the overall impact on organization's performance. Organizations also face difficulty in terms of decomposing goals at lower levels. In order to carry out performance management effectively, organizations need highly developed information systems.

The arguments of researchers suggest that organizations need to embrace advanced technology in order to ensure the efficiency of performance measurement systems. Najmi et al, (2005) also studied frameworks for managing business performance. According to them, performance management frameworks entail the review of business performance, efficiency of PMSs as well as its efficacy. The findings of this study revealed that the PMS is a process used to manage and control the organization. The effectiveness of an organization could be ensured through a systematic review process. The process of reviewing organizational performance is a complex task, which covers the entire organization. A good review process is one that strikes a balance between efforts and benefits.

Bourne & Mills (2000) discussed issues associated with designing, implementing and updating performance measurement system in an organization. The study was based on

performance measurement in manufacturing companies. The analysis of case studies revealed that performance measurement system is a cognitive process that translates views of customers and stakeholders into objectives, from which appropriate performance measures are developed. The results of the study further explained that the implementation of performance management is a mechanistic process. This process must be susceptible to classic project management tools. The speed of progress could be improved by utilizing advanced performance management tools and involving IT specialists.

Neely et al (2000) studied the development and testing of different frameworks for performance measurement. The frameworks include balance scorecard, prism and others. Although different frameworks have been developed for measuring performance, little attention has been paid to ways through which managers can select a framework. The performance management framework identifies the desirable characteristics of performance measurement system design. The frameworks provide guidelines that are used to inform the development of PMS. The study conducted by Neely et al (2000) focused on aerospace and automotive companies.

Parthiban & Goh (2011) also researched the performance management of manufacturing companies. The purpose of their study was to develop a performance management model for manufacturing industries. The performance measures include satisfaction levels and quality function. The findings of the study were in the form of a model, which can be used by manufacturing companies in order to identify current performance. The model can make an important contribution by combining both qualitative and quantitative aspects of performance. The improvement of performance is a never-ending process. It is important for organizations to strive to achieve the goal of continuous improvement. The organizations are also required to increase customer satisfaction and future benefits. The process of measuring manufacturing performance needs to be improved to ensure improvements in overall performance of an organization.

Taticchi et al (2010) conducted a study on small, medium and large sized organizations to study their performance measurement and management systems based on literature review method. The researchers used citation and co-citation analysis in order to explore performance measurement literature. In the study, the common characteristics of different studies were identified. The results of the study revealed that the literature on the performance management of large organization is mature. Therefore, the existing studies

have determined performance management challenges faced by large organizations. On the other side, the literature related to performance management in small organizations is immature. Therefore, small businesses find it difficult to implement performance management processes and understand the challenges associated with performance management (Shaw et al, 2013).

All organizations, whether public or private, are interested in developing and utilizing effective performance measurement and management systems. Organizations could only achieve high performance through the development and implementation of high performance systems (Slavić et al, 2014).

Performance management is considered to be a vital part of manufacturing organization. It is a process that involves quantifying actions. The process is used to measure performance at various levels, including the individual, organizational and environmental levels. The performance measurement process sets the agenda for developing balanced and strategic performance management (Homburg et al, 2012). The positive change brought by performance management is performance improvement. Process improvement identifies missing performance measures. It also identifies potential conflicts between different performance measures and targets for performance measures (Marchand & Raymond, 2008).

2.2 Operations Management Strategy

Operations management strategy is mainly administering all practices within a business to develop efficiency at its best for the organization. It involves looking into every aspect of an organization to see if maximum efficiency is being achieved in all departments. This includes efficiently planning and looking around at all activities and putting them down appropriately to work in sync with the efforts of all employees to provide the customer with products and services above their expectations (Slack et al, 2010). Business process modelling is a kind of operations management strategy that analyses or more appropriately chalks down all integral processes involved within the operations of an organization. A business model is a sketch of the activities or plans that help to reach the final consumer. It encompasses numerous strategies, communications as well as processes of operations within the organization (Kumar & Suresh, 2009).

Figure 2.2: Operation management strategy

Source: Robinson & Jones (2012)

2.2.1 Importance of operation strategy

A thoroughly planned operations strategy will help work out all activities related to operations management effectively. Operations strategy will note all elements of the business operations while formulating plans of how they will be executed effectively. It helps to define the overall scope and direction of an organization. It makes sure that all processes are synchronized with the overall operations strategy of the organization. This way all goals remain clear and focused and aid the organization in climbing the ladder of success. If the operations strategy is very well thought out, it will aid the organization in understanding what is important amongst its business processes and help to enhance those features. This way the organization will know exactly which direction will help it gain success in the long run (Reid & Sanders, 2007; Slack et al, 2010).

2.2.2 Developing an operation strategy

Operations Management Strategy is what majorly influences the decisions of operations and management to help it attain success in the long term. There are five main performance

objectives for effective operations, the most obvious of which is producing at minimum cost. No compromise on quality is another essential element, which concerns ensuring that everything which is being produced under the umbrella of an organization meets customer requirements and sustains competitive edge. Speed is another important element that helps to get things done and managed at the right time with greatest efficiency; everything is done with speed and as the customer demands that is on time. Dependability means that all orders which the organization deals with should be as per what has been promised to the customer, who should be satisfied and pleased with the product. Last but not the least, flexibility helps in making the operations flexible, enabling organizations to have room for innovation and changes in products while maintaining quality. These are the main performance dimensions for an operational strategy to remain successful in the long run. If an organization sets everything right on these competitive priorities it would obtain success and become a growing brand with incremental success (Ostomehin, 2006; Slack et al, 2010; Williams, 2009).

The resource-based theory/view (RBV) of the firm brought a major paradigm shift in the thinking of strategic HRM. The concept which was mainly associated with this particular model was that instead of picking up universal 'best practices', organizations need to stand out and find a competitive advantage for themselves, mainly by concentrating on developing outstanding internal resources that are very rare and non-substitutable. The RBV mainly helps the organization to look at its people to be the major source of long lasting competitive advantage, thus firms applying an RBV strategy typically invest in people by enhancing the skills and core competencies of personnel (Fahy & Smithee, 1999).

As far as quality management techniques under operations management is concerned, it is important to exercise utmost control over all the production procedures, especially the design of the product. It is important to not only focus on the design of products but also to make sure they are of utmost quality and innovation. It is also important to give customers an outstanding experience of products. The main thing is making sure that everyone is on the same page when designing a new product, bringing in some innovation or selling the product to the customer. Everyone should remain focused; they can study their customers' purchasing and online behaviours, which is what helps them to know what to do next

(Barney, 2012; Schneider, 2003). Figure (2.3) helps in understanding the quality management techniques that help run the operations of an organization successfully.

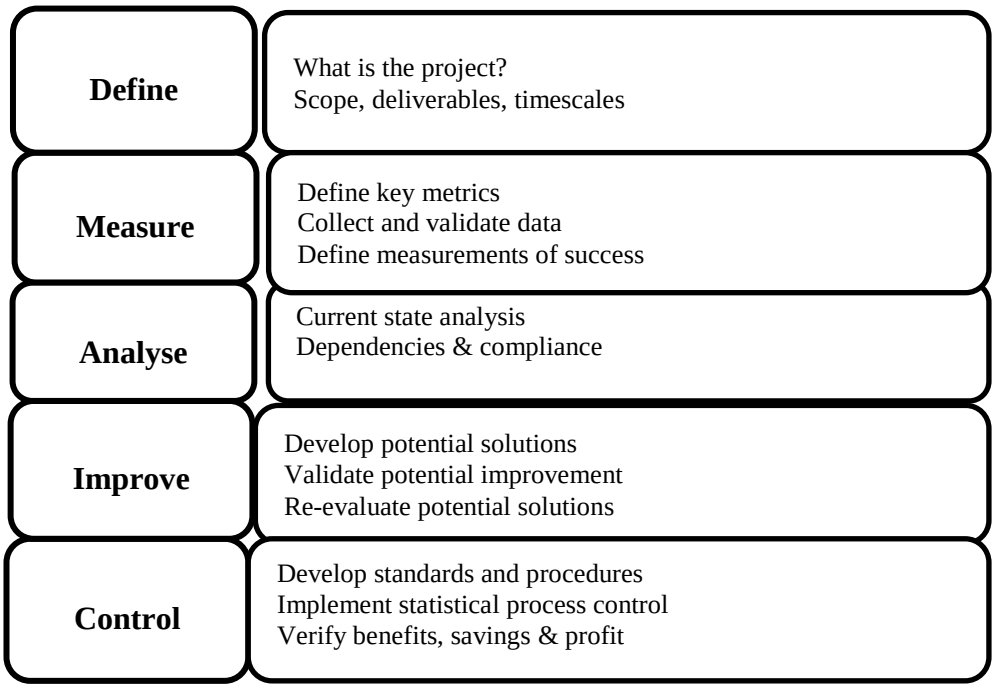


Figure 2.3: Quality management techniques

Source: Schneider (2003)

2.2.3 Production and operations management

Production is a technical process that contains conversion of raw material (input) into desired product or service (output) by adding economic value. Production and operations management involve business organization and management concepts in formation of goods and services. According to Kumar & Suresh (2006), production and operations management are concerned with the conversion of inputs into outputs, using physical resources in order to provide the desired values to the customer while meeting the associated organizational objectives of efficiency and effectiveness. It differentiates itself from other functions such as marketing, finance, etc. They included some activities of production and operations management functions such as: location of facilities, product design, process design, production and planning control, quality control, materials management and maintenance management.

2.2.4 Critical path analysis and network planning as part of production and operations management

Critical path analysis is a tool that can work magnificently if it is worked out appropriately. The major function of this tool is to chalk down all activities and schedule down the estimated time that would be taken for each one of them. The main activities which are part of the production process are mainly its design, engineering and then their manufacturing, which is placed in separate heads, each of which has several smaller steps which are sub-divided further into groups. They are named activity A, B, C, D, E and so on as shown in Figure (2.4) and then a flow chart connects one process to the other and defines how many days (1, 2, 3 and so on) each process and its completion require. This helps to estimate an approximate time for the completion of the overall production process (Hummel, 2006).

Network planning is a broader spectrum of planning in which layers of activities to be completed within the production line or those related to production would be systemized. It maps down all the steps that are integral for the product to go through forming a whole network of essential elements and phases till the product reaches the final consumer. The network plan of an organization should involve a lot of technology and equipment which is essential for keeping the production process rolling and functioning (Piliouras & Terplan, 1998). The essential elements and phases of the network plan as part of the production line are as shown in Figure (2.5).

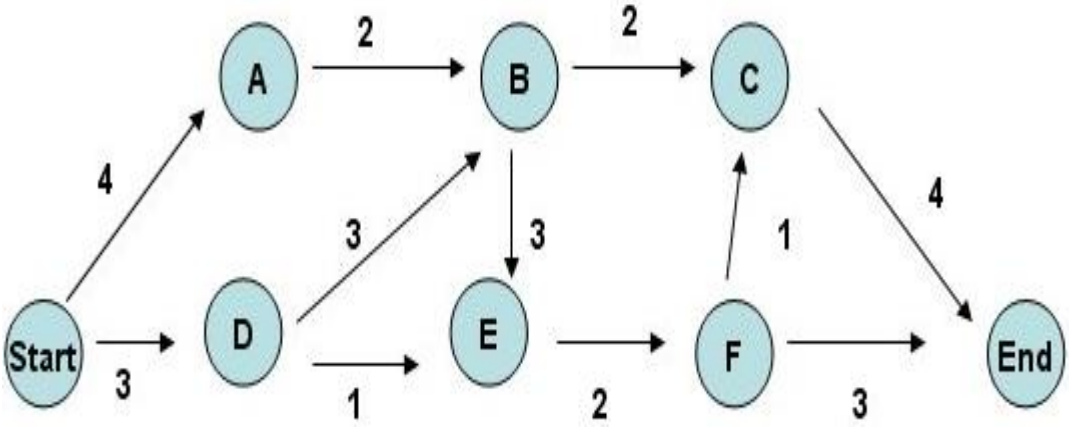


Figure 2.4: Critical path analysis

Source: Hummel (2006)

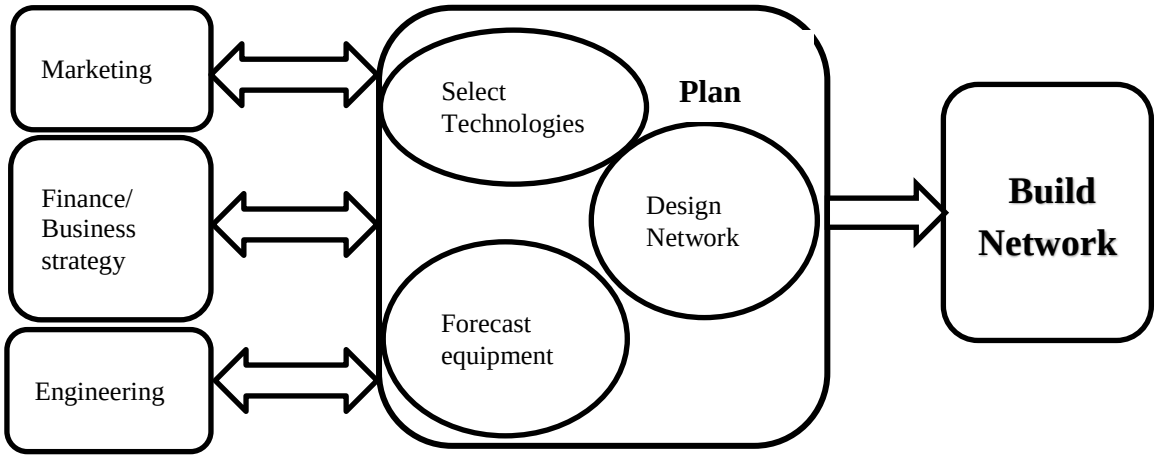


Figure 2.5: Network plan

Source: Piliouras & Terplan (1998)

2.2.5 Resource based theory

As we explore on into the world of business and also take a look into our daily lives we can see that there is a competitive benefit which can be viewed everywhere around us. In this case, even the person who is the fastest runner around the world would have their own competitive advantage which would be way different from everyone who stands in opposition to him as he runs over a race which is 100m. The main idea which specifies a particular element that aids in defeating over the other with the best of qualities and uniqueness in their own way is supposed to be a competitive advantage (Fahy, 2000).

In the way a business works, if in any case any particular organization aims to work out in a better manner from the way its opponents are operating it needs to invest in the development of its competitive advantage. Many businesses and all executives comprehend and implement this concept systematically and a huge number of organizations which are operating in the modern economy invest significant resources and abilities in developing their competitive advantage, such as a unique selling point (USP), which is crucial to their long-term survival in the competitive global marketplace (Barney , 2001; Newbert, 2008).

RBV views the resources of the organization as the main elements that aid it in achieving the best performance. This model aids in achieving competitive advantage for a firm and those who support its theory understand that they need to view inside the firm to find the

best resources and utilize them to establish a competitive edge for the firm, which will set it apart from its competitors (Fahy & Smithee, 1999). There are mainly two types of resources which an organization can apply to enhance its competitive edge: tangible assets, which include all the visible items owned by the organization, and intangible assets, which have no physical presence but which comprise an integral part of the organization, such as brand reputation, image, abilities and the talents of personnel etc. The most important element of the RBV is to gain a competitive advantage over competitors, which entails that the firm has the necessary resources and utilizes them effectively (Barney, 2001; Bridoux, 2004). The RBV model to obtain competitive advantage is shown in Figure (2.7).

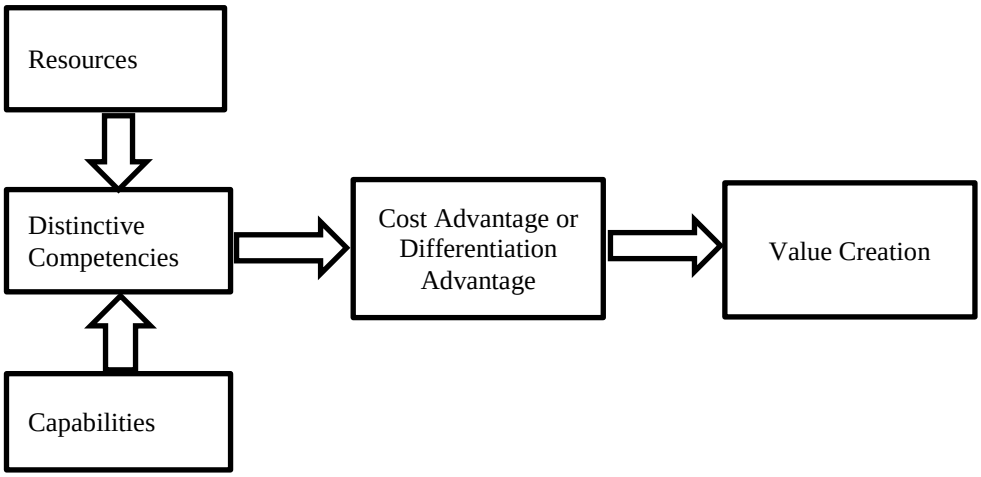


Figure 2.6: Resource-based view

Source: Fahy (2000)

In this model, resources are all the firm-specific assets that aid in creating a cost advantage of differentiation advantage. These resources include elements like brand equity, firms' reputation, customer base etc. Capabilities are linked to the abilities of the firm to utilize the available resources in order to stand out and make a difference. The amalgamation of resources and capabilities is what aids an organization to set up a competitive advantage, which is either through a differentiated product or a low cost structure. This is the main element on which an organization's competitive strategy stands. In terms of value creation the firm should work along one of more value creating activities for creating a definite value of what they are offering to set it out from the competition (Fahy & Smithee, 1999).

2.3 Research Gap

McPherson (2003) argued that existing methodical research work on the state-owned oil firms and their performance is inadequate. There are quite a number of reasons behind this inadequacy, for instance the majority of the work is subjective and relies on independent sources (Victor, 2007). According to Wolf (2008) researchers had largely neglected national oil companies (NOCs) and their performance, important papers on oil ownership were written between 1980s and early 1990s, however, the industry received limited attention further. More methodical examination has been targeted at comprehending the effectiveness as well as outline of investment in state-owned petroleum firms. The difficulties in this respect are primarily due to differences in the targets and missions (whether national or international) of the state-owned oil firms, (Stevens, 2008; Wolf, 2009). Tordo et al (2011) stated that from the early 2000s, the efficiency of NOCs started to interest the research community and policy makers however the work is still inadequate, in the same vein, Stevens (2008) highlighted many operational metrics to assess the performance of oil firms however he argued that much more work is needed to consider which of these metrics is crucial and how. The Center for Energy Economics (CEE, 2007) observed that the part played by state-owned oil firms and their impact on other sectors cannot be comprehended well unless their performance is examined while considering their objectives and targets together with other elements that are directly related with their performance. Considering this inadequacy, this study attempts to examine the activities of oil companies alongside the factors affecting their performance directly. Therefore, this study produced results that are helpful not only for academics related with the petroleum arena but also for the executives, financing organizations as well as shareholders of private and state owned oil firms to examine how their performance creates value and to identify areas for improvement. This study is executed by making use of literature and publications related with performance and operations as well as some publications of interest from the wider field of management.

2.4 Chapter Summary

This chapter reviewed existing literatures to confirm both the need and the gap for the development of performance measurement for improving the strategy as well as the process of an organization. Also this chapter highlighted the important aspects of measuring and managing the performance within the organizations in order to examine

their position in the market so that enhancement strategies can be developed. The following chapter applies this insight into performance management to O & G companies, focusing on National Oil Companies, which due to their political, economic and social importance critically require optimum performance. In addition, performance management literatures, operation management literatures and oil operations literatures have been reviewed to extract the related factors that may influence O & G firms' performance. The next chapter also focuses on building the conceptual framework, based on the literature reviewed in this chapter. It will also show the related hypothesis for the research.

CHAPTER 3: PERFORMANCE MEASUREMENT SYSTEMS FOR MONOTORING OIL OPERATIONS

3.1 Introduction

Oke & Kareem (2013) stated that the last 25 years have seen a major growth in the main demand for that is expected to continue to increase through to the 2030s, as shown in Figure (3.1). Visser & Larderel (1997) explained that more than 50% of the expanding need for energy is actually been satisfied with new production in the oil and gas (O & G) industry. More investments in the upstream production facilities will help in further production.

The last decade hence has seen a major boom amongst all new and upstream investments to support new O & G supplies within the market and get back free capacity.

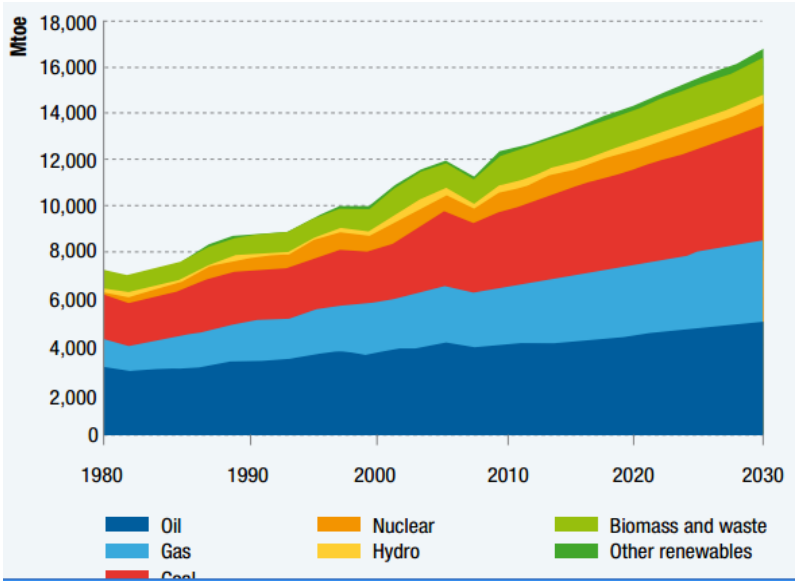


Figure 3.1: World primary energy demand by fuel

Source: IEA World Energy Outlook (2009)

The recent decade has thus seen a substantial revival of huge investments within the production of O & G and their processing facilities to meet rising demand and overcome the scarcity that the world is facing (EniSaipem, 2009). The global O & G industry is a huge sector when valued in dollars, and it is a global powerhouse employing billions of

workers across the globe (directly or indirectly), generating huge amounts of revenues annually.

The importance of O & G can be signified from the way people live and work in the modern era. It is the most integral element of modern human life, used as a fuel for transportation, as a raw material through which numerous products are made (e.g. plastic), and most fundamentally as a key source of electricity generation, making the quality of human life better by all means. The world needs oil because it requires more energy as the population across the globe continues to increase and people in developing economies (particularly India and China) strive for aspirational lifestyles requiring substantial energy.

To understand the O & G industry requires understanding the upstream and downstream sectors. The upstream sector is the one which looks out for oil fields and brings out oil up from within the ground, while the downstream sector is more into refining crude oil to make numerous secondary products (Haderer, 2013). The companies operating in the O & G sector are usually full integrated, which means they have both upstream and downstream interests, usually on a multinational basis. In the upstream sector, a lot of importance is given to the technical service on the whole along with contractor companies offering technical services on a specialist level to the industry. The Middle East mainly dominates the world's overall reserves for oil. It currently has around two-thirds of 1.5 trillion barrels of the proven global reserves (Devold, 2013).

3.2 Overview of Libya's Oil & Gas industry

Libya has one of the largest levels of hydrocarbon resources that remain untapped, with hydrocarbon-containing structures on a geological level. Libya has been shown to have crude oil reserves of around 48 billion barrels as per January 2013 as shown in Figure (3.2), which is supposed to be the largest bequest within the African continent, responsible for around 38% of the total of Africa, and ninth biggest on a global level. Libya exports most of its crude oil to EU countries, as shown in Figure (3.3). Around 80% of the reserves of Libya are part of the Sirte basin, which is responsible for a huge majority of the overall oil output of the country. Visser & Larderel (1997) state the fact that Libya has six huge sedimentary basins, which include the Sirte, Murzuk, Ghadames, Cyrenaica, Kufra, as well as the offshore sources, which remain largely unexplored (EIA, 2014).

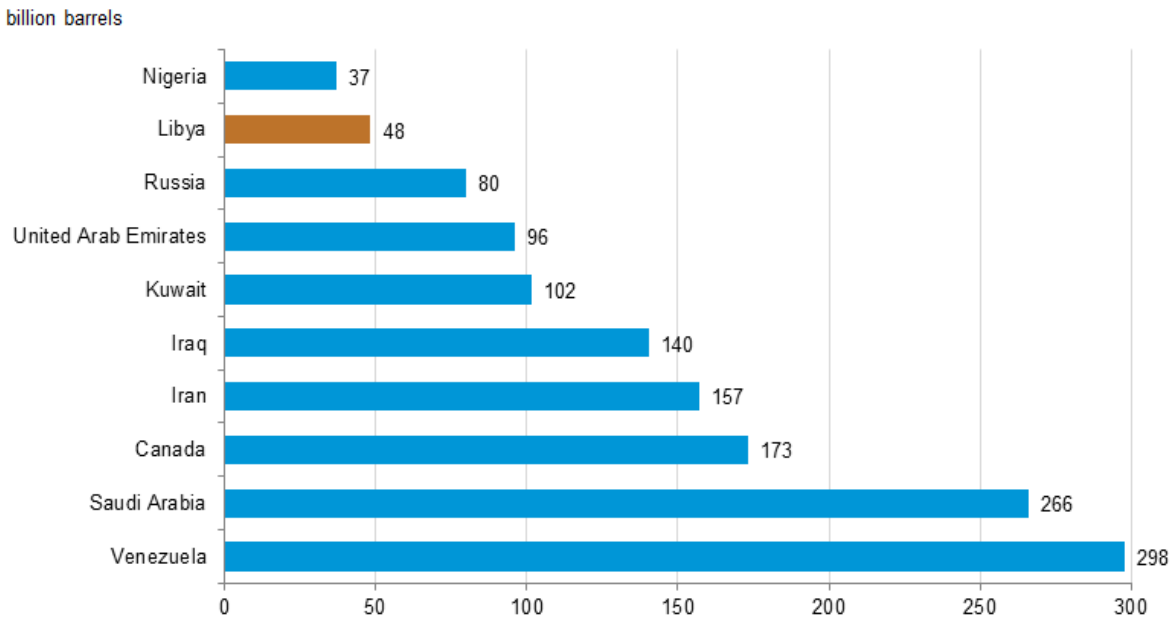


Figure 3.2: The top ten oil reserves holders

Source: Oil & Gas Journal, January 2014

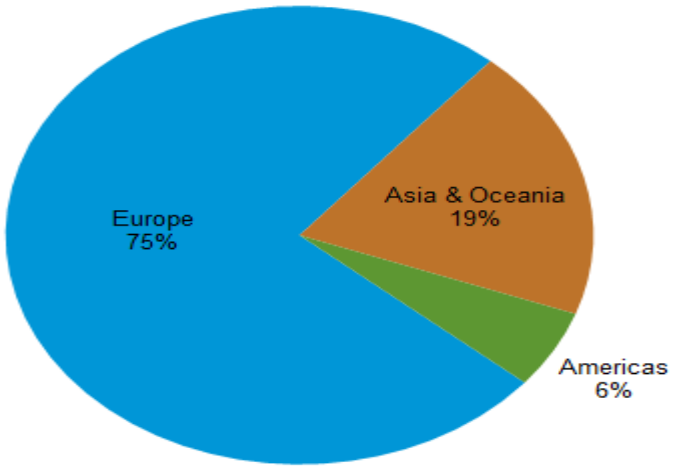


Figure 3.3: Libya's exports of crude oil, 2013

Source: Global Trade Information Services (2013)

Oil exploration and development

The development program of the NOC acknowledged numerous oil-producing fields within which the capacity can easily be augmented. The biggest additions within the capacity were structured mainly for the fields of Waha (Oasis), the complex of Nafoura/Augila as well as the field of El Feel (Elephant). The reserve rates of recovery within Libya remain quite low because of the ostracism of Libya by the US and the

international community from the 1980s, including a UN sanctions regime and intermittent bombing, which prevented the development of oil production infrastructure (notably the ban on importing equipment and technology prior to rapprochement in 2004. Thus for more than 20 years Libyan oil output from all fields stagnated and declined as Enhanced oil recovery (EOR) and foreign investment remained absent. With the end of sanctions, most foreign companies returned to reclaim their rights over their assets, including the US companies Occidental Petroleum as well as the consortium partners within the Waha (Oasis) Oil Company, which includes the ConocoPhillips, Marathon and Hess firms. In 2012, Waha came up with a development plan to augment the capacity at their fields up to a grand total 500,000 bbl/d. As of the first half of October 2013, Waha's overall production (around 330,000 bbl/d of crude oil) was totally halted as due to the protests that happened at the Es Sider port (EIA, 2014).

Oil production

Due to the Libyan version of what called Arab Spring in 2011, which caused a civil war, oil production was totally disrupted but after the installation of a new government it was quickly reinstated towards the end of the year. However, political events again crippled the O & G sector in mid-2013 due to protests closing down ports, oil fields and pipelines amid a generally deteriorating security environment around O & G installations.

In 2012 Libya produced a total of around 1.37 million bbl/d of crude oil, over double the 2011 average of 500,000 bbl/d in 2011. In the absence of political disruption, Libya can currently produce an estimated 1.65 million bbl/d mainly of good-quality, light and sweet crude oil. Over the long term, from 2000 to 2008 Libyan production increased from 1.4 million bbl/d in 2000 to 1.74 million bbl/d in 2008, but overall production remains far below the late 1960s levels of above 3 million bbl/d. The Libyan oil industry was paralysed by internal and external factors. Internally, oil production was organizationally sabotaged by piecemeal nationalization and other administrative reforms under the capricious dictates of government, but more significantly the external factors of international sanctions mothballed the whole country (EIA, 2014).

Libya's on-going effective capacity of production is significantly lower than the theoretical capacity of 1.6million bbl/d. However, there are signs of optimism in the speed with which

the industry recovered from the closing of oil fields during 2011, as shown in Figure (3.4), much more quickly than industry analysts expected.

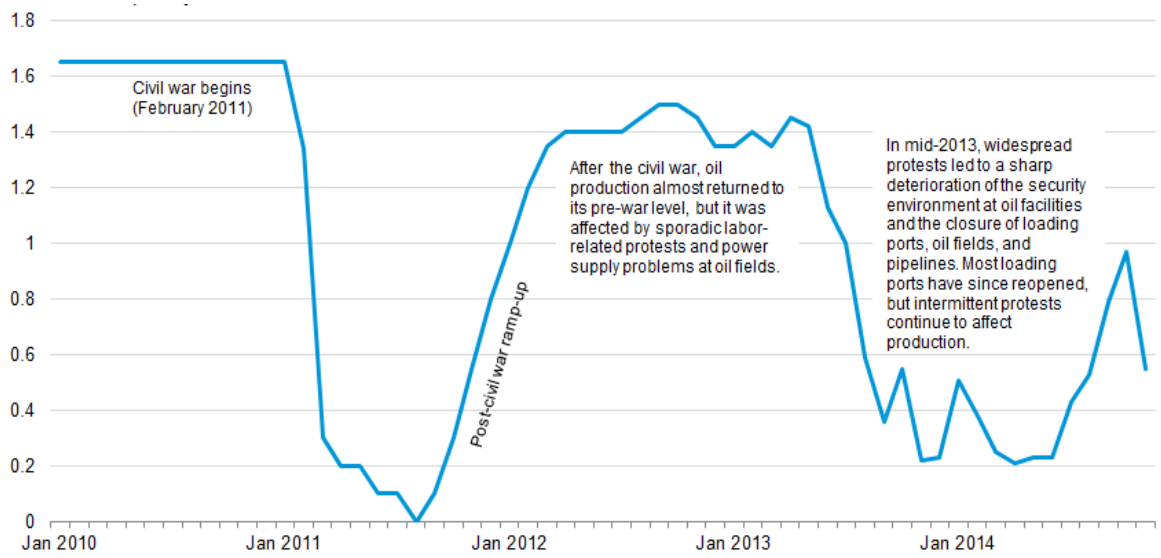


Figure 3.4: Crude oil production in Libya from January 2010 to November 2014

Source: US Energy information Administration, Short-Term Energy Outlook (November 2014)

The Energy Information Administration (2013) highlighted that Libya is currently going through another crisis that has crippled its oil sector. What began as labour-related protests for higher salaries and better working conditions has evolved into more politicized issues such as regional autonomy and allegations of corruption. During the months of July and August 2013, major protests took place amongst the leading oil loading ports that were part of the central as well as the eastern parts of Libya that enforced the inclusive or fractional shut-in, which was linked to the oil fields connecting them to the ports. This again resulted in protests at ports and also at some major oil fields as crude oil production went down to 1.0 million bbl/d in the month of July and to about 600,000 bbl/d within the month of August. Libya's production also involves an approximate 120,000 to 140,000 bbl/d of non-crude liquids, including condensate as well as liquid natural gas (EIA, 2014).

Oil consumption and refining

Libya consumed an overall average of around 170,000 bbl/d, mainly of petroleum, within the year 2012, which was much lower than its peak of 280,000 bbl/d during 2010. Most of the consumption of domestic oil in the Libyan state is mainly coming from refineries on

the domestic level. This country has also been mainly exporting a very small part of the refined products to markets on a global level. Libya mainly encompasses five different domestic refineries which have an overall combination of capacity of crude oil distillation of around 378,000 bbl/d. The NOC of Libya had in recent times announced certain plans for expanding the sector downstream, which had planned investments of around $60 billion. This plan encompassed mainly raising the standards of current refineries, mainly under the financial auspices of the NOC, along with developing some new refineries on a small scale along with petrochemical complexes, usually with private companies. The following presents an overview of the existing refineries in Libya (EIA, 2014).

Ras Lanuf is the biggest refinery in the country with an overall capacity of 220,000 bbl/d. It is situated within the region of Sirte, which is situated within the central-eastern region. The overall refinery is mainly fuelled through the output of Sarir as well as the Messla fields, which are operated by Agoco.

Zawiya is the second-largest refinery with an overall capacity of around 120,000 bbl/d, and it is located very close to the capital city of Tripoli. The refinery mainly gets fuelled through the production of oil fields situated within the south-western region of Libya.

Tobruk (Marsa al-Hariga) is another refinery with an overall capacity of 20,000 bbl/d situated within the eastern region. It is majorly dependant on crude oil produced at fields operated by Agoco.

Sarir is an associate mainly of Agoco that is thought to be dealing with crude oil pumped from Sarir field. It mainly has a total capacity of 10,000 bbl/d.

Marsa al-Brega is amongst the oldest refineries present within Libya that has a good enough capacity around 8,000 bbl/d.

Gas exploration and production

The natural gas production as well as exports within Libya were amplified after 2003 with numerous large projects, particularly the development of the Western Libya Gas Project (WLGP) of Western Libya Gas, which was associated with the Greenstream pipeline infrastructure that linked it to Italy. Flows that got associated along with the pipeline of Green Stream mainly were disrupted by the civil war in 2011.

The production of dry form natural gas in Libya increased substantially from 194 billion cubic feet (Bcf) in 2003 to around 594 Bcf in 2010, Figure (3.5) shows that Libya has about 55 trillion cubic feet of natural gas reserves. Under the WLGP, essentially a joint venture between the ENI and the NOC, was mainly under the auspices of Mellitah Oil and Gas for most of the growth of production in natural gas after 2003. The WLGP involved the onshore Wafa as well as the offshore fields of Bahr Essalam. The major portion of gas formed through WLGP was exported through the Greenstream. Most of the other output of natural gas mainly gets produced through the NOC along with its subsidiary of the Sirte Oil Company within the Sirte Basin (onshore) (EIA, 2014).

Libya's production of natural gas was totally shut down for continuous periods within the year 2011. Production of dry natural gas came up to an average of 277 Bcf during the year 2011, which was above a 50% drop that happened in the previous year. The production of natural gas subsequently recovered to a good average of 431 Bcf during the year 2012. The production of natural gas was seriously affected by protests in 2013, but the extent of the impact on the output of natural gas remains unclear.

The NOC has also announced some plans for increasing the production of natural gas within the country both from offshore as well as onshore fields. Expanded projects that would aid in supporting this goal would encompass linked along oil as well as gas fields within numerous stages within the development stage, mainly Faregh, which functioned by Waha within the Sirte Basin, as well as Mellitah's Bouri field on the offshore end. The NOC intends to operate natural gas autonomously. Augmented production in the marketed natural gas mostly would end up in a major utility of natural gas within the sector on the power end, hence freeing up more oil for export. Hence, much greater expansion within the natural gas sector is mainly dependent on political institutions along with the environment of security (EIA, 2014).

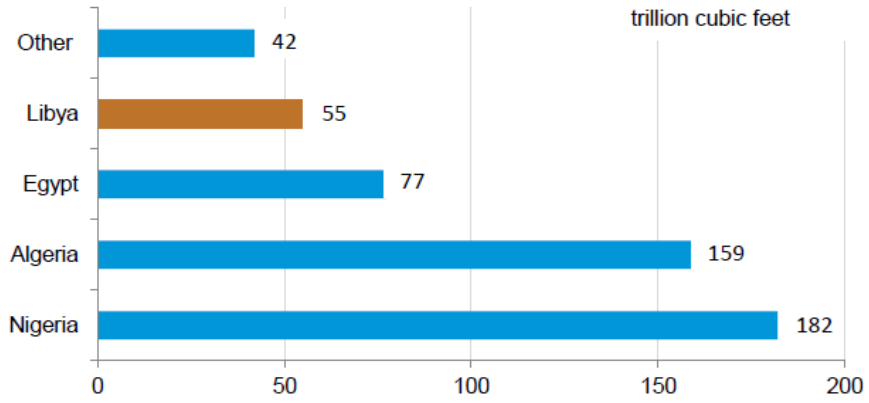


Figure 3.5: Natural gas reserves in Africa, 2013

Source: Oil & Gas Journal (2014)

Gas consumption and exports

In 1971, Libya was the third largest exporter of liquefied natural gas (LNG), after Algeria and the US. Most of the country's LNG exports were to Spain. However, the LNG plants were damaged during the 2011 civil war and Libya has been slow to resume production.

Devold (2013) stated that in 2011, Libya consumed a total of around 190 Bcf, which was totally related along with dry natural gas, less than 242 Bcf in 2010. As in the pre-2011 normalcy, 35-40% of the overall supply of dry natural gas was consumed domestically, as shown in Figure (3.6), while the remainder was exported to Mediterranean countries such as Italy and Spain. In the year 2011, exports of dry natural gas went down to around 85 Bcf from the peak level of 242 Bcf during 2010. In the year 2012, the overall exports of Libya recovered to a good 228 Bcf, most of which was sent through the Greenstream pipeline to Italy. Before 2012, Libya mainly exported very small volumes of LNG to Spain.

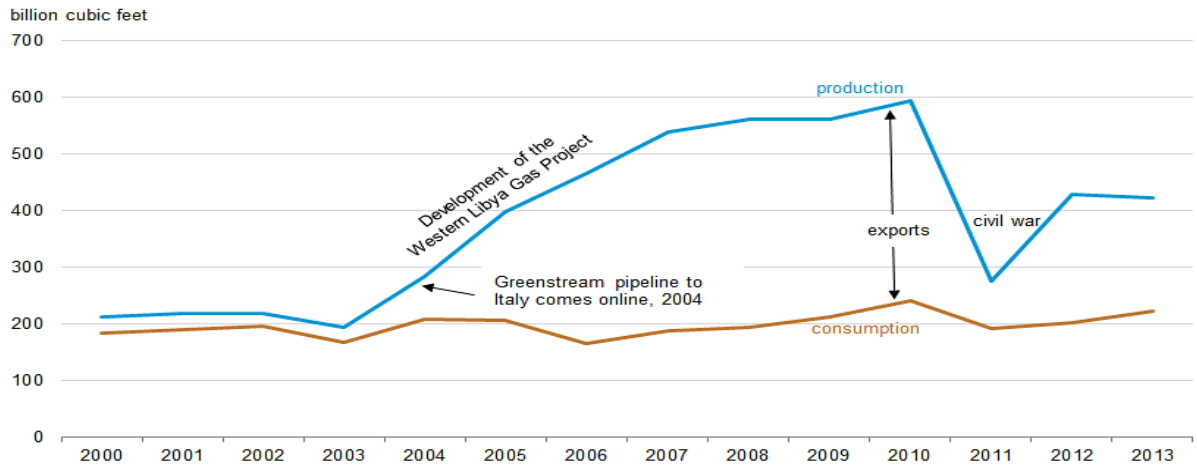


Figure 3.6: Libya's gas production, consumption and exports, 2000-2013

Source: US Energy Information Administration, BP Statistical Review of World Energy (2014)

Greenstream

The overall capacity of Libya as a gas exporter was magnified exponentially with completion of the Greenstream pipeline in October 2004. The 370 mile pipeline begins in Mellitah, the place where the natural gas is piped down mainly from the onshore Wafa as well as the offshore fields of Bahr Es Salam, which serve as export fields; it runs under the Mediterranean towards Gela, up to Sicily, then onto the mainland where it links up to Italy. The pipeline of Greenstream mainly functions by Eni along with the partnership along with the NOC. Its overall capability is around 11 billion cubic meters each year since its expansion (EIA, 2014).

3.3 Creating Value in O & G

Stevens (2008) explains that value is developed within a sector through numerous links which are part of the overall value chain of the oil industry that begins up with the resource base and then moves on via production, transportation, overall processing and then into the market, as shown in Figure (3.7). Translating the overall resource base within the reserves along with appropriate production needs good enough effort as well as investment. Most NOCs have estimates of reserves which are mostly a result of arithmetic based on assumption rather than serious investigation and honest disclosure, thus it their estimates are generally disregarded as serious measures of effective performance. The link of production, which is part of the overall value chain, is linked up with recovery factors on

the field along with costs of production both on the technical as well as managerial levels. This is the case with the processing and transportation phases as well. The overall market value of oil, which includes not only crude but also petroleum products along with gas, can be considered outside the control of NOCs due to the global factors at play.

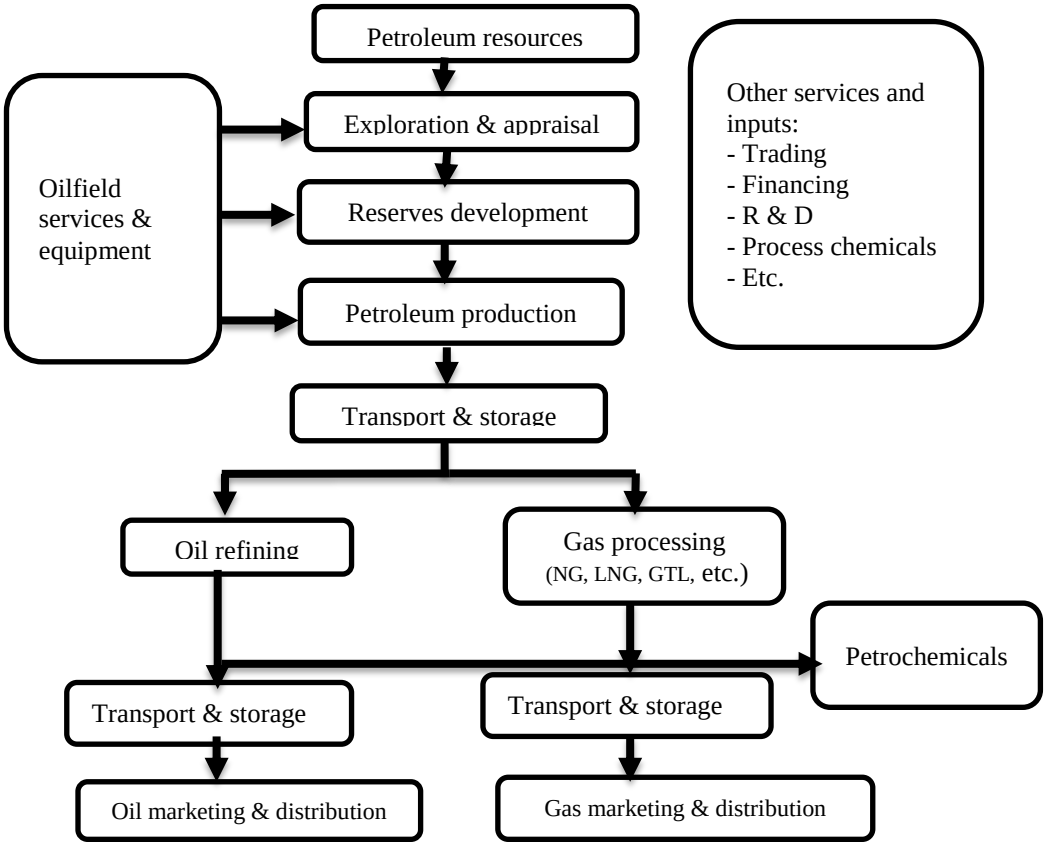


Figure 3.7: The petroleum value chain

Source: Wolf (2009)

3.3.1 National oil companies & their roles

Tordo et al (2011) and the Center of Energy Economics (2007) stated that out of all the globally proven reserves of oil, that total up around 1,148 billion barrels around a good 77% out of these resources mainly lie under the total control of national oil companies (NOCs). They do not have any participation of equity through international oil producing organizations. The traditional international oil companies from the West today control less than 10 percent of the global base of O & G resources. As far as the oil production is concerned, at current levels NOCs dominate at a major level. Out of the leading 10

countries that produce oil globally, 14 are NOCs. The following table demonstrates some NOCs and their year of establishment.

Table 3.1: Establishment of selected NOCs

Country	*Company*	*Year*
United Kingdom	BP	1914
Malaysia	Petronas	1974
Venezuela, RB	PdVSA	1975
Italy	Agip	1926
Mexico	Pemex	1938
Iran	NIOC	1951
Brazil	Petrobras	1953
India	ONGC	1956
Kuwait	KNPC	1960
Saudi Arabia	Petromin	1962
Algeria	Sonatrach	1965
Iraq	INOC	1967
Libya	LNOC	1970
Indonesia	Pertamina	1971
Nigeria	NNOC	1971
Norway	Statoil	1972
Qatar	QGPC	1974

Source: UNCNRET, State Petroleum Enterprises in Developing Countries (1980)

The Center of Energy Economics (2007) explains that most NOCs are between the process of reformulating and reconsidering all their business strategies through effects of O & G markets on an international level. Numerous NOCs have been working out their resources on a strategic level within the Middle Eastern region, Euroasia and Africa. Most of all these emerging NOCs have quite strong relationships with their national governments, with their strategic goals more into investments on the foreign level rather than commercial purposes. In the local market, these NOCs work on a social and economic level rather than competing for capital budgets.

3.3.2 Significance of and requirement for NOCs

Lewis (2007) explains that NOCs mainly take control over of the most dominant share amongst the global hydrocarbon resource bequest along with numerous other oil as well as gas related systems of infrastructure. This aids the actual producers or even the gatekeepers to exploit accessibility via international companies of energy. NOCs have a major influence on the performance of hydrocarbon sector. Even the smallest NOCs remain quite powerful within their own nations. They support the public by supplying them with integral energy fuels, while generating profits that can boost their country's economy,

managing all kinds of environmental risks while helping optimize performance (Wolf, 2009).

Tordo et al (2011) and the Center of Energy Economics (2007) explains that NOCs are actually quite varied from one another through numerous perspectives as some of them depend on position of monopoly within their own countries while others face competition, some of them link themselves up into joint ventures while some others operate on a solo basis while some of them function internationally and some of them within their home nations; some of them work along with certain segments which are part of the value chain, while others are well-integrated. Most of them face challenges on the economic, political and social levels.

3.3.3 NOCs and value creation

Lewis (2007) asserts that NOCs collectively control over 77 percent of global oil reserves and around 75 percent of production. NOCs are in the top 20 oil producing companies in the world. There are some NOCs that have established downstream operations, for refining and distribution.

3.3.4 NOCs and domestic agendas

Devold (2013) suggests that in the developing nations NOCs are generally used as instruments looking out over a huge spectrum of social, political and national goals that help in making the most of revenues for their own governments. Some people think that they are a positive means of supporting domestic needs and getting profits on a local level, while other industry experts consider that the non-commercial goals mainly serve to incur unnecessary costs and liabilities for these firms, diminishing their overall profits while evading raising capital within the financial markets, letting state treasuries take up all the load of capital allocation.

3.3.5 Role of national oil companies in creating value

Stevens (2008) explains that NOCs straightforwardly develop value of some sort; they are usually the operators that mainly control costs along with suitable efficiency. They work along through their national mission that makes them different from all other international oil companies. Hence the shareholder (the government) would have numerous kinds of objectives and goals, which often entail social welfare commitments. This tends to make

the overall national mission quite complicated and measuring NOC performance even more difficult. Three main dimensions can be analysed: protecting the hydrocarbon wealth on a national level, developing the economy and enhancing the interests on a political level of the state.

3.3.6 Libyan oil & gas industry and OPEC

Haderer (2013) states that Libya is a very active member of the Organization of Petroleum Exporting Countries (OPEC), which it joined in 1962, a year after it began oil production. The country is the owner of Africa's largest oil reserves while being an integral member to contribute to the overall supply of the global light and sweet crude oil. It is a country that stands fourth in providing natural gas reserves. The Energy Information Administration (2014) (EIA) states that Libya's economy mainly relies on hydrocarbons. Oil and natural gas both are responsible for 96% of the overall revenue of the government along with around 98% of revenue of export within the year 2012. The OPEC revenue fact sheet jots down that Libya has a total net of oil export revenues accounting for $40 billion each month between January and June 2013.

3.3.7 Libyan National Oil Corporation

The EIA (2014) stated that the Libyan NOC (LNOC) generally emphasize the importance of improving oil recovery techniques for increasing the production of crude oil at all maturing fields of oil. Just before the civil war in 2011, the NOC claimed overall additions of capacity of around 775,000 bbl/d, probably only from existing oil fields. EIA states that way before the crises of the oil sector in 2013, the government of Libya had come up with numerous announcements which were to augment the production capacity of crude oil up to 1.7 million bbl/d during the year end 2013 along with 2 million bbl/d within the coming years, as per the Middle East Economic Survey (MEES). Within the past era, the LNOC mostly stressed on putting maximum investment within the methods of enhanced oil recovery (EOR) for countering any kind of depletion within the reserves while expanding production capacity within all the fields that already existed. Within the year 2009, the NOC went on to announce a very effective development program that mostly encompassed the expansion as well as treatment of 24 different fields of oil as well as natural gas.

3.4 Performance measurement in O & G

Considerable research work has been done in area of performance measurement, including in the industry of O & G, over last few decades (Victor, 2007). Oil processes include high amounts of capital tools together with high competence production courses for which performance gauges can aid with scrutinizing production throughout the oil and petroleum industrial phases. For academics, e.g. Keegan et al (1989) and Neely (1998), the area of performance management always remains very significant when detecting performance supervision together with its arrangements (Hudson et al, 2001). However, Marr & Schiuma (2003) pinpointed that the diverse relevant performance gauges stating that the studies have been undertaken in the past about performance supervision were diverse as it was likely that they would be doing opinion purposes by offering the firm significant data concerning the organizational business model.

Conventionally, businesses have gauged the performance in fiscal terms (e.g. income, revenue, ROI etc.), and such financial gauges of performance have been the only standards of an organizational success. However, Bourne et al (2003) claimed that performance standards that have been centred upon fiscal gauges cannot deal with the current changes taking place in the business, chiefly because of the appearance of novel technologies as well as increased power of contest (Kaplan & Norton, 1992).

Escobar & Vredenburg (2011) stated that one of the reasons for performance measurement by organizations is that enterprises are determined to examine their position in the market so that improvement strategies can be developed in the light of performance examination. Marr & Schiuma (2003) stated that Neely (1999) pointed out seven reasons upon which developments in performance measurement are chiefly based, i.e. altering work type or character, elevating contest, particular improvement proposals, home and worldwide quality medals, varying entrepreneurial roles, altering exterior demands, as well as the rule of information technology and all these reasons are also pertinent to the oil and petroleum industry.

The oil and gas industry has undergone several stages of development and retrenchment due to a diversity of financial and political stimulating factors. However, Helfat & Winter (2011) stated that the current stage is distinct because of a comparative turn down of the private division chief operatives as well as a rush in the evident significance of national oil

companies as the heads of the universal power industry. NOCs are valued for the reason that they govern the established energy reserves that are likely to satisfy the demand for energy products all over the world. According to Bourne et al (2003), in numerous states, the oil division governs the financial system and is taken as the key channel of financial development.

Escobar & Vredenburg (2011) revealed that the petroleum division is generating value by connecting a variety of elements in the petroleum industry, beginning from the resource centre to production, dispensation, shipping and ultimately to the marketplace. Resource centre is a natural endowment, however conversion into reserves as well as manufacturing requires asset and endeavour. The production connection in the value sequence is linked to area revival elements and production expenditures, all of which have technological and administrative aspects and the equivalent for the dispensation and transportation phases of the chain. The majority of the time the market value of petroleum products together with gas is supposed to be out of the control of NOCs. Helfat & Winter (2011) observed that because NOCs generally control expenditures and competence, they consequently generate immediate value.

It is estimated that upwards of ninety percent of novel chief power production until 2030 will appear from emerging states, the majority of whose power divisions are NOCs (Escobar & Vredenburg, 2011). Therefore, it is critical to recognize the elements that impel the degree of difference among NOCs' performance. The academic work on NOCs is restricted because the majority of such research is subjective and centred upon individual records. Few of the more methodical investigations have been designed to understand the effectiveness and outline of asset in oil organizations. One of the issues in examining oil enterprises is that majority of the companies have a range of undertakings both indigenous and commercial, consequently they do not function as companies aimed at profit maximization. Hudson et al (2001) stated that a range of non-commercial instructions are loaded upon NOCs by governments involving employment, community transportation and a range of other duties that are not firmly connected to their central industrial functions.

For the understanding of the function of oil enterprises and their influence on petroleum sector authority, it is essential to value the performance of oil enterprises within the background of their targets together with the key elements affecting them (CEE, 2007). This study consequently relates to the development of the scaffold for oil firms operation

together with their performance. The results and findings obtained through this study will be of great concern of oil firms involving governments, global benefactors and financing enterprises, and international oil enterprises. The research draws upon academic literature examining performance, one emerging field of study. Specifically, the academic material on performance is disjointed and depends on a broad selection of other literatures, together with performance management as well as operations administration. This study chiefly employs the performance together with operations literatures, in addition to certain publications of concern from the wide field of administration

3.5 The Conceptual Framework

For Kasperson et al (1988), a conceptual framework is about the descriptive display of the construction of a study or principal scholarly precepts, usually embedded in the literature review of that study as a disconnected summarization, whereas Wustenhagen & Menichetti (2012) define the construct of conceptual framework by stating that it is the collective exhibition of theories as well as independent elucidation of notions together with theories. However, for Den Hertog et al (2010), the structure of conceptual framework is constructed by assuming scaffold as a means of relating every element of the research together with investigator nature, perception, and practices for literature as well as hypothesis. However, this view is very close to the conceptual framework developed for this research.

The preliminary conceptual research framework shown in Figure (3.8) is developed before the conduction of the pilot study, which is elaborated upon later. However, the key performance metrics as displayed in the conceptual framework came from the review of the pertinent literature, which is explicitly and comprehensively given in this chapter. After the literal introduction of the concept of literature review in this chapter, an attempt is made to cite and explain the model factors of this study. In fact, the conceptual framework for this study is developed and digs out from different factors, such as, asset management, and others in order to observe the changing drivers of oil operations in developing countries and their strategic importance and the associated evolution of operational performance and metrics for NOCs.

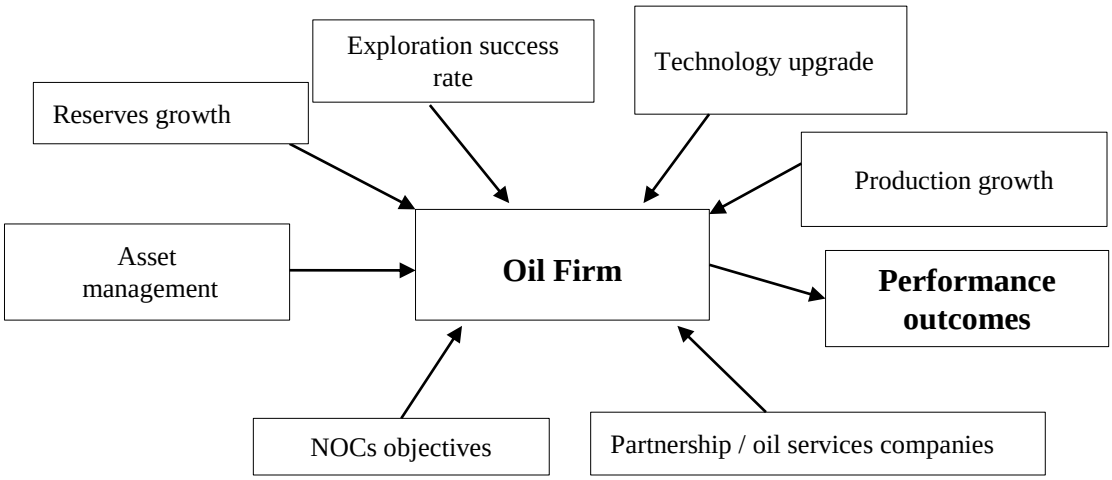


Figure 3.8: Preliminary conceptual research model

Table 3.2: Literature map of the preliminary conceptual research framework

Performance metrics	*Studies*
NOCs objectives	Mommer (2002), Boué (2003), Victor (2007), PESD (2006), Energy Policy (2009), CEE (2007), Stevens (2008), Tordo et al (2011), Wolf (2009)
Production growth	Stevens (2008), CEE (2007), Energy Policy (2009), Victor (2007), Tordo et al (2011), Ike & Lee (2014)
Reserves growth	Stevens (2008), CEE (2007), Energy Policy (2009), Victor (2007), Tordo et al (2011), (McPherson, 2003)
Exploration success rate	CEE (2007), Stevens (2008), Energy Policy (2009), Victor (2007), Tordo et al (2011), (McPherson, 2003), Ike & Lee (2014)
Technology	Stevens (2008), CEE (2007), Al-Naimi (2004), Alleyne (1980), PESD (2006), Energy Policy (2009), Tordo et al (2011), Asghari,& Rakhshanikia (2013)
Partnership	Stevens (2008), Pedroni et al (2013), CEE (2007), Tordo et al (2011), Pongsiri (2004), Baird & Bismuth (1983), Ghandi & Lin (2014), Du & Vieira (2012)
Asset management	Stevens (2008), Schuman & Brent (2005), Bolton et al (2004), Aoudia et al (2008)

There are different means for the presentation of the conceptual scaffold. As stated by Kasperson et al (1988), the development of the conceptual framework can either be done descriptively or graphically in order to examine the principal factors and construct variables as well as to assume links amongst them. The conceptual framework for this study is developed by employing both descriptive and graphical techniques, so that a clear picture about the selected research line will be developed for the facilitation of the readers' comprehension. A framework can be simple, intricate, hypothetical, logical, suggestive and casual (Den Hertog et al, 2010). However, for this research, the conceptual framework will be kept elementary instead of developing it along complicated lines, so that numerous stakeholders can understand and utilise it.

This framework is developed on the basis of related literature, keeping in view the consistency and integration of each literary portion hired from the literature pertaining to the subject with the devised aims and objectives of this research. As stated by Wustenhagen & Menichetti (2012), empirical knowledge is weaved with previous theory and study on the same topic. However, Madhavaram et al (2005) stressed that the conceptual framework helps examiners as it is constructed over a timespan wherein a number of related constructs as well as correlations get more evident.

This conceptual framework covers the intellectual practices that lead the study; on the other hand, such activities are highlighted with the help of a careful as well as precise appraisal of literature regarding the subject. Not only this but it also persuades and involves reader into the research. As mentioned above, the conceptual structure is constructed simply rather than in an intractable and manifold complex, because the achievement of reliability is intrinsically difficult in conceptual structures.

The preliminary conceptual framework shown in Figure (3.8) was modified after the pilot study into the refined version displayed in Figure (3.9). The changing process of the conceptual framework is done after considering the results of the pilot study together with the feedback obtained from the International Conference on Manufacturing Research (ICMR2013) paper by Nouara & DeCoster (2013). The other elements that were added after the incorporation of expert comments and results obtained through the conference and the pilot study were drilling, together with health, safety and environment factors. One of the key reasons why drilling along with other factors were considered was the fact that results obtained in the pilot study revealed that both these factors have an influence on the performance of O & G companies. In addition to this, other changes made to the preliminary conceptual framework particularly as the result of feedback obtained from the conference include the conversion of NOC objectives into a ‘moderator’, partnerships into a precursor (alike to asset management) and variables (exploration, technology, production, reserves) into the ‘oil operations’ factors as they deemed all as operational activities.

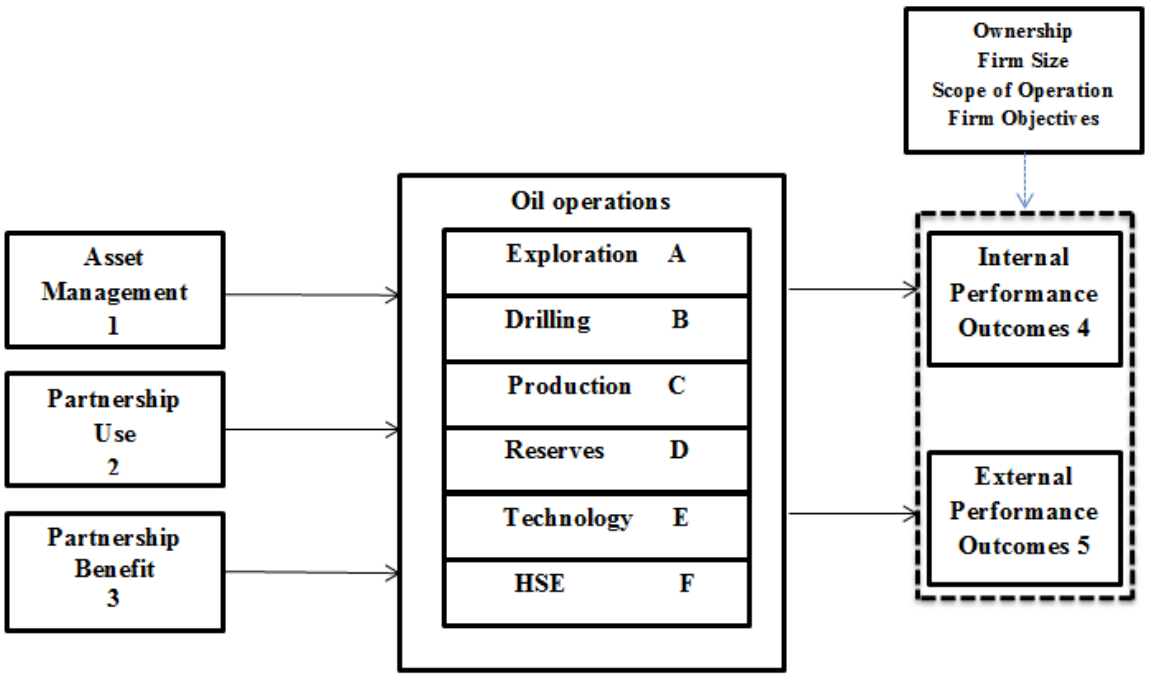


Figure 3.9: Conceptual framework

The constructs in this study were devised from the relevant literature and adapted to the framework of oil operations in developing countries where required. The framework is developed upon three basic constructs: partnership use, partnership benefit and asset management, which are further associated with oil company operations i.e. exploration, drilling, production, reserves, technology and HSE. The company operations are responsible for internal and external performance outcomes, which leads to the organizational objectives. The framework can be summarized as resources including partnerships and asset management together with processes including exploration, drilling, production, reserves, technology and HSE and finally organizational output.

3.6 Construct Measures

The constructs in this study were developed from related literatures and Table (3.3) is demonstrating the construct measures source.

Table 3.3: The construct measures source

Construct	*Source*
Asset management	Stevens (2008), Schuman & Brent (2005), Bolton et al (2004), Aoudia et al (2008), Abu-Siada & Islam (2012)
Partnership	Stevens (2008), Pedroni et al (2013), CEE (2007) , Tordo et al (2011), Pongsiri (2004), Baird & Bismuth (1983), Ghandi & Lin (2014), Du & Vieira (2012)
Exploration and production	Stevens (2008), CEE (2007), Energy Policy (2009), Victor (2007), Tordo et al (2011), (McPherson, 2003), Ike & Lee (2014), Olsgard & Gray (1995), Devold, (2013), Jaffe & Soligo (2007), Wolf (2009), Eller et all (2011)
Reserves	Stevens (2008), CEE (2007), Energy Policy (2009) , Victor (2007), Tordo et al (2011), Jaffe & Soligo (2007), Wolf (2009), Eller et all (2011), (McPherson, 2003),
Technology	Stevens (2008), CEE (2007), Al-Naimi (2004), Alleyne (1980), PESD (2006), Energy Policy (2009), Tordo et al (2011), Asghari,& Rakhshanikia (2013)
Health, safety and environment	Boue (2003), Stevens (2008), CEE (2007),Tordo et al (2011), Colborn et al (2011), Gordon (1998),
Performance outcomes	Al-Obaidan & Scully (1991), Stevens (2008), PESD (2006), Hartley (2009), Victor (2007) , Oke & Kareem (2013), Tordo et al (2011), Eller et all (2011), Jaffe & Soligo (2007), Ike & Lee (2014), Wolf (2008), ECC (2007), Wolf & Pollitt (2008), van der Linde,(2000), Hartley & Medlock (2013)

3.6.1 Asset management

Bolton et al (2004) stated that the management of assets in the contemporary industrial age is the stimulus for optimized turnover by making use of assets to utmost possible way, considering all assets required for manufacture and allocation of commodities as well as services. This is the reason why the management of asset is not related only with dimension of assets as well as channels but also examining information and rapidly making production decisions centred on gathered data (Abu-Siada & Islam, 2012). The worsening of the status of plants and consequently their performance with the passage of time because of wear from numerous elements exerts a negative influence on manufacturing processes and associated expenditures (Suraji et al, 2001). However, Schuman & Brent (2005) found that asset management plans or schemes can counteract this influence by methodically scrutinizing tools to stay away from unintentional manufacturing downtime as well as to decrease operational expenditures by maximizing protection setting up, which means the main advantages of an asset management policy are enhanced asset accessibility as well as performance together with optimized process and protection efficiency.

One of the asset management solutions is asset optimization offering asset scrutiny, announcement and preservation workflow maximization of mechanization tools, communications, field machines, electrical tools; IT-related wealth together with production courses are all instantaneous (Locatelli, 2006). Conversely, Abu-Siada & Islam (2012) state that asset optimization is a software network that is developed to collect

information from several channels of the plant and carry it into framework of the asset and if upon examination of the data, situations are examined and in case of any deprivation remedies are suggested, which means an error report is produced and later transported to staff equipped to carry out that data. Asset optimization centres into two significant features of the asset management: enhanced asset accessibility and presentation and optimized operations alongside maintenance efficiency (Suraji et al, 2001). Asset management of oil companies is shown in Figure (3.10).

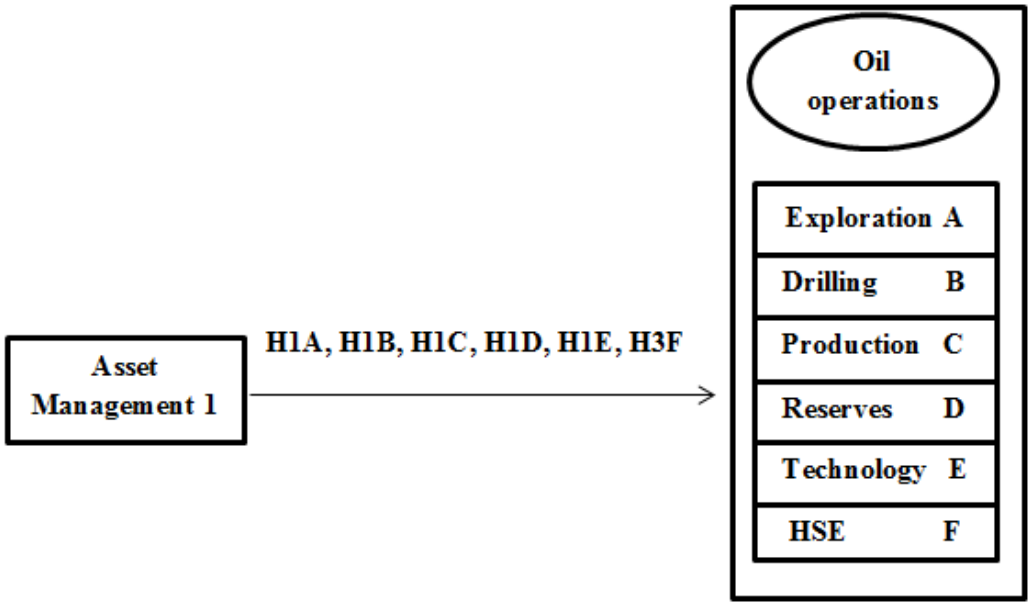


Figure 3.10: Hypotheses related to asset management

Bolton et al (2004) argue that in case of the implementation of an asset management policy it is significant to chiefly deem the assets that function a decisive part to the manufacturing and the protection of the plant, which is true particularly for the O & G sector which is greatly synchronized and possible accidents have a bigger influence in the setting and to human targets. However, Schuman & Brent (2005) pointed out another significant constituent that should be deemed is the procedure historian, which logs all information that alarms an asset throughout a long time span, which is later employed for statistical examination of the performance and preservation of assets and also aids to construct an outline for the asset. Therefore, it is hypothesised that:

H1A. Asset management positively influences the oil exploration.

H1B. Asset management positively influences the oil drilling.

H1C. Asset management positively influences the oil production.

H1D. Asset management positively influences the oil reserves.

H1E. Asset management positively influences the oil technology.

H1F. Asset management positively influences the oil health, safety and environment.

3.6.2 Partnership

Investing in associated abilities, knowledge and capability have to be extremely valued in the corporation (Pongsiri, 2004). This unlocks a state of mind plus strength of facilitation, producing chances to form and improve relationships for both parties. In this setting, partners can more efficiently mirror equally developmental gains and losses (Sodhi & Son, 2009). Administration activities and channels are needed to attain organizational targets and harmonize the future of the partnership (Pedroni et al, 2013). Strong partnership is not possible without well-built communication channels (Sodhi & Son, 2009). Effectual communication at all stages in the corporation as well as in partner companies, distribution and sharing knowledge and data is required (Pongsiri, 2004).

The possible partners contribute in a cross-division association because they are linked to the society and are capable of constructing networks that can generate long-term ability (Pedroni et al, 2013). They are ambassadors of community issues. Furthermore, this kind of cross-division partnership offers oil companies more country-wide associations and offers the other companies more grassroots links (Pongsiri, 2004). One more gain for governmental organizations is the constructive public opinion concerning the concern and obligation to the society and its progress (Sodhi & Son, 2009). These companies also gain from being capable of being contributing in society expansion without coping with political plus authorized directives, permit and other issues.

Chan et al (2010) observed that any kind of partnership for a commerce reason evidently needs an agreement, or a minimum of sufficient assurance by different parties to embrace accountabilities for sharing of threats and in order to envelop the failures and the authority to allot the turnovers or the common gains between the parties. However, Pongsiri (2004) identified that possible issues in functioning by mean of public-private partnerships take in

divergences in beliefs as well as uneven authority as discernments in the communal and private divisions stay diverse in numerous significant aspects. The private division emphasizes the conception of cash streams as private monetary funds will merely be put in when the venture offers a logical income, and the cost-benefit-analysis validates investment, whereas the public division has manifold objectives that connect to the search of the public centred targets (Cheng & Carrillo, 2012). The most general kind of contractual agreement in O & G is the production-sharing contract, whereby mineral reserves are possessed by the country, which fetches in an overseas corporation as a freelancer to offer technological as well as fiscal services for examination as well as development activities. However, the foreign corporation generally presumes the whole exploration expenditure risk, and gets a particular part of creation as a recompense for its preliminary venture, working expenditures and the work done (Pongsiri, 2004).

According to Du & Vieira (2012), the production-sharing agreements are broadly employed in emerging as well as intermediary economies as they are aligned with administrative objectives to be extra practical as well as indulge in administrating the petroleum reserves. However, Chan et al (2010) state that the most frequent arrangement of driving forces in a production-sharing agreement is a host regime, or one of its authoritative powers, for instance the NOC, and an international oil corporation which can be an independent company or a combined project or association. Contrarily, Cheng & Carrillo (2012) highlighted that the production-sharing contract normally needs the development of a corporation amid the communal as well as private divisions to supervise functions along with participation in judgments pertaining to production phases alongside accounting activities. Oil company partnership is shown in Figure (3.11).

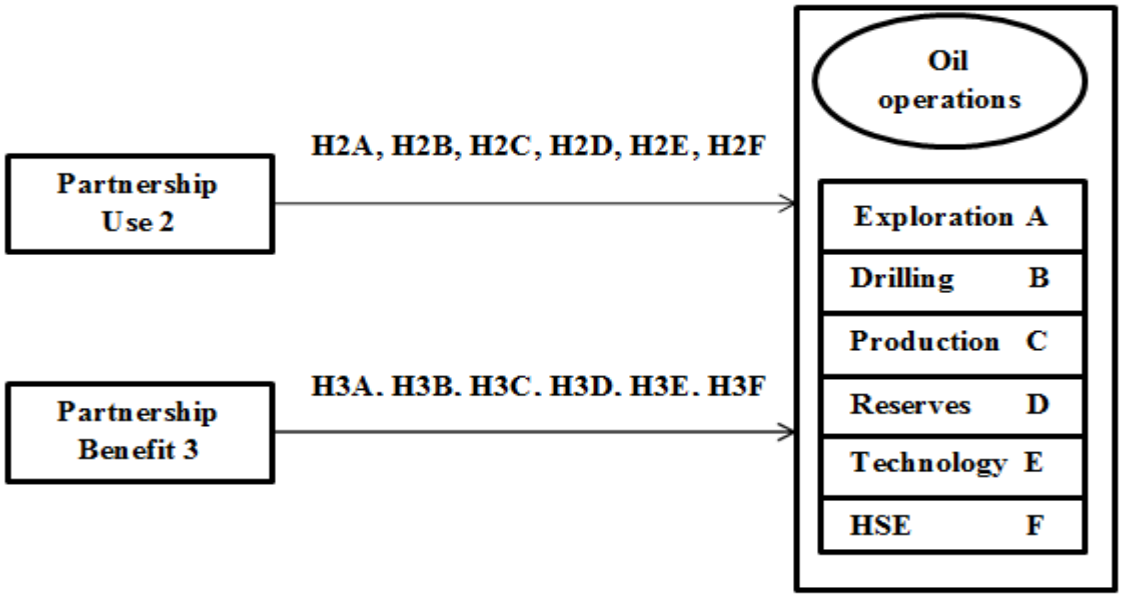


Figure 3.11: Hypotheses related to partnership use & benefit

Du & Vieira (2012) discussed that the intend of the corporation activity is to guarantee that both groups take diverse potencies to the association to employ identified reserves of energy in an efficient manner, particularly in terms of cost, as in well-built and dynamic incorporations both groups gain from collaboration, whereas the principal target of an international oil company being a private unit is optimization of returns, while the national oil company of the host state is mostly interested in optimization of financial values of the owned reserves. Therefore, it is hypothesised that:

H2A. Partnership use positively influences the oil exploration.

H2B. Partnership use positively influences the oil drilling.

H2C. Partnership use positively influences the oil production.

H2D. Partnership use positively influences the oil reserves.

H2E. Partnership use positively influences the oil technology.

H2F. Partnership use positively influences the oil health, safety and environment.

H3A. Partnership benefit positively influences the oil exploration.

H3B. Partnership benefit positively influences the oil drilling.

H3C. Partnership benefit positively influences the oil production.

H3D. Partnership benefit positively influences the oil reserves.

H3E. Partnership benefit positively influences the oil technology.

H3F. Partnership benefit positively influences the oil health, safety and environment.

3.6.3 Exploration and production

Exploration and Production policies in the O & G sector encompasses choices over exploration of possible oilfields, expansion of novel oilfields, crude oil creation amounts together with oil profits shares. According to Stevens (2008), the rationale of exploration action is to recognize commercially practical reserves of petroleum. However, the states essential for these reserves to have amassed are multifaceted and chiefly based on earlier ecological records together with current ecological structures as well as arrangements, whereas for the deposits to come about, specific amalgamations of probable channel together with reservoir rocks as well as immigration trails and ensnare arrangements are required (Ramirez, 2014).

The value chain begins with the recognition of appropriate areas to carry out exploration for O & G (McPherson, 2003). However, after early discovery, oil fields are examined, developed and shaped. These actions are usually known as exploration and production or upstream petroleum (Ike & Lee, 2014). Oilfield services involve a variety of supplementary services in the exploration and production course, for example ecological as well as geophysical reviews and examination, drilling, tools supply and business schemes (Ramirez, 2014). The fundamental connection is knowledge of the subsistence of these channels, which needs discovery and maturity, and is a fundamental portion of examining the degree of the channel base (Stevens, 2008).

Undoubtedly, the search for such reservoirs as well as guessing the probability of their petroleum sources is a theoretically multipart procedure wanting the employment of a variety of methods, which involve profound and shallow seismic reviews, low drilling together with coring, aero-gravity reviews as well as searching and assessment drilling (Olsgard & Gray, 1995). Ike & Lee (2014) discuss that wide parts of the land have been

spotted as having O & G potential, with the likelihood of reserves of petroleum centred on a wide-ranging ecological perceptive, but mapping practices as well as seismic reviews are necessary to comprehend subterranean geology.

Stevens (2008) discusses that aero-magnetic together with significance reviews are functional in explaining wide-ranging arrangement (e.g. sedimentary rocks) in addition to highlighting parts likely to contain petroleum. On the other hand, McPherson (2003) identified that parts of probable concern are under extra geophysical research work, which may include re-understanding on-hand seismic information or implementing new reviews. According to Ramirez (2014), the only trustworthy method to decide if the recognized configurations have hydrocarbons is to pierce into them; however, the choice to drill is not done exclusively on ecological views while government prerequisites, financial elements, (e.g. drilling and transportation expenditures etc.) together with technological viability are all variables that are considered while decision making. The exploration and production process is shown in Figure (3.12).

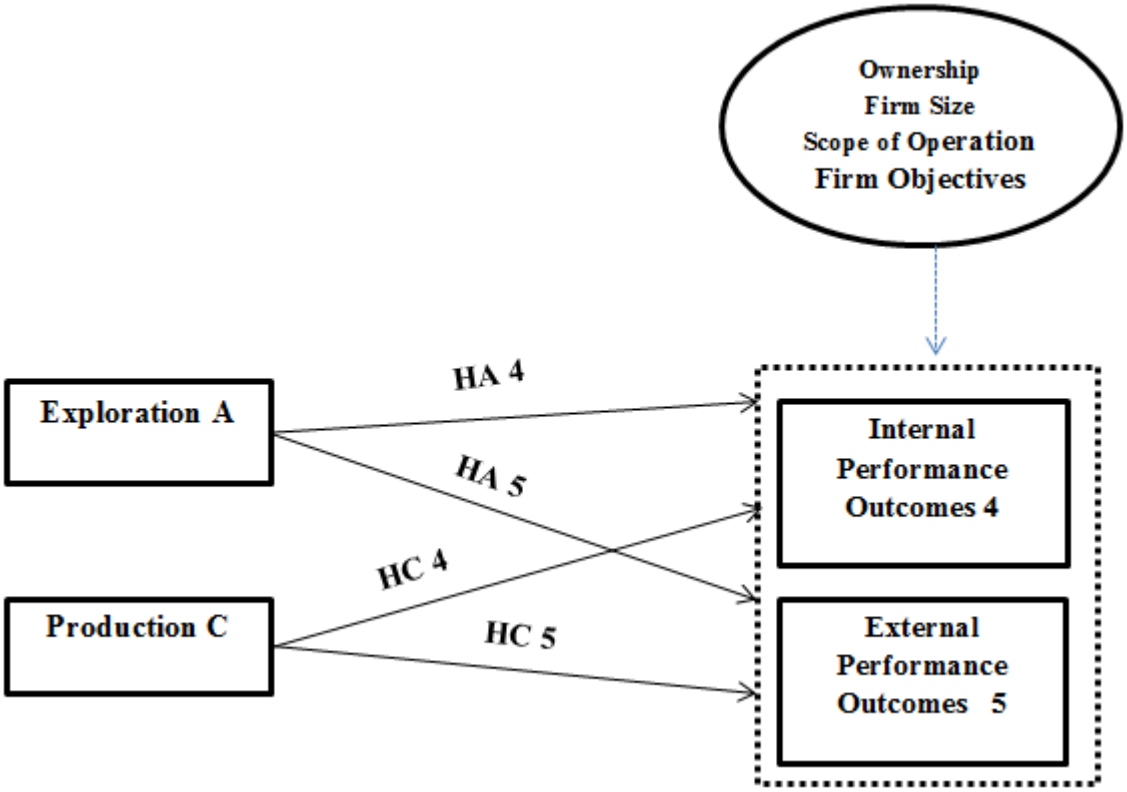


Figure 3.12: Hypotheses related to exploration & production

Olsgard & Gray (1995) argue that the marked arrangements and locations to be drilled are detected chiefly from the explanation of seismic review data. Ike & Lee (2014) explain that the character and expenditure of the well to be drilled talks about particular objectives whereas the secondary goal for a primary exploration well in a part is to determine if the constitution spotted have petroleum reservoirs or not. However, Stevens (2008) states that the more intricate are the objectives/goals the longer time the well may have and the bigger the array of checks to be carried out because the objectives identify the data to be collected throughout the drilling process together with well records as well as probable well checks, and if the well is blocked it may be discarded upon closing of the plan or postponed for re-entrance afterward. According to Ramirez (2014), the well plan and map is subject to outside appraisal as well as endorsement. Therefore, it is hypothesised that:

HA4. Exploration positively influences the internal performance outcome.

HC4. Production positively influences the internal performance outcome.

HA5. Exploration positively influences the external performance outcome.

HC5. Production positively influences the external performance outcome.

3.6.4 Drilling

The purpose of a drilling activity is extracting the improvable reserves from the ground as efficiently as possible. The amount of wells as well as sites wherein they are drilled is based on the dimension as well as character of the basin. According to Mottu & Ahmad (2002), enlargement wells are frequently drilled over time span while both the sequential as well as areal spacing of the wells are based on the pool characteristics as well as ground economics. There are three main types of wells used in the oil extraction lifetime, namely creation wells, insertion wells and dumping wells, but these structures may change purpose over their operational life (Olsgard & Gray, 1995).

Jin & Jorion (2006) argue that drilling is like discovery and assessment drilling because the plane positions of wells are usually based on the major production ability, while directional drilling practices are employed to way in the diverse fractions of the basin. However, the drill filament integrates assemblies to load and ward off the drill bit to the preferred position from perpendicular, while radiographic tools are integrated in the filament to pass on to the outside data on site and point of divergence of the drill bit together with porosity

as well as thickness of the developments for the reason that the frictional coefficient goes up with the angle of divergence and drills, such as jet bit drills employed instead of rotary drills (Daan et al, 1994). The drilling process is illustrated in Figure (3.13).

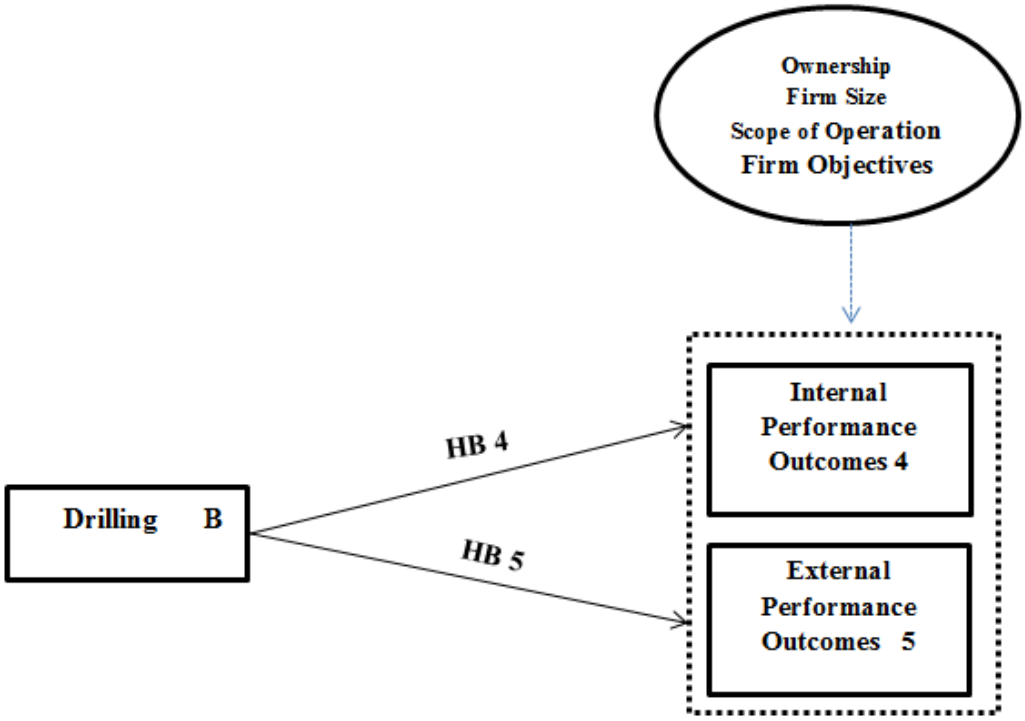


Figure 3.13: Hypotheses related to drilling

However, Ramirez (2014) found that in the places where it is not in principle practicable to drill to the marked position of chief ability, enlargement wells may be useful, perhaps drilled at different outpost sites. To decrease track and optimize the employment of the network, deviated drilling methods are also employed. On the other hand, to lessen holdup between the fitting of the chief facility as well as beginning of making, some enlargement wells, perhaps predrilled from a portable rig and momentarily postponed, may be implemented (Mottu & Ahmad, 2002). Therefore, it is hypothesised that:

HB4. Drilling positively influences the internal performance outcome.

HB5. Drilling positively influences the external performance outcome.

3.6.5 Reserves

Stevens (2008) identified that the reserves are the gifts of nature that require searching and development. A number of research studies of NOC performance employ reserves in

factors of the calculation, for instance petroleum reserves, but this is only instructive where petroleum reserves are found in place and are developed for daily consumption (McPherson, 2003). Therefore, Schuman & Brent (2005) state that the reserves organized by an international oil companies are in certain way reflect attempts on the behalf of the international oil companies, which reproduces performance. Conversely, Van der Linde (2000) reveals that for numerous national oil corporations, reserve digits are based on estimations of the oil on site and merely mirror arithmetical extrapolation instead of any attempt per se, thus they should not be employed as section of a performance appraisal. Stevens (2008) discussed that production has numerous links, and every link in the chain is supposed to affix value to the preliminary gift of the reserves. The reserve pattern of oil companies is shown in Figure (3.14).

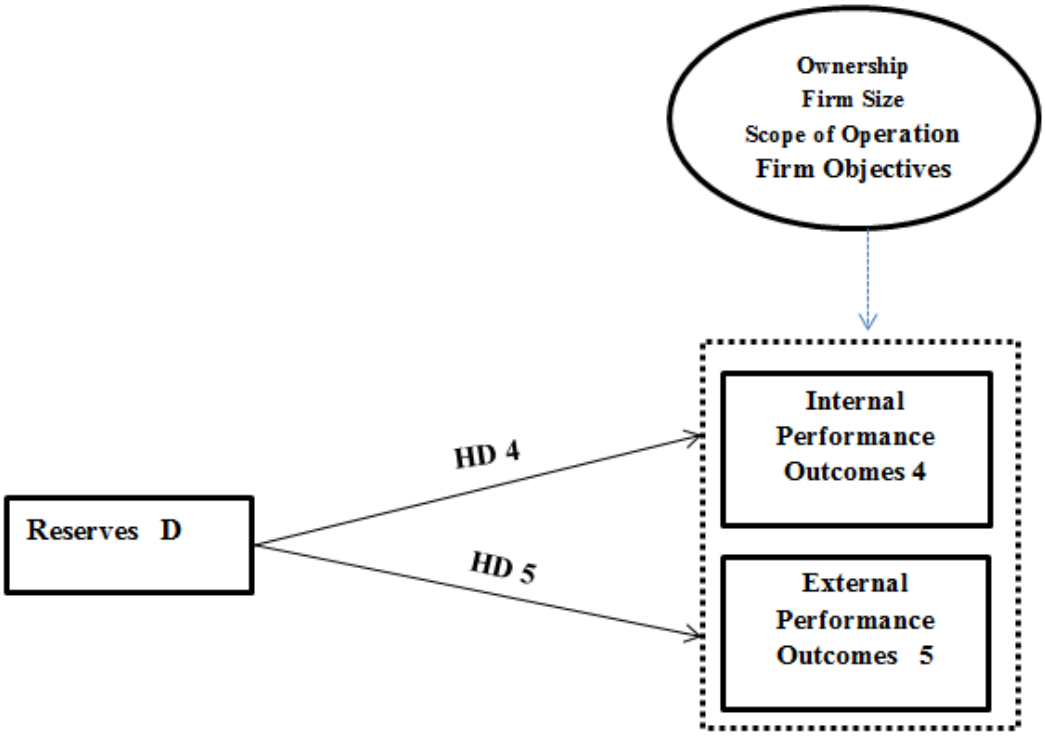


Figure 3.14: Hypotheses related to reserves

Therefore, it is hypothesised that:

HD4. Reserves positively influences the internal performance outcome.

HD5. Reserves positively influences the external performance outcome.

3.6.6 Technology

According to Flannery (1994), in the procedure of time and quick velocity of transformation in technology, no corporation or state is capable of obtaining all required technologies, so relocating from other corporations or states is inevitable. Kondo (2001) mentions that technology as the efficient component of production is composed of four constituents, namely techno ware (i.e. equipment and material tools), human ware (i.e. intellect, experience, expertise, science, novelty), info ware (i.e. facts, pictures, brochures, books and journals) and organ ware (i.e. administration, networking, advertising, inclusion, exploitation). Tabatabaian (2001) pointed that these four wares cause natural reserves and commodities be changed to unpreserved or capital commodities as well as services; without them, conversion is not achievable.

The influence of the O & G industry on the international financial system, strategy and expansion of oil-producing states is substantial due to the function of oil-connected technologies in emerging states and growing returns, and the threat of no oil prospects for oil-producing states. However, Asghari & Rakhshanikia (2013) state that regardless of dependence of such states on oil production, there is a huge discrepancy among them and oil companies from an income perspective. The engineering capacity together with well-built technical network is the basis for big oil companies; however, there are two techniques for advancement of technology; first endogenous advancement employing interior reserves and research and development, while the second technology employs exterior reserves from outside companies (Kingsley et al, 1996). The technology pattern of the oil companies is given in Figure (3.15).

Therefore, it is hypothesised that:

HE4. Technology positively influences the internal performance outcome.

HE5. Technology positively influences the external performance outcome.

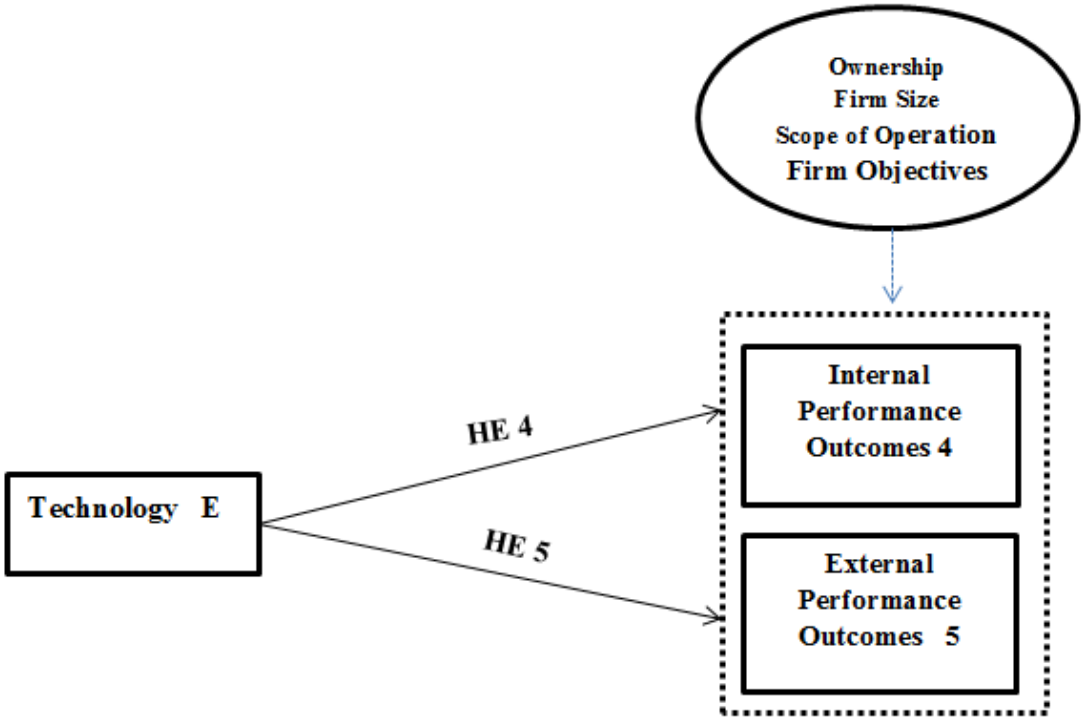


Figure 3.15: Hypotheses related to technology

3.6.7 Health and safety environment (HSE)

The UK Division of the Health and Safety Executive explained asset reliability as the aptitude of an asset to execute its requisite purpose efficiently as well as proficiently by shielding health, safety as well as the environment, which guarantees that individuals, strategies, process and reserves in operation will carry out and facilitate appropriate health and safety (H & S) safeguards and inspections on request over the lifespan of the asset (Colborn et al, 2011). However, Clarke (2006) points out that safety-critical protection is the examination, analysis and protection attempts applicable to guarantee that security constituents stay in good condition and keep on satisfying outlined performance measures, which is fundamental to effectual and continuing asset reliability as well as key risk management as the result of which failure to finish such protection may negotiate asset reliability.

Incident risk of exploration and production operations

Exploration and production companies administer a compound collection of threats starting from slight incidents to main occurrences, such as grave independent injuries, important ecological harm or considerable fiscal influence (Colborn et al, 2011). However, such

companies are often confronted with the challenge of lessening the probability of such occurrences (Clarke, 2006). Over the past few decades, considerable enhancements in the industry have resulted from the adoption of Lost Time Injury Frequency (LTIF) and Total Recordable Incident Rates (TRIR), which testify to the gains of a methodical approach to hazard supervision in presence of close connections amid risks and effects (Gordon, 1998).

A general recurrent improvement administration structure may be employed, but extra industrial abilities together with capabilities are required to administer chief incident perils. It is significant to recognize that the purpose of appropriate tools technological measures is not an adequate condition for the deterrence of main events.

Human factors

Human mistakes are a main element in the majority of negative H & S incidents, and in order to decrease the likelihood for mistakes human factors are a necessary element of asset reliability (Gordon, 1998). The most complicated abilities are vulnerability to loss of reliability due to erroneous activities and even inappropriate maintenance or discouragement to people due to inappropriate concern about the human capital (Colborn et al, 2011). Scheming facilities, job procedures and duties to appropriately speak to human elements can add considerably to the general consistency and reliability of the asset, involving the capability to physically start revival if other obstacles fail.

Environment risk

O & G discovery along with production activities have the potential for a number of influences on the atmosphere, although obviously the main implication of O & G for the climate due to secondary consumption (in power generation and vehicular engine combustion) is of much greater magnitude. Clarke (2006) revealed that the primary influences of O & G are based on the phase of the procedure, the mass and intricacy of the scheme, the character and understanding of the adjacent setting and the efficiency of preparation, pollution deterrence, improvement and control practices.

The business has been practical in the expansion of administration structures, operational activities along with engineering skills aimed at maximization of environmental influence, and this has considerably decreased the quantity of environmental events, for example, inventive skill adopted by Malaysian Mobil and Shell, and different environmental security

plans executed by Chevron in Papua New Guinea, and many more (Colborn et al, 2011). Various kinds of likely impacts can affect the human, communal, economic, atmospheric, marine, and bio spheres (Gordon, 1998). The health, safety and environment pattern of O & G companies is shown in Figure (3.16).

Therefore, it is hypothesised that:

HF4. HSE positively influences the internal performance outcome.

HF5. HSE positively influences the external performance outcome.

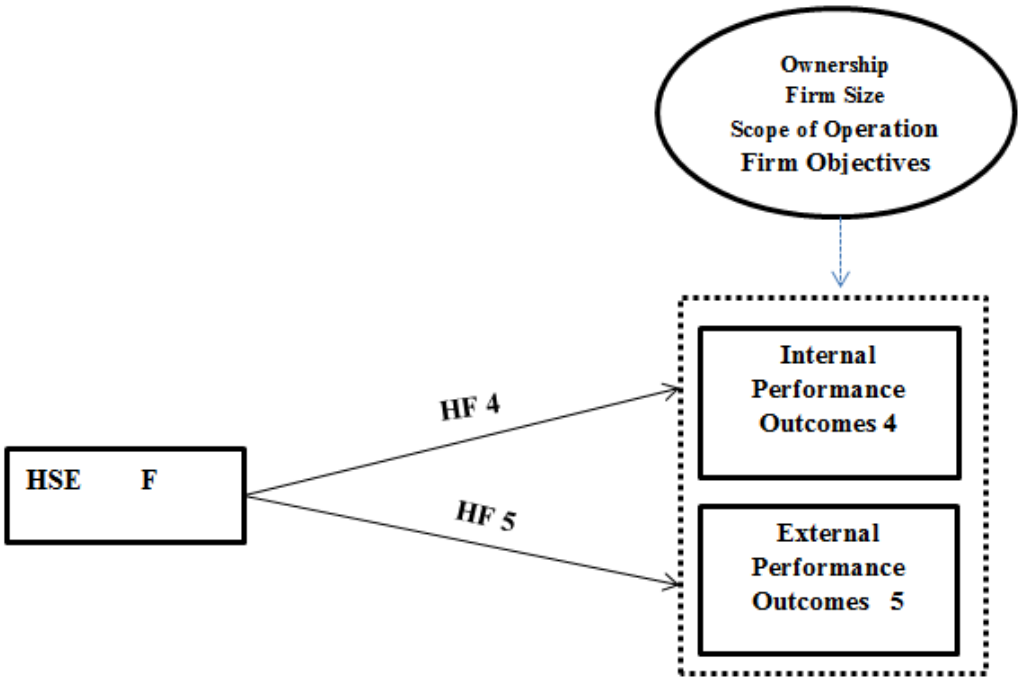


Figure 3.16: Hypotheses related to HSE

3.6.8 Firm performance

Van der Linde (2000) claimed that both academic as well as practical literature is unable to offer decisive proof of whether public or private rights are essentially better in encouraging economic effectiveness, and whether privatization is a suitable instrument to develop organizational performance as well as effectiveness. However, the majority of academics found that in the circumstances of aggressive markets as well as the dearth of other market malfunctions, private organizations are inclined to be more competent as well as more cost efficient compared to state-owned organizations for the reason that such restrictive circumstances seldom exist in actuality (Wolf & Pollitt, 2008).

Al-Obaidan and Scully (1991) argued that despite the significance of national oil companies in the petroleum market, very few writers have assessed the comparative effectiveness of national oil companies. In this regard, Al-Obaidan and Scully (1991) employed figures for forty four organizations in 1981 to develop a production boundary using deterministic alongside stochastic techniques particularly to evaluate the capacity of organizations to employ assets together with workers to generate production, whereby output was elucidated as income earned or the amount of crude oil generated as well as processed. They concluded that NOCs are merely 63-65% as competent in producing revenue as private enterprises.

Market value shows what shareholders consider an openly traded organization value. In order to calculate market value the quantity of remaining shares of an organization is multiplied by the existing market price of a single share. However, it is associated with the assets, manufacture and fiscal show of the company, and characteristically balances with the size of the organization (Wolf & Pollitt, 2008). Market value is a defective gauge for calculating performance for the reason that a great number of NOCs, particularly in the Middle East, do not publicly disclose key data (Al-Obaidan and Scully, 1991). Certainly, the biggest oil producers in the world are unlisted NOCs. The performance measures explanations are listed in the Table (3.4).

Table 3.4: Performance measures explanations

Measure	*Explanations*
Asset management	The use of asset management in oil operations
Partnerships	Using partners in the companies' operations
Exploration success rate	Number of successful exploration wells/total exploration wells (ability to replace reserves)
Drilling success rate	Number of successful development wells/total development wells (ability to produce reserves)
Production growth	The growth in production in the current period comparing to prior period
Reserves growth	The growth in reserves in the current period comparing to prior period
Technology upgrades	research and development /technology upgrades investment
Health, safety and environment	How well implemented the health and safety / developed strategies for clean hydrocarbon and emissions reduction

Source: ECC (2007), Steven (2008)

The performance of state oil organizations is of interest because they govern established reserves alongside crude oil exportation into the global oil marketplace, for instance, seventy-seven percent oil reserves were controlled by state oil organization, while ten percent is controlled by non-state organizations and seven percent by joint venture

companies in 2005 (Jaffe & Soligo, 2007) Considering the large share of state oil organizations, it is evident that stoppage has grave implications for prices of oil and international power markets (Al-Obaidan and Scully, 1991). Thus the key indicators of NOCs' performance are effectiveness and operational and fiscal measures.

Performance in economics is defined as production function whereby material inputs produce the utmost material output. Economic and resource allocation efficiency are the two key considerations in this regard. Economic effectiveness is associated with dynamic effectiveness, which implies functioning at the lowest cost, whereas allocate effectiveness governs resource deployment (including human). However, decoding these constructs into any kind of performance dimension for oil organizations is highly complex (Stevens, 2008).

A generally employed gauge of effectiveness in oil organizations is to use the declaration of commercial goals. Performance is then gauged against whether the organization achieved such goals relative to time frames and financial investment. These targets can vary from functional goals (for example pertaining to manufacturing and reserve substitution) to fiscal goals, such as incomes on funds and ecological goals connected to decreasing carbon dioxide releases and other ecological gauges (Wolf & Pollitt, 2008).

Operational gauges of performance involve material and fiscal gauges and can be employed to deem the expansion of the company. Generally, physical gauges are employed to assay production stages in reserves and the upstream. Accountants usually employ a number of fiscal ratios i.e. leverage ratios, profitability and market-value ratios to review the organizational performance derived from the yearly versions of these organizations. Revenue is the simplest gauge of fiscal performance. Moreover, reserves and manufacture allocations are gauges for dimension (Stevens, 2008; Tordo et al, 2011; Victor, 2007).

3.7 Chapter Summary

This chapter has developed the structure of the conceptual framework for this research in detail by explaining different operations of oil companies. The conceptual framework is based on three components, i.e. resources, which are partnership and asset management, and processes, which are exploration, drilling, production, reserves, technology and HSE (processes). The last constituent is output, which comprises organizational performance. This chapter also includes all the hypothesis development in the proposed model which will be tested in Chapter Six to check whether these hypotheses are supported or not.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

The methodology refers to the overall approach used for the research process. This involves theoretical position that underpins a research design and methods used in the research strategy to answer the questions. On the other hand, methods refer to actions and techniques that are used for data analysis (Saunders et al, 2009). The research strategy and method clearly influence process design and data collection. The choice of research method is important because it determines reliability of research and the ultimate value of the conclusions of the study. Therefore, it is fundamentally important to choose an appropriate research method (Collis & Hussey, 2003).

This chapter reviews different research approaches and processes to explain and justify the chosen methods used in this research. The discussion covers different research methods that are used in relevant studies. The chapter also discusses the design of research instrument, strategy, sample selection, pilot testing and other concepts.

In order to conduct a successful study, it is important for researcher to develop a plan and schedule of activities that need to be performed. This allows the researcher to perform different activities within the time and budgetary limitations of the research project in order to achieve the study aims.

4.2 Research Paradigms

A research paradigm can be defined as a perspective that is held by a community of researchers based on shared assumptions, values and practices. Collis & Hussey (2009) observed that it is essentially a philosophical framework describing the means to carry out research based on assumptions of the world (ontology) and the nature of knowledge (epistemology). A paradigm offers a basic structure underlying a system that comprises an accepted set of theories, methods and ways of defining and interpreting data (Glenn & Bowen, 2009).

Taylor, Kermode & Roberts (2007) explained that a paradigm is a broad overview. The paradigm of a research discusses how a research is guided. Research paradigms are

patterns of practices that regulate research with a particular discipline and provide research frames and processes used for carrying out investigations.

The paradigms that are commonly used in research include positivist, interpretive and critical social theory. In quantitative research, positivist paradigm is used. The positivist paradigm is based on the philosophy of logical positivism, involving the use of rigid rules and measurement. Another research paradigm is realism, which has elements of both positivism and constructivism. The difference between realism and positivism is that positivism is only concerned with single reality, while realism is concerned with multiple perceptions of reality (Saunders et al, 2009).

4.2.1 Positivism versus interpretivism

Positivism and Interpretivism are two most distinguished research paradigms within social sciences (Blumberg et al, 2008; Collis & Hussey, 2009). Positivism is adopted from the natural sciences and is mainly related to the inspection of the essential patterns and associations in social life in order to determine their nature or condition (Blaikie, 2000). Furthermore, positivism is associated with very organized quantitative methods like experiments and questionnaire surveys that yield numerical data; it is a blunt perspective for analysing complex and deep interpersonal phenomena.

On the other hand, interpretivism believes that applying research principles adopted from natural science cannot yield a deep understanding of the social world, thus a different research philosophy is required for social sciences (Blumberg et al, 2008; Collins & Hussey, 2009). Statistical patterns or correlations cannot be understood on their own. Therefore, it is necessary to make know what meaning people attach to their actions and experiences and how they construct their realities. In addition, the interpretive approach is associated with qualitative methods that are not organized. The interpretive approach is also linked with participants' observation studies and in-depth interviews (Blaikie, 2000).

According to Saunders et al (2007), there are two research paradigms including positivism and interpretivism. The positivism approach is based on the identification of key patterns associated with a phenomenon. It is associated with confirmatory research that attempts to confirm relationship between variables. Positivist approach is associated with structured approaches and involves the use of questionnaires, surveys and experiments. On the other side, the interpretivism approach is based on the establishing the meanings that are

assigned by people to different actions that result in certain patterns. The interpretivist approach is associated with exploratory research and identifies relationships between factors. This approach is recognized as being unstructured and is based on in-depth interviews.

Table (4.1) summarises the differences between the research paradigms.

Table 4.1: Research paradigm

Positivism	*Interpretivism*
Reality is objective and separate from the researcher	Reality is subjective and inseparable from the researcher
Knowledge is based on observable facts outside of the human mind	Knowledge is determined by people rather than by objectives external factors
Uses large samples	Uses small samples
Theory testing	Theory generation
Statistical analysis	Observation of individuals' interpretations of the phenomenon
Deductive approach	Inductive approach

Adopted from Bryman & Bell (2007), Collis & Hussey (2009: 58), Creswell (2009), Hussey & Hussey (1997: 54), Saunders, Lewis & Thornhill (2007: 102).

Positivism is mainly associated with confirmatory research, which identifies pre-specified association between different factors. This approach is largely used in quantitative studies and involves the use of highly structured research methods such as questionnaires and experiments. On the other hand, interpretivism argues that it is important to assign values to results. It is not possible to comprehend results through correlations alone. Interpretivism is hence associated with exploratory methods of research (Saunders et al, 2007).

4.2.2 Deductive versus inductive

Research is categorized depending on whether to its logical move from general to specific or vice-versa (Myedaand, 2012). Deductive method involves moving from the general to the specific. This research method involves a conceptual and theoretical structure elaborated and tested by verifiable observations (Collis & Hussey, 2009).

On the other hand, inductive research is referred to as moving from the specific to the general. Inductive research involves theory developed from observations of empirical reality (Collis & Hussey, 2009).

Table 4.2: Major differences between deductive and inductive approaches

Deductive	*Inductive*
Scientific principles	Understanding of the meanings humans attach to events
From theory to data	In-depth knowledge of the topic
Quantitative data collection	Qualitative data collection
Highly structured approach	More flexible structure

Adapted from Saunders et al (2009: 127).

In deductive approach, a conceptual stance is developed before empirical investigation. This approach involves conceptualization and theory testing in different situations. Deductive approach is associated with positivist research. This approach is mostly used in quantitative methods of research. It also involves statistical testing of hypotheses through the selection of samples on a random basis (Saunders et al, 2009).

Inductive approach involves the study of relationships between theory and research. Theory, in inductive research, is generated from the research. Inductive research involves the use of research data to develop theory. The inductive process of research is largely used in qualitative research. Inductive research method is used in order to reflect current and past experiences (Margaret, 2008).

4.3 Research Methods

Information conveyed in numerical form is quantitative. The focus of quantitative research is on measurement and analysis of variables and identification of causal relationships between variables by empirically testing a priori hypotheses (Denzin & Lincoln, 2000). Conversely, qualitative research investigates people's understandings of phenomena, and allows findings to emerge from the data gathered. The important distinction between qualitative and quantitative research is that qualitative research is based on perspectives and actions of subjects while quantitative research focuses on the ideas of researchers (i.e. testing preconceived theoretical hypotheses) (Zikmund et al, 2012).

4.3.1 Qualitative methods

Qualitative research method can be defined in terms of research strategies that emphasize words rather than quantification. Qualitative research consists of an array of techniques that describe, decode and translate data (Collis & Hussey, 2009).

Qualitative research methods have been used extensively in research requiring a deeper understanding of research phenomena. Moreover, the use of qualitative research offers subjective evaluation of a topic. Qualitative research method can capture the words communicated by people (Creswell, 2003).

Interviews

Rubin & Rubin (2011) state that interviews are one of the widely and most commonly used techniques of collecting primary data directly from the source, then this data facilitates researchers to examine the facts profoundly to expose new evidences, reveal new aspects of a concern, precise and comprehensive data that are depend on individual experience. However, Collins et al (2003) held that it is mainly appropriate for a research aimed at investigating opinions and credence of certain groups of people regarding a specific matter or condition; or to expand comprehension of the participants' views. According to Smith (2005), an interview gives a very elastic technique of assembling big quantities of probable data concerning a broad range of topics. Rowley (2012) mentioned that it is either carried out in person or by other contact channels, for example by telephone or via internet. However, Hiebl (2014) state that although several interviews focus on one-to-one extraction of data, it may also be completed with a cluster of people, which can give resourceful channels of examining analogous judgments from quite a lot of people. The group interview, which is also known as focus group interview, is a principally practical way of knowing experiences of certain group of people, for surveying approaches and judgments, and for attaining a variety of standpoints (Caldwell & Atwal, 2005). The key categorizations of interviews are structured, unstructured, semi-structured and standardised open-ended interviews.

Undoubtedly the application of interviews is wide ranging for diverse reasons. Grbich (2012) reveal that interviews present a very bendable method of collecting big quantities of information on the subject of a broad range of topics. However, Hiebl (2014) pointed out that an interviewer has complete authority over the conversation in the interview and can lead the conversation in any direction considering the relevancy; therefore, reaction information can be handled numerically. On the other hand, Rowley (2012) opined that a structured interview gives a reliable and methodical way to get hold of qualitative information and facts.

There are also some disadvantages associated with interviews. Collins et al (2003) mentioned that the structuring and information-gathering procedures guarantee that the interview process is very time-consuming, with transcription being a particularly laborious and difficult procedure. However, Smith (2005) stated that the dependability and soundness of the interview method is respected based on the quality of the information obtained due to the ability of the interviewer in cooperation with the (data) value of the interviewee.

Case study

Case study method is preferred for answering *how* and *why* questions. Case study is the empirical inquiry that aims to investigate a phenomenon in real life scenarios. The method involves holistic investigation of different real life events. The case study approach involves the use of a variety of research methods for capturing multifaceted reality under examination (Yin, 1994).

The use of case study approach provides reliable and solid results. The approach also provides in-depth information and explanation of the topic however hard in case study approach to produce pure results because observable effects are present (Yin, 2003).

Simulation

Simulation is a technique used for the analysis of complex processes. The approach allows researchers to analyse the artificial world. The focus of simulation method is on *what if* questions. This method provides researchers with practical feedback. The drawback of simulation is that the real world issues cannot be exactly simulated (Moshirvaziri & Benli, 2008).

4.3.2 Quantitative methods

Quantitative research is associated with the use of induction techniques. It can be considered a research strategy that emphasizes on the quantification of data. The main strength of quantitative research is the control of data. The control is achieved through the choice of sampling deign. The precision is achieved through reliable measurement methods. The use of quantitative research methods could lead towards the development of different statements regarding causation (Creswell, 2003).

Questionnaires

Grbich (2012) pointed that questionnaire is a widely used data collection method while conducting academic research on diverse topics and subjects and it has been explained as a prearranged list of queries which is generally self-completed by participants. Rubin & Rubin (2011) emphasized that questionnaires are very broadly employed in large-scale analysis to gain opinions and inclinations of certain groups of people. Fidler & Kleinknecht (1977) stated that there are two main means to differentiate a query. Biographical data can help questionnaire method to identify research phenomena with reference to key demographic markers such as age, education or professional experiences. Likewise, questionnaire is also structured either upon close-ended question format or on open-ended format. Close-ended questionnaires restrict answers to given options (e.g. multiple choice, often using Likert scales), while open-ended questionnaire enables participants to give greater voice to their own thoughts and opinions (Zikmund et al, 2012).

Contrasting the closed-ended style and the open-end questionnaire style, the power of the previous is that they are swift to fill as well as examine, whereas the flaw is that information gained may be extremely shallow (Fidler & Kleinknecht, 1977). The second permits the likelihood of asking detailed questions and attained unexpected standpoints on a subject, but the parallel flaw is that filling and examination can be complicated and time taking. However, Grbich (2012) mentioned that closed questions often guide responses with certain prearranged responses, therefore closed queries can in fact produce more biased results than simple Yes/No options. Likert scales offer the most nuanced form of close-ended questionnaire, giving respondents some degree of flexibility within a range of responses, usually three, five or seven (e.g. strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree). The respondents will be required to choose one option showing the potency of conformity or divergence for the preliminary statement. However, Rubin & Rubin (2011) stated that another shape of closed query needs respondents to show the order of significance from a list of qualities or assertions. For an intricate closed ranking query, it is usually prudent to limit the figure of items to a maximum of six.

The advantage of questionnaire is its relatively low cost, especially if administered in person or by email (i.e. not by post). Compared to other methods of data collection, questionnaire is also less time consuming as the onus is on the respondent to complete and

return it. As a result of anonymity, participants can give more clear and honest responses (Stanton et al, 2005). The process of questionnaire design, data collection and data analysis is a challenge, but the most common problems in questionnaire method are low response rate if not administered face-to-face, and inappropriate responses that can cause questionnaires to be discarded (e.g. if someone unanimously selects '5' on a Likert scale throughout a questionnaire, the researcher will typically disregard this form due to invalid response) (Saunders et al, 2009).

4.3.3 Mixed methods research

The mixed method approach is also used in different studies. This approach involves the use of both quantitative and qualitative methods. The use of mixed research methodology results in a stronger study (Creswell & Clark, 2006); the utilization of both methods results in increasing the validity of research, because each method counteracts the deficiencies of the other, allowing the study to benefit from both approaches.

The use of mixed research method results in an in-depth overview of the topic as well as specific, quantifiable results of most value to decision makers. The combination of qualitative and quantitative methods results is considered to be a complementary toolkit. The first benefit of mixed research methodology is the increase in potential of the research and the second benefit is the increased certainty and validity. The use of mixed research method also allows researchers to get diverse data on the same issue (Harrison et all, 2011).

According to Creswell (2009), mixed method is the third paradigm (in its own right), after its constituents qualitative and quantitative methods. Qualitative research process provides a method for understanding and examining behaviours of individuals or groups towards a social or human problem. The qualitative research involves emerging procedures and questions. In qualitative research data analysis is inductively constructed from specific to general themes (Creswell, 2009). Quantitative research inspects the relationship between variables and offers method for testing objective theories. In quantitative research, data is analysed by using statistical procedures (Creswell, 2009).

Table 4.3: Summary of major differences between qualitative and quantitative research

Quantitative Research	*Qualitative Research*
Deductive approach, testing of theory	Inductive approach, generation of theory.
Associated more with scientific research	Not viewed as scientific
Confirm or reject hypotheses about phenomena	Explore new phenomena
Use highly structured methods such questionnaires, experiments, and structured observation	Use semi-structured methods such as in-depth interviews, focus groups, and participant observation
Larger sample size and uses statistical analysis	Smaller sample size
Closed questions format	Open-ended questions format
Numerical data format (obtained by assigning numerical values to responses)	Textual data format (obtained from audiotapes, videotapes, and field notes)
Participant responses do not influence or determine how and which questions researchers ask next	Participant responses affect how and which questions researchers ask next
Study design is subject to statistical assumptions and conditions	Data collection and research questions are adjusted according to what is learned

Adopted from Morse & Mitcham (2002), Payne & Payne (2004), Bryman & Bell (2007), Creswell (2009: 4), Bernard (1995), Bryman & Bell (2011), Spratt et al (2004)

4.4 Cross-Sectional Versus Longitudinal Research

Longitudinal research is one in which data is gathered during different periods from same population, it studies the relationship between different factors. Cross-sectional research design is one in which there is no time dimension. This method relies on existing differences rather than changes after different interventions. The groups are selected in cross sectional studies on the basis of existing differences. The use of cross-sectional study offers a clear snapshot of results. The focus of cross-sectional research is on drawing inferences from differences between people. On the other side, longitudinal design focuses on repeated observations. The longitudinal research allows researchers to track changes in participants over a period of time. Therefore, the difference between longitudinal and cross-sectional research is that the former involves multiple observations over extended time period but the latter involves observations at one time (Blumberg et al, 2008).

4.5 Research Approaches within Performance Management

The choice of the research method is critical in conducting a study. Performance management is a significant area of research where different approaches are used. McKenna et al (2011) argued that performance management is an established element of any organizational system and the diversity in performance management could contribute towards a sophisticated research approach.

The performance management research approaches is often in context base such as: experiments, questionnaires, case studies and interviews (Neely, 2007; PMA, 2012; Pradhan & Chaudhury, 2012). Further, in performance management research, experiment methods are used to study the link or association between variables. Experiments are used in performance measurement research in order to answer how and why questions. The survey questionnaire method is used for testing a predefined hypothesis. The survey questionnaire method is used for answering *who*, *what*, *where*, and *how many* questions (Pradhan & Chaudhury, 2012; Neely, 2007). The survey questionnaire method could be applied to a large population. It is an economical way of using knowledge (Stanton et al, 2005). The case study method is used for studying phenomena in detail. It is used to evaluate the performance management process of an organization (Marco & Umit, 2006).

Neely (2007) discussed that innovation could be measured through different methods, some methods involve the use of qualitative techniques such as expert discussions or interviews. The other methods involve quantitative measurements. The conference of performance measurement association has also presented important arguments, According to the Performance Measurement Association conference (PMA, 2012), the dominant approaches used for performance measurement include survey questionnaires, interviews and case studies.

Performance measurement systems are used in organizations in order to gather data for implementing strategies. This allows organizations to achieve key goals and aims. According to Myeda & Pitt (2012), performance measurement system is an effective tool used for the purpose of performance monitoring. The tool is used in most industries around the world. Gaeti et al (2012) conducted a study to determine the connection between firm strategy and performance. The study was conducted by gathering data from 68 manufacturing companies. Data was quantitatively gathered and analysed through statistical techniques.

Another study was conducted by Myedaand (2012) in Malaysia to study performance measurement system in facilities management practitioners. This study was based on the quantitative method and involved the use of survey questionnaire.

In the UK the government continues to conduct or sponsor research into the performance of the police (Berry, 2009; Flanagan, 2008). The British Crime Survey (BCS) has been in

use since 1982 as research tool measuring the performance of public services (Cantor & Lynch, 2000).

Abdullah (2012) argued that using the surveys in measuring the performance in higher education have developed and matured. On the other side, Pekka Puustinen (2012) studied performance measurement in the financial services sector using quantitative method (N=300) and provided guidelines for financial services providers on how to provide facilities that support consumers' investment.

Petr et al (2012) examined the quality of performance measurement and management systems as well as rewards systems of the biggest Czech companies using 100 e-mail survey questionnaires whereas De Waal and Counet (2009) studied the main problems that can be met during the implementation and use of a PMS using a survey of 31 experts in performance management.

Neely (2007) measured the innovation performance quantitatively using a survey of 100 biotechnology companies and regression analysis is use d to test the hypotheses. The structured survey was also used by Parthiban & Goh (2011) for performance management of manufacturing industries, and their study provided a way to identify the current performance of an organization and a methodology for further improvement.

In the performance measurement literature using a survey questionnaire method is a well-established approach. Bourne et al (2003) stated that the performance measurement questionnaire (PMQ) is one of the main performance measurement design processes. PMQ is used for evaluating and developing the measures which already in use in an organization (Ho et al, 2012).

4.5.1 Research approaches within O & G firms' performance

Ho et al (2012) studied different types of operation strategy practices. They also studied how different processes could lead towards superior performance. Their study was based on a survey conducted on 100 participants selected from the O & G sector of Canada. The hypotheses developed in the research were tested through regression analysis in SPSS. Another study was conducted by Victor (2007) on performance national oil companies. She analysed available macro-level data from 1999 to 2006 on O & G companies. The top 100 companies from the world were selected for this research, the performance of NOCs

was compared with the performance of private oil companies and the data was analysed through regression analysis. The regression analysis has also been used in other studies (Hartley & Medlock, 2013; Wolf, 2008; Wolf & Pollitt, 2008). Hartley & Medlock (2013) conducted a study on the efficiency of NOCs. Data was gathered from 61 companies and analysed through regression analysis. Wolf (2008) used *Petroleum Intelligence Weekly* publications to study drivers of performance. Wolf & Pollitt (2008) conducted research on the performance of firms in the O & G sector. Data was gathered from 28 public companies. These researchers also used regression analysis. Ike & Lee (2014) gathered data from the period of 2003 to 2010. Data was obtained from the *Energy Intelligence Petroleum Industry Weekly*. Regression analysis was carried out on different environmental factors that have an effect on the efficiency and productivity level.

4.6 Research Approaches Applied in this Study

As discussed previously regarding performance management research approaches and O & G firm analysis, the researcher has decided to opt for quantitative research method as the most suitable method for this research, to build on previous literature and contribute to the field. The survey questionnaire method allows researchers to develop background and learn from other studies conducted on the topic. The use of quantitative approach is also beneficial because it offers a rigorous and scientific examination of a research topic. It helps in the identification of factors that have a positive effect on the performance of firms. The survey questionnaire method is also useful in finding answers of research questions. The questionnaire method for data collection helps in achieving clarity and accuracy in research.

4.7 Sampling

Sampling technique is an important process used in research. In social sciences, two approaches are used for the purpose of sampling: probability and non-probability sampling. In probability sampling, every member of the population has the opportunity of getting selected. On the other side, non-probability sampling is one in which every member of the population does not have the chance of getting selected (Henry, 1990).

The considerations for sample size are also important in quantitative and qualitative research. It is done with different statistical generalizations that involve generalizing

findings from sample to the population. The recommended sample size for case study research is 2 to 5 participants. In questionnaire research, the appropriate sample size is 30 to 50, while in focus group the recommended size is 6 to 9 (Creswell, 1998, 2002).

According to Gill & Johnson (2002), it is not practical to involve all members of population in the research. Therefore, it is important to select the appropriate sample for the research. As suggested by Hussey & Hussey (1997), population consists a set of people under consideration, while the sample is the subset of population.

According to Blumberg et al (2008), it is recommended to use non-probability sampling when cost and time need to be considered. According to Saunders et al (2009), snowball sampling is recommended in situations when the members of population could not be identified. Saunders et al (2009) have further argued that convenience sampling method involves choosing respondents who could be approached in a convenient manner. In this research, convenience sampling method has been used.

Boyer & Pagell (2000) argued that the studies that involve one participant from each organization could be carried out easily. However, such studies involve significant risk because the decisions regarding operations and implementation could not be taken by a single person. In fact, such decisions involve the contributions from several people at all levels of organization. Gargeya (2005) conducted a performance management study on manufacturing plants. His study was based on the use of different performance measures in manufacturing organizations. He noted in his study that in most of previous works, the performance measurement practices were not identified and evaluated effectively because they involved the use of only one respondent in an organization.

It can be comprehended from these arguments that the use of one participant from each organization results in problems. Therefore, in order to overcome this limitation, it has been recommended by Boyer & Pagell (2000) that multiple respondents used to get a holistic representation of the organization. This research aimed to get accurate perspectives related to performance measurement in the O & G sector. Therefore, data was gathered from several respondents selected from different hierarchical levels of the organization.

The industry experts in O & G industry from the Oil Ministry in Libya suggested that general manager, operation manager, financial manager, planning manager and general services manager are appropriate samples for this research. It was also advised by industry

experts to collect data from all active firms in Libya. Therefore, the researcher used 17 firms including public, joint venture and private oil firms and targeted the whole population.

4.8 Two-Dimensional Approaches for Measuring Performance

In order to measure the firms' performance, two variables were used including internal performance outcomes and external performance outcomes. The internal performance outcome is within the firm itself in terms of management capabilities however and the external performance outcomes is comparing to O & G sector. Item seventeen in the questionnaire (see appendix C) aims to measure the internal performance outcome. On the other side, item number eighteen (see appendix C) aims to measure the external performance outcome.

4.9 Questionnaire Design

The questionnaire consisted of three sections and a cover letter. The first section was related to company profile. The second part was related to proposed model constructs, including asset management, partnerships, drilling, reserves, production, health and safety environment and technology. The third section was related to the output of oil operations in terms of their performance.

The items on the questionnaire were based on five-point Likert scale. According to Sekaran (2000), a Likert scale is a widely used method used for gathering information from respondents. According to Gargeya (2005), performance measures have not properly addressed hierarchical perspectives by surveying only one respondent in an organization. In this study, it is assumed that one respondent cannot represent the entire organization. In order to alleviate these limitations, Boyer & Pagell (2000) recommended that researchers employ multiple respondents at different organizational levels in order to get a holistic representation of the organization.

The questionnaire survey consists of closed and open-ended questions. The purpose of questions is to explore the demographics of participants and identify the criteria used for performance management. The multiple choice questions are designed in order to evaluate performance management from different perspectives including efficiency, effectiveness,

and collaboration, innovation and management skills. The use of ranking questions helps in discovering the relative importance of performance management criteria.

In order to get an accurate perception regarding performance management in Libyan oil companies, the researcher employed more than one questionnaire in each organization. In each organization, the researcher employed five questionnaires. The total firms surveyed in this research were 17. Hence, the researcher administered a total of 89 questionnaires, four of which were excluded because of missing data.

4.9.1 Timeline for data collection

Data was gathered through questionnaires handled personally by the researcher between July and September 2013. Personally-handled questionnaire is associated with higher response rate than alternative questionnaire data collection methods (Sekaran, 2000; Zikmund, 2003).

4.9.2 Ethical consideration

The ethical issues associated with a research are associated with collecting, analysing and reporting data (Bryman & Bell, 2007; Saunders et al, 2009). The ethical issues have been discussed with the supervisor. In order to meet ethical requirements, a covering letter was attached with the questionnaire that explained the purpose of the study and the contact details of researcher (see Appendix C). The researcher also had a letter of approval from the Libyan embassy in London to the Libyan oil ministry which explains the current states of the researcher and the purpose of the data collection as well as gives support for data collection see Appendix F. The researcher also ensured that the details of participants would not be revealed to anyone else. The participants were told that they were free to take part in the research or to withdraw, and that their responses would be treated with confidentiality. Data will be stored in a password-protected computer accessible only to the researcher and on the servers of Brunel University for a period of seven years, after which it would be discarded (in accordance with the UK Data Protection Act, 1998).

4.9.3 Translation

The questionnaire was designed in English by the researcher then it was pre-tested by a Brunel University Engineering School lecturer and another academic with highly respected experience in O & G industry in Libya as well the supervisor to ensure that all questions

were easy, understandable and clear. Even though the target respondents are key personnel of O & G companies and have good level of English, the fact that the first language in Libya is Arabic cannot be ignored. According to Saunders et al, (2007: 375) *"translating questions and associated instructions into another language requires care if your translated or target questionnaire is to be decoded and answered by respondents in the way you intended"*. Thus the questionnaire was translated into Arabic by the researcher with the help of three PhD students who belonged to Brunel Engineering Design School. In addition the questionnaire was back-translated from Arabic to English by another three different bilingual PhD students at Brunel University in order to highlight any differences. Finally, the three versions were examined by another two PhD participants from the English Department whose native language is Arabic, and the newer English version satisfied the researcher as well as the PhD participants.

4.10 Pilot Study

This questionnaire was conducted in two oil companies in Libya with 11 interviews. According to Saunders et al (2009), before using questionnaire it is important to conduct pilot testing. The purpose of pilot testing is to refine questionnaire so that respondents do not face problems in answering questions. The pilot testing was conducted on 2 oil companies by conducting 11 interviews.

Table 4.4: Sample profile for pilot study

Position	*Frequency*
Corporate planning manager	1
Offshore senior integrity engineer	1
Logistic & general service manager	1
Account manager	1
General manager	1
Material general manager	1
Senior project engineer	1
Drilling coordinator	1
Field operation manager	1

HSE advisor	1
Reservoir engineering coordinator	1

Reliability test

According to Lee and Hooley (2005), Cronbach's alpha is used to measure internal reliability of a scale. The method is used for assessing reliability in marketing and other fields. SPSS was used to analyse data. The tests that were conducted on data included descriptive statistics and scale reliability analysis.

In this research, the values of Cronbach alpha are from 0.70 to 0.81. However, the value for oil operation is 0.62 (i.e. less than 0.7). The researcher decided to continue research with this item because the value was not very low. The value for this variable was less than 0.7 because the number of respondents was only eleven. Yin (2003) argued that reliability demonstrates that operations of a study, including methods of data collection, are reliable. The concept of reliability can be compared with the concept of precision. Precision in an instrument refers to the minimization of measurement errors. The more precise an instrument, the more reliable it is. According to Shadish et al (2002), the term validity refers to the truth of an inference. For ensuring validity, the data must cover complexity of the research topic. Table (4.5) indicates the measurement scales of reliability for the pilot study.

Table 4.5: Reliability for the pilot study

Factor	*Cronbach Alpha (α)*
Asset management	0.70
Partnership use	0.72
Partnership benefit	0.74
Oil operations	0.62
Internal outcomes	0.75
External outcomes	0.81

4.11 Research Design

According to Hussey & Hussey (1997), the success of a research depends on the selection of right research process. According to Neely et al (2005), PMS design consists of seven principles. The first principle says that measures must be related to the strategy of a firm. According to the second principle, the non-financial measures must be adopted in the

performance management process. According to the third principle, it is important to recognize that performance management measures vary between different locations; therefore, a single measure must not be used for all departments. According to the fourth principle, it is important to acknowledge that measures change according to circumstances. The fifth principle says that the measures must be simple and the sixth says that the feedback on performance management measures must be fast. According to the seventh principle, the measures must be designed in such a manner that they stimulate continuous improvements rather than just monitoring.

Figure (4.1) illustrates the step of a research design. The process starts with an extensive literature review. The framework was formulated by extracting factors from the most cited factors from the well-established theories. The framework reviewed in Performance Measurement Association (PMA) 2012 conference at Cambridge University, UK and was presented in British Academy of Management (BAM) 2013 conference at Liverpool University. The pilot study was presented in International Conference on Manufacturing Research (ICMR) 2013 at Cranfield University, UK. The framework was reviewed on the basis of the feedback of experienced scholars in the filed from the conferences and the pilot study. After feedback, two factors (drilling and HSE) were added to the framework. The questionnaire was developed by extracting questions from previous studies conducted on the topic. The questions were adjusted according to the topic. The questionnaire was refined by PhD students. The results of pilot test were presented in ICMR and were derived through SPSS. The field study was administered through questionnaire in Libya for 17 O & G firms and was presented at AMEE research seminar and ResCon at Brunel University.

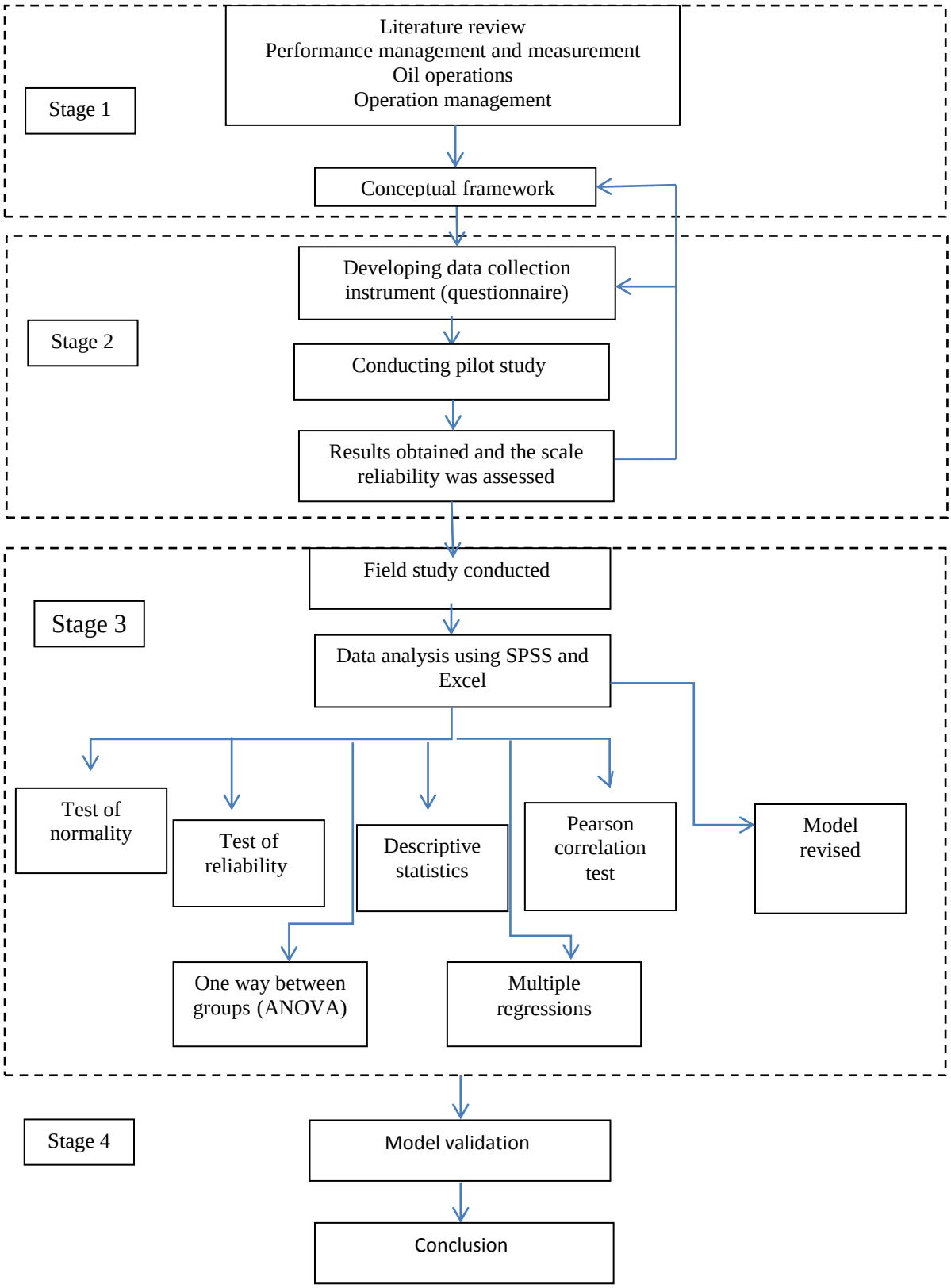


Figure 4.1: Research processes

4.12 Validation through Qualitative Interviews

The researcher also conducted face-to-face interviews in order to confirm the model developed with oil industry experts. The interview questions covered factors included in the proposed model. Four participants from different departments in O & G companies of Libya took part in the interview in July, 2014. A cover letter was provided to all participants that included the purpose of research and the guarantee that the privacy of participants will be protected (see Appendix E).

4.13 Chapter Summary

The focus of this chapter was on the classification of different research paradigms and methods. The research has explored research methodology and methods. The research methods are the cornerstone of a research and help identify appropriate methods that need to be applied in the research.

CHAPTER 5: SURVEYED OIL FIRMS' CHARACTERISTICS

5.1 Demographic Characteristics

This section is based on the analysis of demographic characteristics of different oil companies located in Libya. When this survey took place the firms studied in this research include public firms, joint venture firms, and private firms in Libya. Data in this research is grouped on the basis of type of ownership.

A large number of oil firms in Libya are owned by the government. The public oil firms are the largest firms in the country. There are seven public oil firms in Libya and five joint venture companies; the remainder of the oil companies are private.

5.1.1 Ownership type

Figure (5.1) shows different types of oil companies in Libya. The share of public companies is 41% while that of joint venture firms if 30%. The share of private firms is 29%.

The graph shows that the public sector possesses the highest share of ownership while the second highest share is owned by joint ventures. The private sector has the least market share i.e. 29%.

During the last few years, different oil-producing countries have promoted privatization in order to increase efficiency. Therefore, private ownership of oil companies has been increasing in these regions. However, the majority of oil ownership is still in the hands of the government (CEE, 2007).

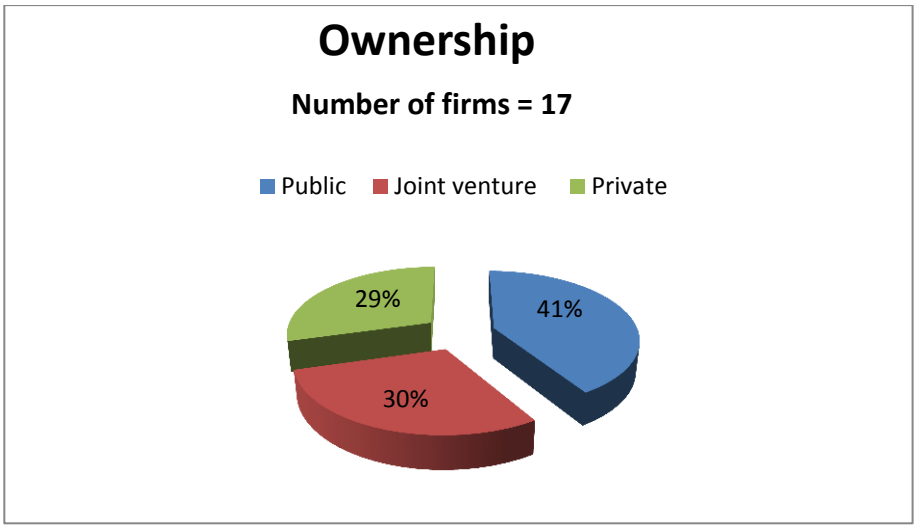


Figure 5.1: Distribution of sample based on ownership type

5.1.2 Firms size

The firms were also grouped on the basis of number of employees. The large organizations were those with where the number of employees is from 1500 to 4000. The medium-sized organizations are those where there are 501 to 1499 employees while small organizations are those where the number of employees is 500 or less (these are typically private companies).

Figure (5.2) shows the distribution of employees on the basis of organizations. The percentage of large organizations is 41 while medium sized organizations comprise of 35%. The remaining 24% organizations are privately owned.

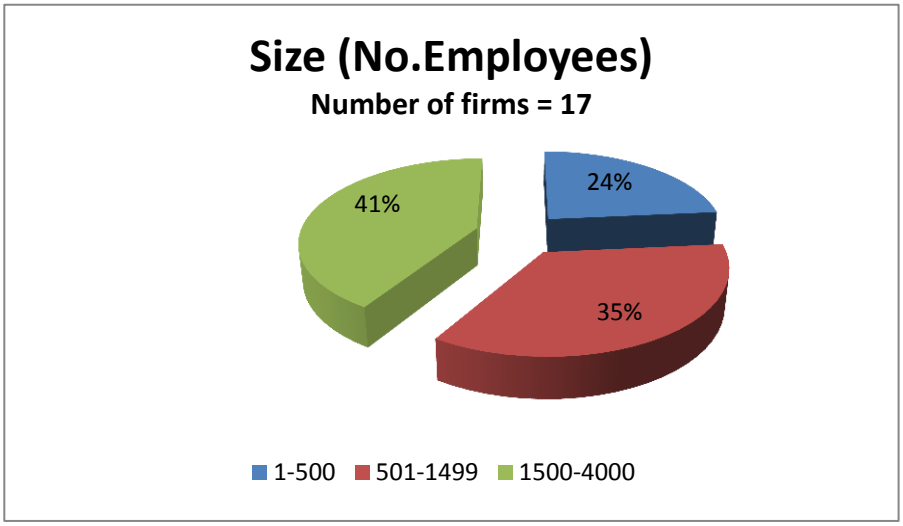


Figure 5.2: Distribution of data based on firms' size

5.1.3 Scope of operation

The oil firms have also been divided into international operations and local operations. According to data analysis shown in Figure (5.3), there are 59% firms, which are operating in Libya while 41% firms are operating internationally.

The international operation of oil companies is a positive indicator. It is because at the international level, petroleum resources could be used for the purpose of securing financial assets and political support. Furthermore, it could also enhance the standing of Libya's government. The international operations also indicate better understanding of global technical and commercial decision making in the oil sector (Tordo et al, 2011).

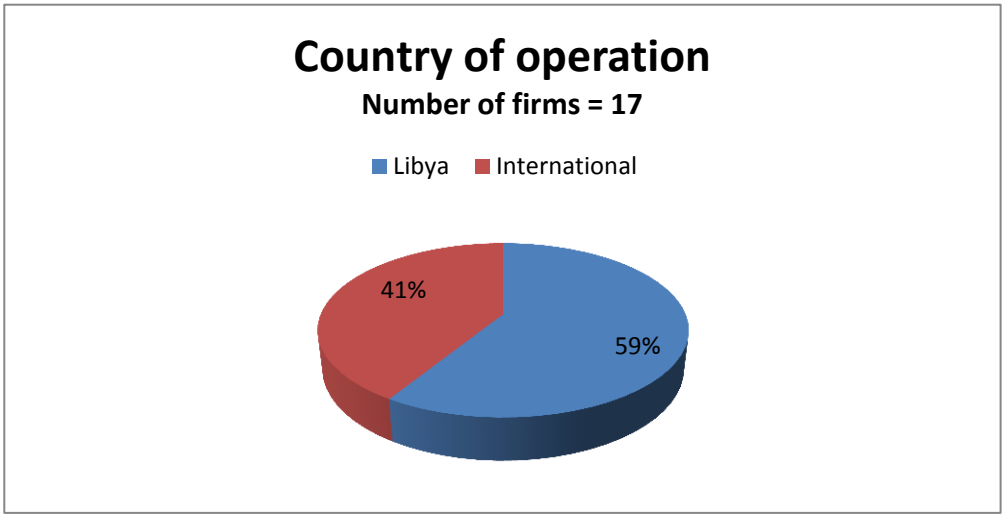


Figure 5.3: Distribution of data based on scope of operation

5.1.4 Respondent work experience

Respondents working in different oil companies were also diverse on the basis of years of experience. The years of experience have a significant effect on the perception of employees regarding their companies. The experienced employees are often more knowledgeable than those who are newly hired. On the other side, the newly hired employees are often blunt and direct in expressing their views.

There were three groups of respondents. The first group (51%) consisted of employees with more than 20 years of experience. The second group (43%) included those who have 10 to 19 years of experience while the third group (6%) had 5 to 9 years of experience in O & G companies.

These results show that a majority of employees were highly experienced. The experience of employees would add value to this research.

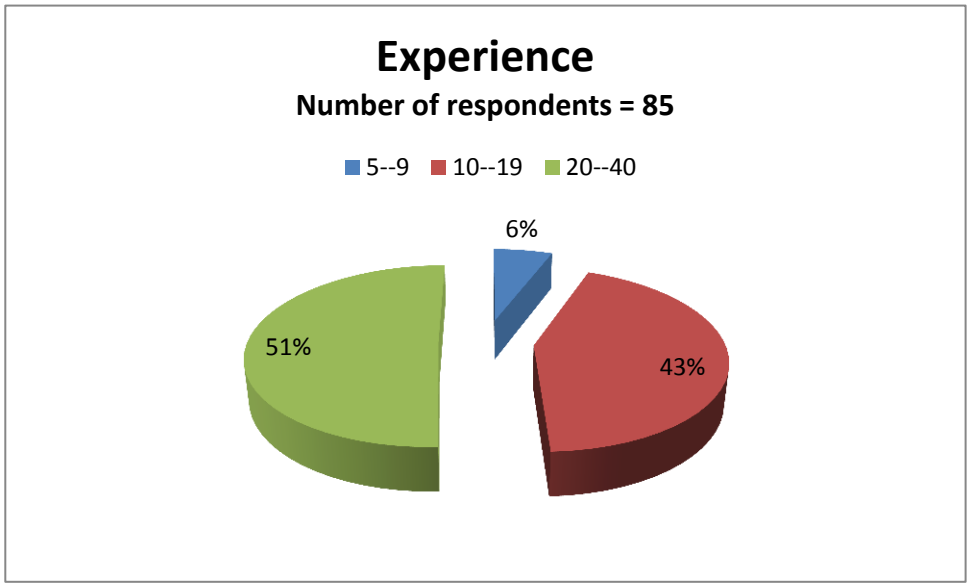


Figure 5.4: Distribution of data based on work experience

5.1.5 Respondents qualifications

The respondents were also classified on the basis of their education. The participants of the research had various levels of qualification including MSc, BSc, Diploma, and PhD. This shows that the opinions of respondents are also diverse on the basis of varying level of education.

Figure (5.5) indicates that 53% of the respondents have MSc, 31% have BSc, 10% have PhD and just 6% have high diploma. This means that majority of respondents have a high educational level, which makes the data more valuable.

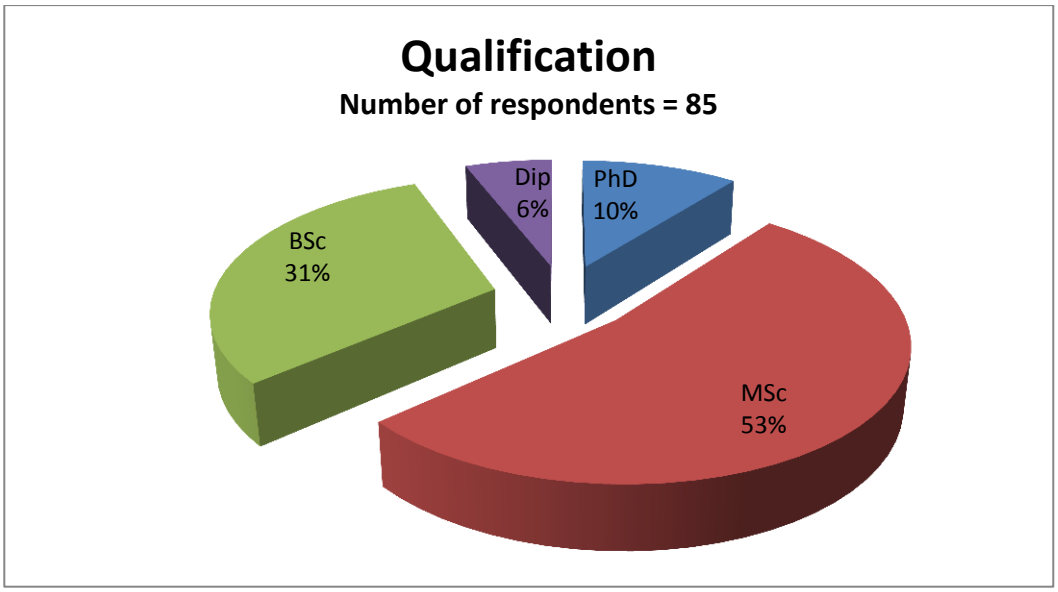


Figure 5.5: Distribution of data based on qualifications

5.2 The Effect of Ownership on the Study Factors

5.2.1 On firms' objectives

It is important to understand objectives of NOCs before evaluating their performance. The literature available on the topic suggests that objectives could be classified into two categories including effective development of the country hydrocarbon and overall contribution towards social and economic development (Megateli, 1980; Zakaria, 1980).

There are different objectives of NOCs, including the protection of hydrocarbon wealth, promotion of economic development and promotion of political interests. The main objective of NOCs is the creation of value for the society (Stevens, 2008).

The objectives of firms are diverse. Figure (5.6) shows the objectives of different O & G companies in Libya.

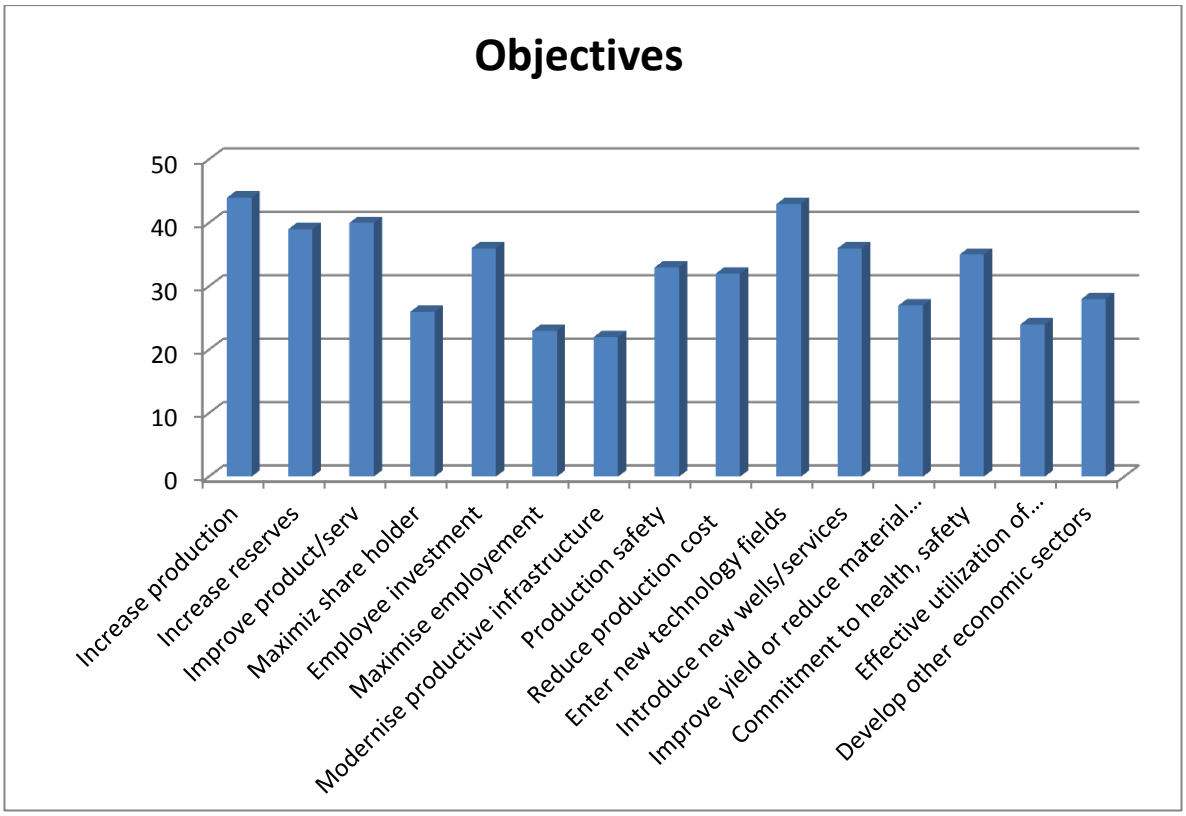


Figure 5.6: Oil and gas firms' surveyed objectives

According to the figure, the main objectives of firms include increasing production, increasing reserves, increase in employment, and introduction of new products and services. Furthermore, firms also aim to improve the quality of their product and services and maximize shareholder value. The other objectives of firms also include decrease in production cost, increase in production safety.

The increase in production is an important objective of O & G companies. Firms tend to spend significant resources to extract resources for increasing production. The maximization of shareholders' wealth is also important because they play a significant role in decision making. The government and private organizations of a country are responsible for providing employment opportunities. Therefore, it is also an important objective of O & G companies in Libya.

The respondents were also asked to highlight five important objectives of O & G companies. Table (5.1) shows the main five objectives for the O & G firms surveyed and Figure (5.7) demonstrates the firm objectives based on the type of ownership.

Table 5.1: The surveyed firms' objectives

The main five objectives		
Public firms	*Joint venture firms*	*Private firms*
Increase production	Increase production	Improve quality of product and service
Increase reserves	Increase reserves	Enter new technology fields
Introduce new wells/services	Reduce production cost	Investment into employees
Develop other economic sectors	Introduce new wells/services	Commitment to health, safety and environment
Maximise employment	Production safety	Maximization of shareholders value

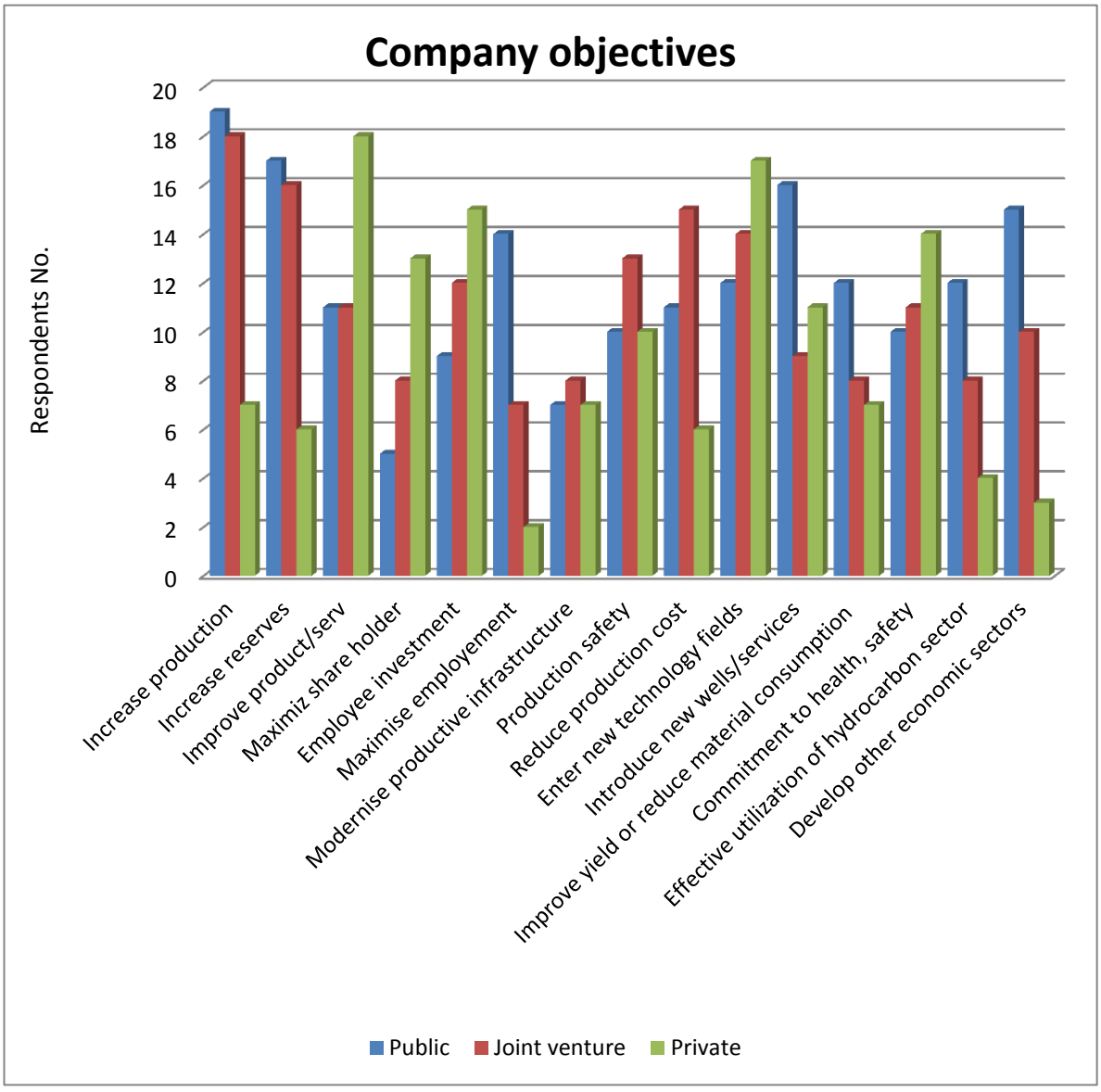


Figure 5.7: Distribution of firms objectives based on ownership

5.2.2 On oil exploration

Respondents were asked to give their answers about the companies' exploration success rate in the past decade which is shown as illustrated on a scale of 1 to 5, representing 0-10%, 11-19%, 20-29%, 30-39%, and 40% and over. Private companies have a higher level of oil exploration than public and joint venture firms, as shown in Figure (5.8).

Some respondents from the survey commented *"exploration is an important element to the oil firms to increase their reserves and we have achieved good level of exploration in the last few years however now days the exploration activities have decreased and completely stopped for some firms because of the war"*.

Some respondents from public and joint venture firms explained that *"exploration activities are highly important to us however it requires high technology and equipment, therefore, we always use the private companies in this activity"*.

There are different reasons, which could be associated with these results. The exploration of petroleum requires significant resources and knowledge about relevant locations. Furthermore, it also requires technological competence and project management expertise. Exploration is a high-risk activity; therefore, firms need risk-management approaches for this activity. Private firms are often risk takers while public organizations avoid risk. Therefore, the success rate of exploration is high among private firms (Ghandi & Lin 2014).

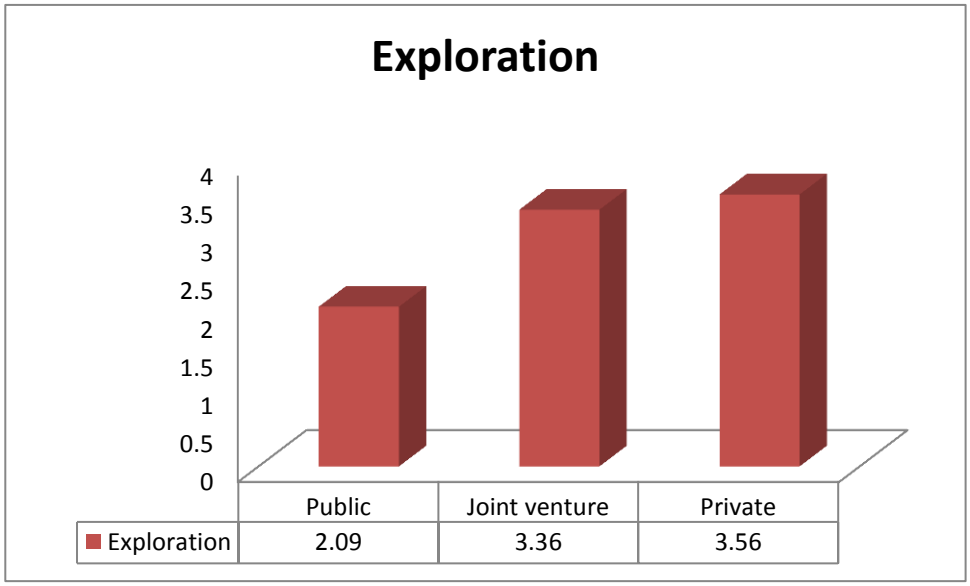


Figure 5.8: Distribution of firms' exploration based on ownership

5.2.3 On oil drilling

Respondents were asked to give their answers about the companies' drilling success rate in the past decade, which is shown as illustrated on a scale of 1 to 5 representing: 0-10%, 11-19%, 20-29%, 30-39%, and 40% and over.

Again, Figure (5.9) indicates that private firms seem to have a higher level of oil drilling than public and joint venture firms.

Some respondents claimed *"oil wells not always drilled, after exploration many oil wells are kept as reserves for future drilling and production"*.

Some respondents from public firms stated that *"we are highly dependent on oil services companies in the drilling activities"*.

These findings are related to the previous findings regarding the success rate of exploration. Similar to exploration, drilling is also a risky business. Furthermore, the decision to carry out drilling has consequences. The success rate of drilling is higher among private and joint venture firms than public firms, which is considered within the oil sector to be due their technical competence and risk-taking approach (Ghandi & Lin 2014).

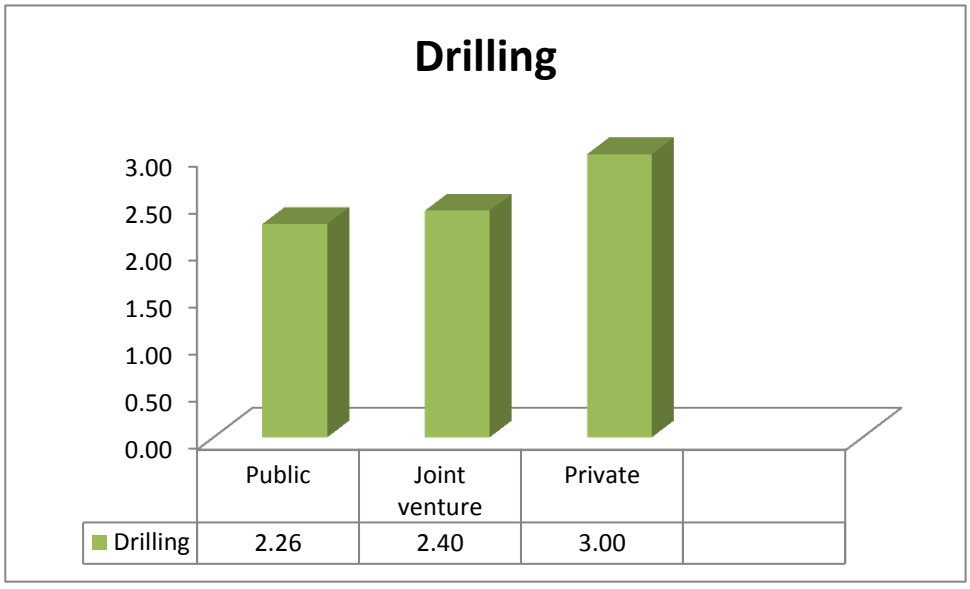


Figure 5.9: Distribution of firms drilling based on ownership

5.2.3 On oil production

Respondents were asked to give their answers about the companies' production growth rate in the past decade, as illustrated on a scale of 1 to 5 representing: 0-10%, 11-19%, 20-29%, 30-39%, and 40% and over.

Public firms reported a higher level of oil production growth than both private and joint venture firms, as shown in Figure (5.10).

Although the drilling and exploration rate of private and joint-venture companies is higher than those of public companies, public companies produce more oil than their counterparts. Some studies stated the two important factors associated with increased production in public NOCs are policies on the production of oil and resources available (CEE, 2007; Tordo et al, 2011).

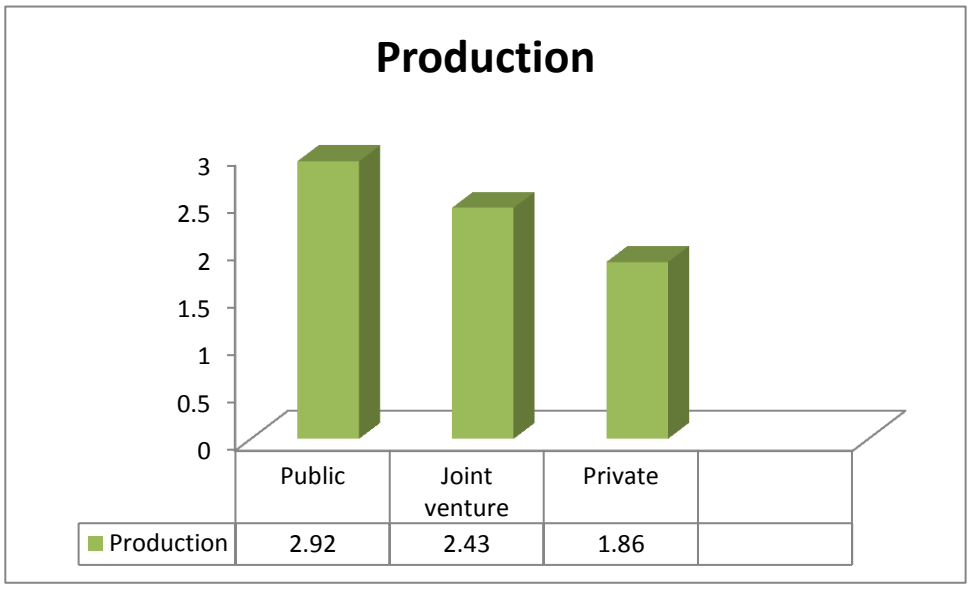


Figure 5.10: Distribution of firms' production based on ownership

Some respondents stated that *"increase the production level totally depends on the market needs as well as the OPEC regulations"*.

Others said *"Libyan oil firms have achieved excellent level in oil production in the past decade, however the production level went down since the war started in 2011"*.

5.2.4 On oil reserves

Respondents were asked to give their answers about the companies' reserves replacement growth rate in the past decade, as illustrated on a scale of 1 to 5, representing 0-10%, 11-19%, 20-29%, 30-39%, 40% and over.

Figure (5.11) indicates that public firms have higher level of oil reserves than both private and joint venture firms. Private firms seem to have the lowest level of oil reserves.

Some respondents commented *"reserves level is a significant indicator for the oil firms nationally and internationally, they are the key indicator of how big the firms are".*

The growth of reserves is also a significant challenge faced by oil companies. This is also influenced by policies as well as resources (Victor, 2007)

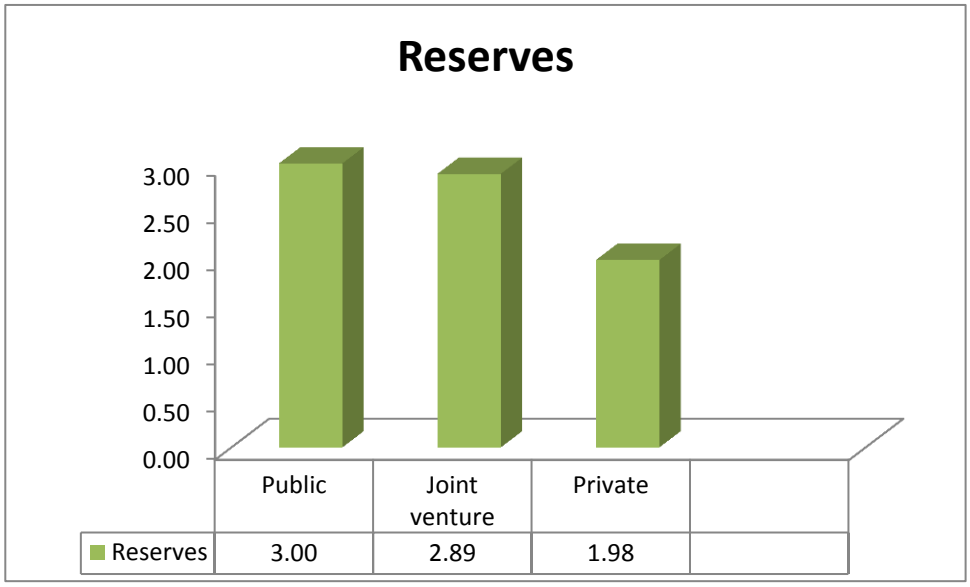


Figure 5.11: Distribution of firms' reserves based on ownership

5.2.5 On technology upgrades

Respondents were asked to give their answers about the companies' technology upgrade rate as an approximate percentage of revenue in the past year, as illustrated on a scale of 1 to 5, representing 0-5%, 6-10%, 11-15%, 16-19%, 20% and over.

Private firms are perceived to have a higher level of oil technology upgrades than both public and joint venture firms, Public firms seem to have the lowest level of technology upgrade, as shown in Figure (5.12).

Technology is an important factor, as recognized in the literature, which has shaped competition in the O & G sector. The management techniques and other processes have been changing continuously in the O & G companies. In order to achieve success, it is important for firms to update technology in order to deal with changing needs (Alleyne, 1980; Asghari, & Rakhshanikia, (2013).

Some respondents stated that *"oil firms should always seek the new technology and increase the budget for staff training, the new researches and development"*.

Others claimed *"private firms have more advanced technology than public companies; that is why they in need for the oil services companies for training, consultations, implementing new technologies"*.

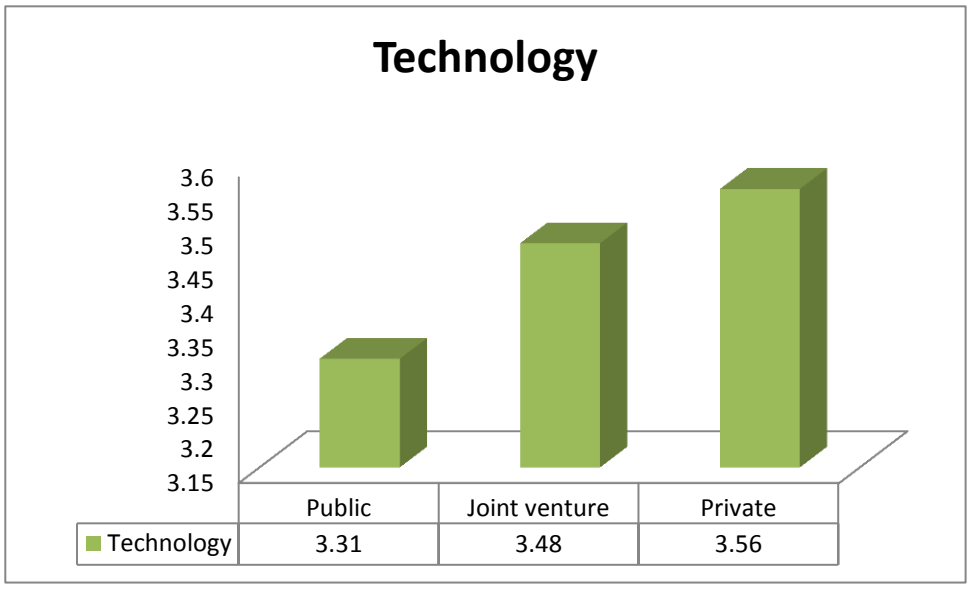


Figure 5.12: Distribution of firms' technology upgrades based on ownership

5.2.6 On health, safety and environment

Respondents were asked to give their answers about how well the health, safety and environment is implemented in the company, as illustrated on a scale of 1 to 5, representing strongly agree, disagree, neither agree nor disagree, agree, strongly agree.

Figure (5.13) shows private firms have higher level of oil HSE than both public and joint venture firms. Public firms seem to have the lowest level of HSE.

Some respondents stated *"Libyan oil firms should make more effort and pay more attention to the HSE, as it is influencing the other operation activities"*.

These findings show that the awareness regarding the importance of health and safety is higher among private and joint venture firms than public organizations.

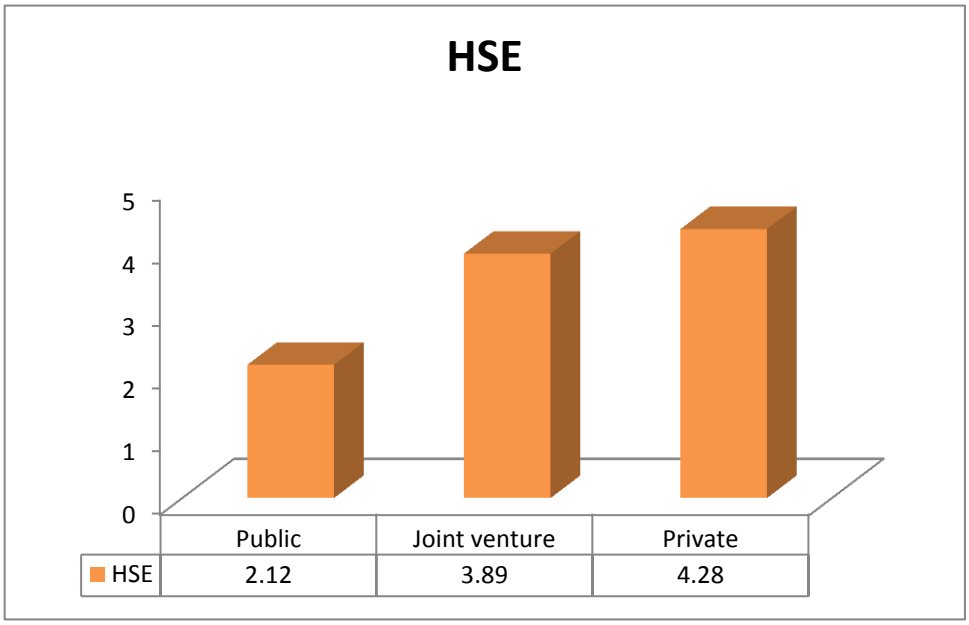


Figure 5.13: Distribution of firms' HSE based on ownership

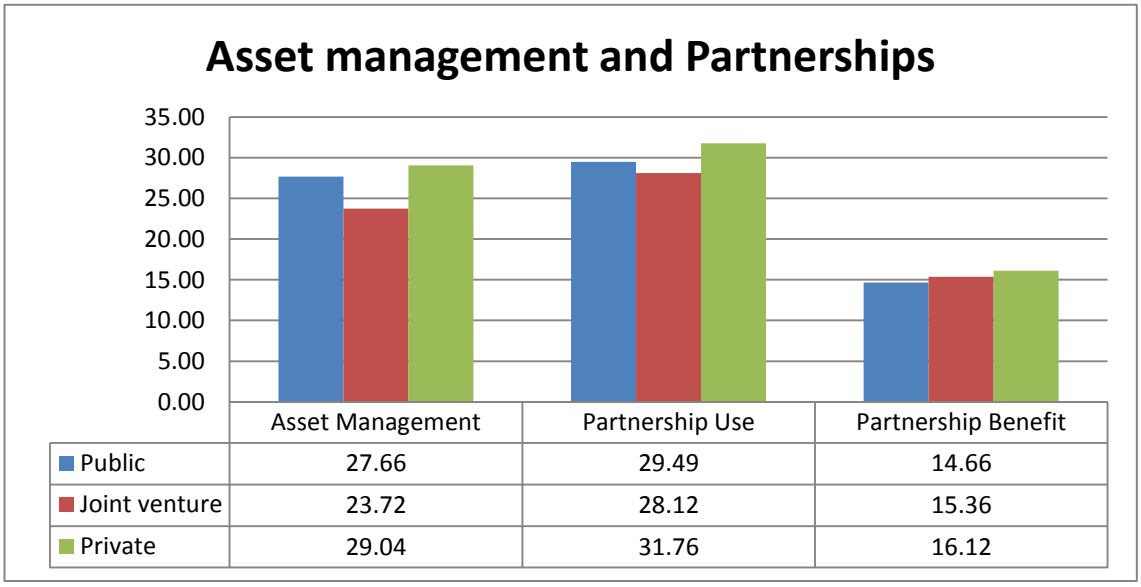
5.2.7 On asset management, partnership use and partnership benefit

Respondents were asked to give their answers about the use of asset management in the company in seven questions based on scales of 1 to 5, which means the overall scale is out of 35. The scale represents: very low, low, average, high, very high. Again respondents were asked to give their answers about the use of partnership in the company in seven questions based on a scale of 1 to 5 (thus the overall scale was out of 35), with the scale representing strongly agree, disagree, neither agree nor disagree, agree and strongly agree.

For the partnership benefit respondents were asked to give their answers in five questions based on scale of 1 to 5 representing: strongly agree, disagree, neither agree nor disagree, agree, strongly agree. The overall scale is out of 25.

Figure (5.14) shows in terms of asset management, private firms have reported to have the highest level then joint venture firms, with public firms last; the same pattern is reflected for partnership use. In terms of partnership benefit, private firms have the highest level then joint ventures and lastly public firms.

Some respondents stated that *"proper asset management is extremely important to increase reserves and to extend the life of the field facilities"*. Another claimed that *"Asset management is a fundamental tool to maintenance cost"*.



	Asset Management	Partnership Use	Partnership Benefit
Public	27.66	29.49	14.66
Joint venture	23.72	28.12	15.36
Private	29.04	31.76	16.12

Figure 5.14: Distribution of firms' asset management, partnerships based on ownership

Some respondents stated *"partnership is very important for technology transfers, adding funding to expand the company activities, and increase reserves as well as provide employment opportunities"*. Others from public and joint venture firms claimed *"firms should use the partners more in improving the human resources and bringing the advanced technologies"*.

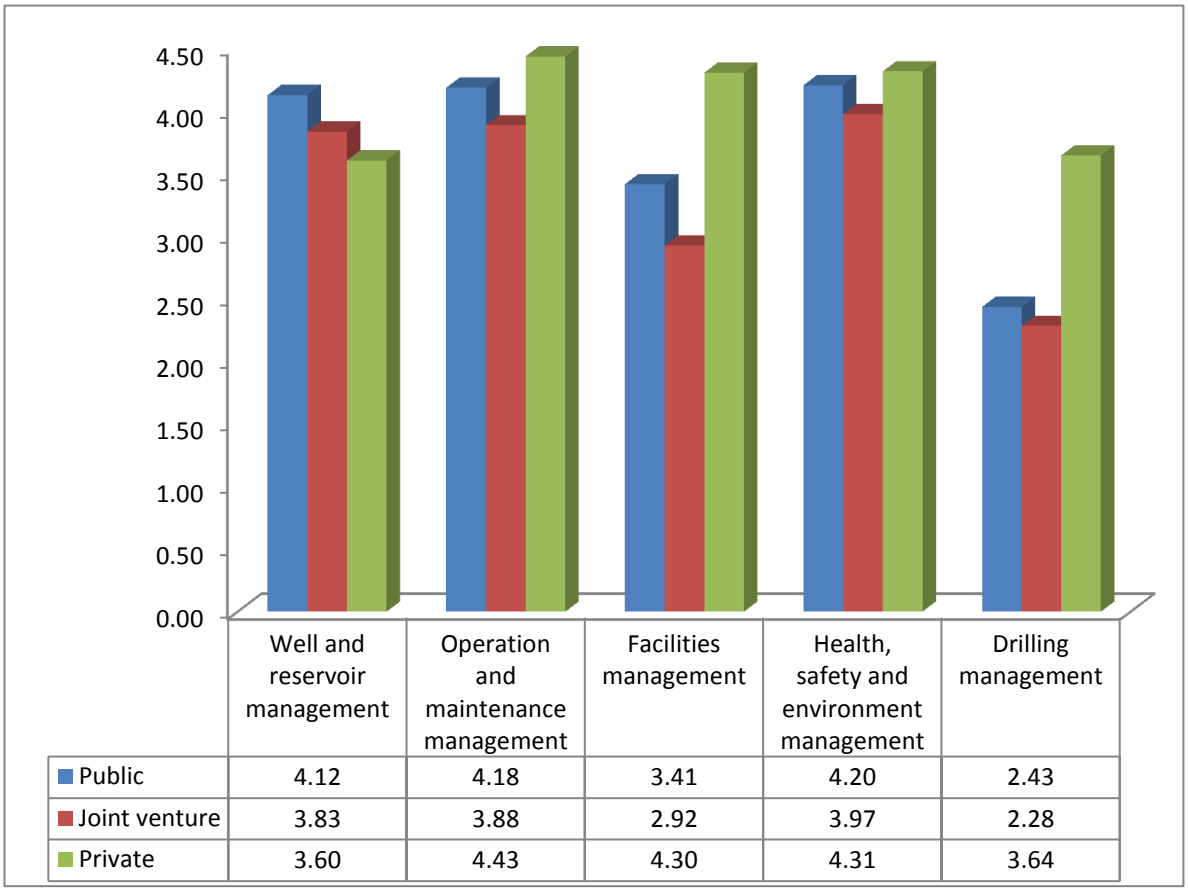
According to these findings, asset management, partnership use, and partnership benefits are higher among private firms. Asset management is lowest in joint venture firms while partnership use is also lowest in joint venture firms. The partnership benefits are higher for private firms because these firms are open to competition. The characteristics of partnership and competition are common to the strategy of private firms.

Some respondents stated *"partners play major role in developing relationships with other firms and helping the company in improving its facilities as well as consultancy in future investments"*. Others claimed *"without partners it would be impossible to operate the field production activities"*.

The responses of respondents indicate the importance of partnership in different areas. The graphs show that partnership use in private companies higher than public and joint venture companies.

Asset management areas priority

The respondents of this study were also asked to express their opinions regarding priority areas in asset management. According to the findings shown in Figure (5.15), private firms give the highest priority to operation and maintenance management. Public and joint venture firms give the highest priority to HSE management. The priority areas for public and joint venture firms include reservoir, operation and maintenance and HSE management. On the other side, the priority areas for private firms are operations and maintenance, facilities and HSE management.



	Well and reservoir management	Operation and maintenance management	Facilities management	Health, safety and environment management	Drilling management
Public	4.12	4.18	3.41	4.20	2.43
Joint venture	3.83	3.88	2.92	3.97	2.28
Private	3.60	4.43	4.30	4.31	3.64

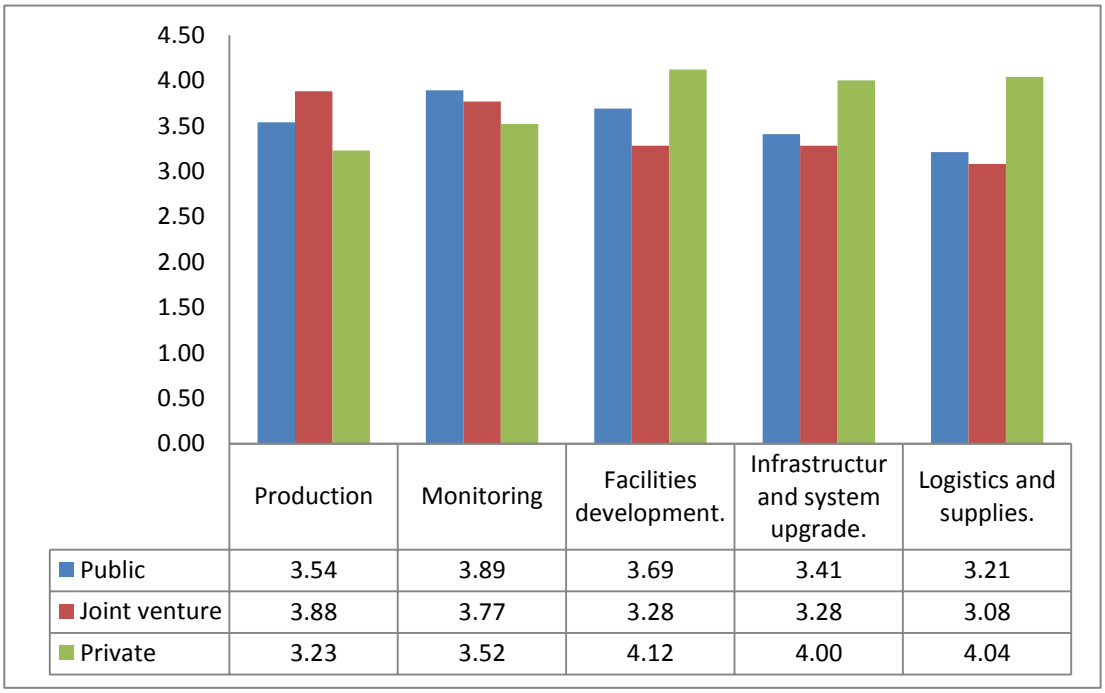
Figure 5.15: Distribution of firms' asset management areas priority based on ownership

The results show that drilling management is an important activity performed by private companies. The private companies in Libya give much higher priority than public and joint

venture companies to this activity. Similarly, facilities management. Health, safety and environment regulations are also important for oil companies as well as operation and maintenance management. The figure shows that there is not much different among public, private and joint-venture firms in these areas. However, the consideration for health, safety, and environment and operation and maintenance management are still higher among private firms than public and joint-venture firms.

The current use of the business partners in the areas of business

The respondents were also asked about the use of current partners in production, monitoring, facilities development, infrastructure, logistics, and other activities. Participants were asked to rate these activities as never, rarely, sometimes, frequently and always.



	Production	Monitoring	Facilities development.	Infrastructur and system upgrade.	Logistics and supplies.
Public	3.54	3.89	3.69	3.41	3.21
Joint venture	3.88	3.77	3.28	3.28	3.08
Private	3.23	3.52	4.12	4.00	4.04

Figure 5.16: Distribution of the current use of the business partners based on ownership

According to the results shown in Figure (5.16), the use of business partners is more likely among private firms than public and joint-venture firms for facilities development, infrastructure and system upgrade, logistics and supplies, and. On the other side, public and joint venture firms rely on partners for the purpose of production and monitoring.

Joint venture firms reported to have more reliance on business partners for production than private and public firms. The reliance on business partners for the purpose of monitoring is high among public firms than private and joint-venture firms.

5.2.8 On firms' performance

Respondents were asked to give their answers about the company performance in 5 questions, as illustrated on a scale of 1 to 5, which means the overall scale is out of 25. The scale for internal performance represents: strongly agree, disagree, neither agree nor disagree, agree, strongly agree and for external performance the scale represents: poor, below average, average, good, very good.

Private firms seem to report to have higher internal and external performance than public and joint venture firms, while joint venture firms look to have better performance than public firms.

According to Figure (5.17), the internal and external performance of private companies is higher than those of public and joint-venture companies. The internal performance of public companies is higher than their external performance. However, internal and external performance of private and joint venture companies is at the same level. These findings suggest that there are differences in the internal and external performance of public companies.

Some respondents stated *"in terms of production and reserves, performance differs from services firms to production firms in other words government policy, OPEC and firms' objectives play major roles in the activities".*

The performance of private and joint venture firms is higher than that of public firms. This indicated that private and joint venture firms in Libya are more efficient than public firms. The public firms need to evaluate their performance and identify factors, which have caused lower performance as compared to their counterparts (Hartley & Medlock, 2013; Tordo et al, 2011; Victor, 2007; Wolf & Pollitt 2008).

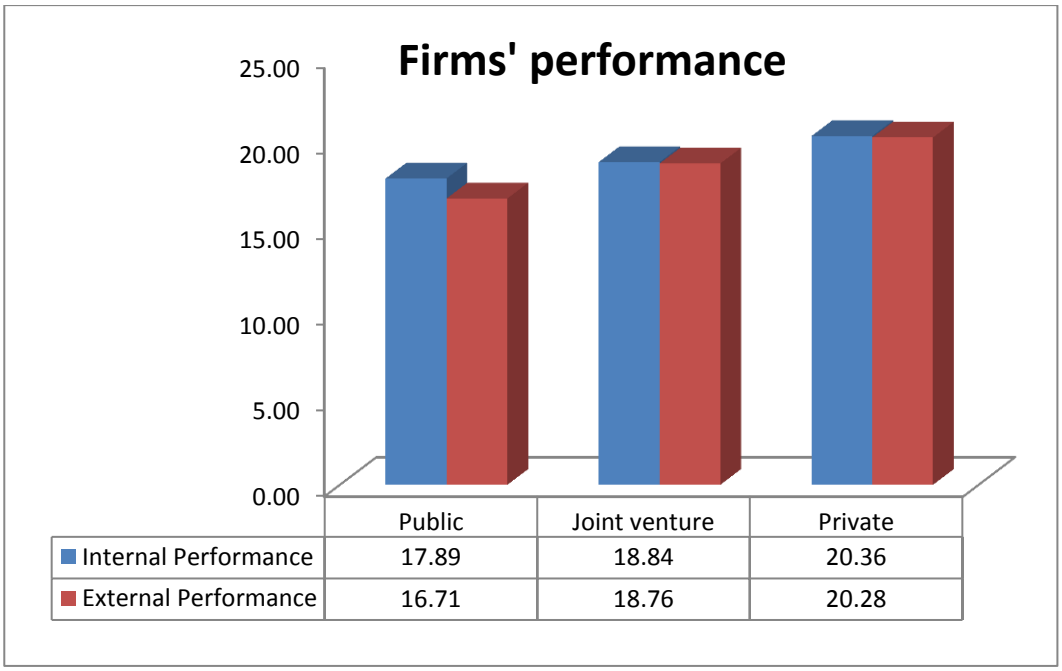


Figure 5.17: Distribution of firms' performance based on ownership

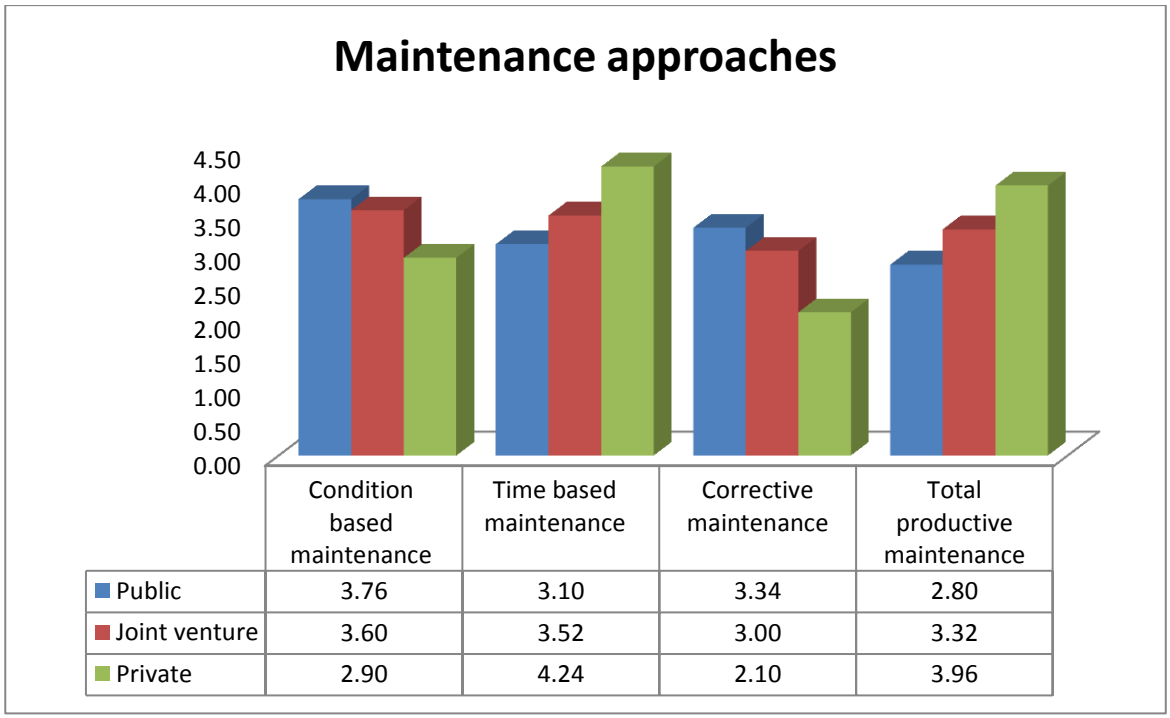
5.2.9 On maintenance

Respondents were asked about the use of the maintenance approaches based on scale 1 to 5, representing never, rarely, sometimes, frequently and always.

The maintenance approaches used by oil companies include time-based and corrective approach. The time based approach is one whereby the aim is to maintain existing machinery even if there is no potential problem. The purpose of time based approach is to prevent future problems and accidents. The corrective maintenance is one where the purpose is to take corrective measures against any problems. In this research, the maintenance approaches of oil firms in Libya were also evaluated.

According to the results shown in Figure (5.18), joint venture firms in Libya use more condition and time based maintenance. On the other side, private firms use total productive maintenance more than other maintenance approaches. Public sector firms rely more on corrective and condition based maintenance than other approaches.

The results indicate that the maintenance approaches of private and joint venture firms are more efficient than those of public firms.



	Condition based maintenance	Time based maintenance	Corrective maintenance	Total productive maintenance
Public	3.76	3.10	3.34	2.80
Joint venture	3.60	3.52	3.00	3.32
Private	2.90	4.24	2.10	3.96

Figure 5.18: Distribution of firms' maintenance approach based on ownership

Maintenance cost

Respondents were asked about the maintenance cost in percentage of the companies' operation expenses per year, as illustrated on a scale of 1 to 5 which represents: 0-10%, 11-19%, 20-29%, 30-39%, 40% and over.

According to Figure (5.19), public firms reported to have higher maintenance cost than joint venture and private firms. Private firms have the lowest maintenance cost comparing to public and joint venture firms. The private firms have shown the minimum cost among other companies, which shows that private companies have control over their cost.

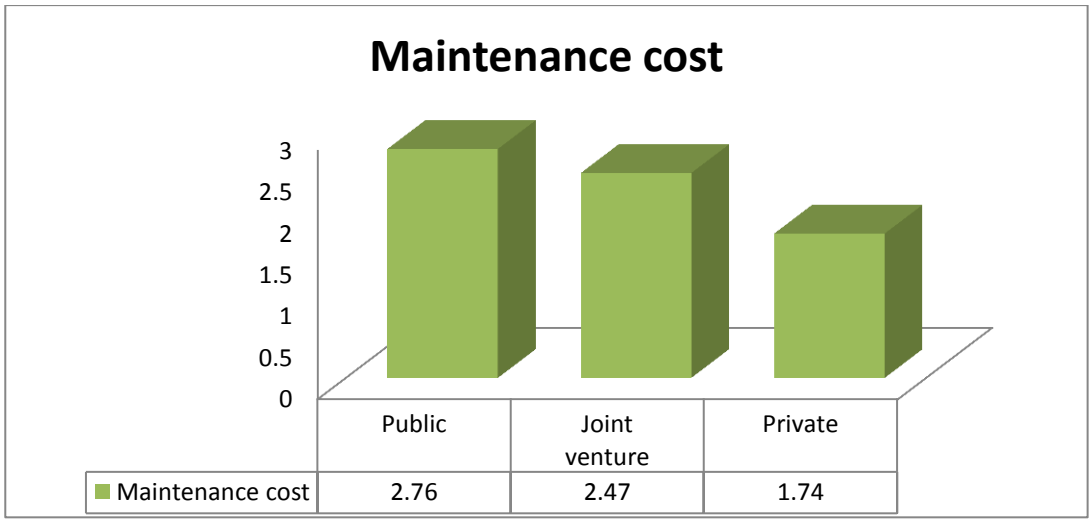


Figure 5.19: Distribution of firms' maintenance cost based on ownership

Some respondents claimed *"there is a strong relationship between types of maintenance and the cost"*. Others said *"using preventive maintenance as the main type of maintenance for the firm is highly important to prolong the duration of the assets"*.

The relationship between maintenance approaches and the cost based on ownership

Figure (5.20) indicates that if firms use time based and total productive maintenance approaches more than condition based and corrective maintenance, their maintenance cost is lower

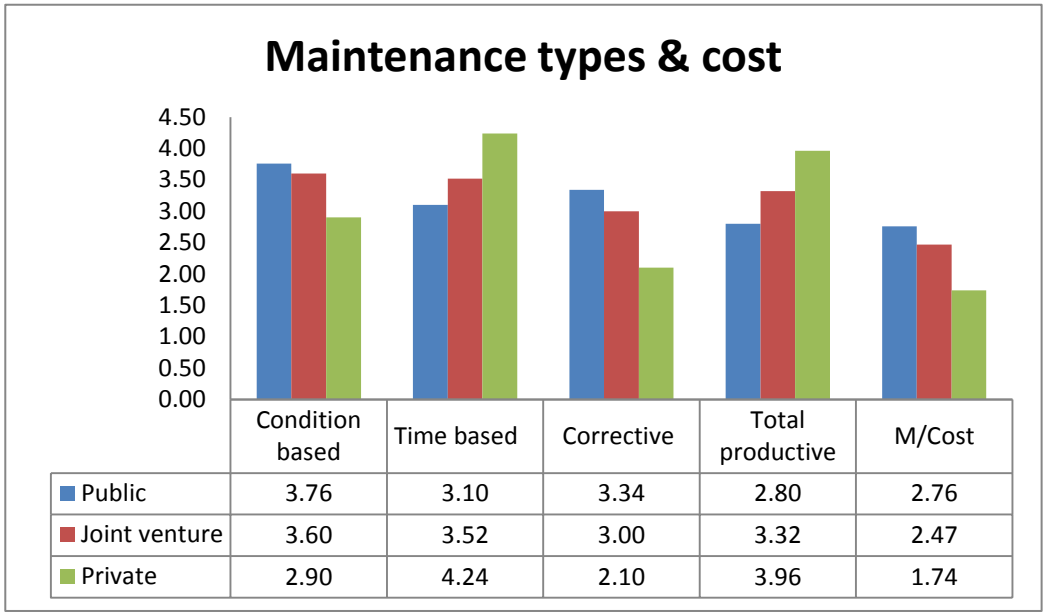


Figure 5.20: Distribution of firms' maintenance approaches & cost based on ownership

The maintenance cost of public firms is higher than that of private and joint venture firms. The public firms in Libya use different maintenance approaches, including condition and time based among others. However, the use of condition based and time based approaches is higher among these firms. The use of these approaches is contributing towards significant costs in public firms; therefore, their maintenance costs are high. Private and joint-venture firms rely heavily on total and time based maintenance. As compared to public and joint-venture firms, private firms have lower maintenance cost.

5.2.10 On measuring KPIs

Respondents were asked about measuring the KPIs in the company based on scale of 1 to 5 representing: weekly, monthly, quarterly, midyear and yearly. Private firms were reported to measure the KPIs more frequently at a much higher level than public and joint venture firms, as shown in Figure (5.21).

The use of KPIs is reported as effective in achieving desired results. Firms that utilize KPIs are more efficient than firms that do not use. The findings of the study suggest that in Libya, the use of KPIs is higher among private and joint venture firms than public firms.

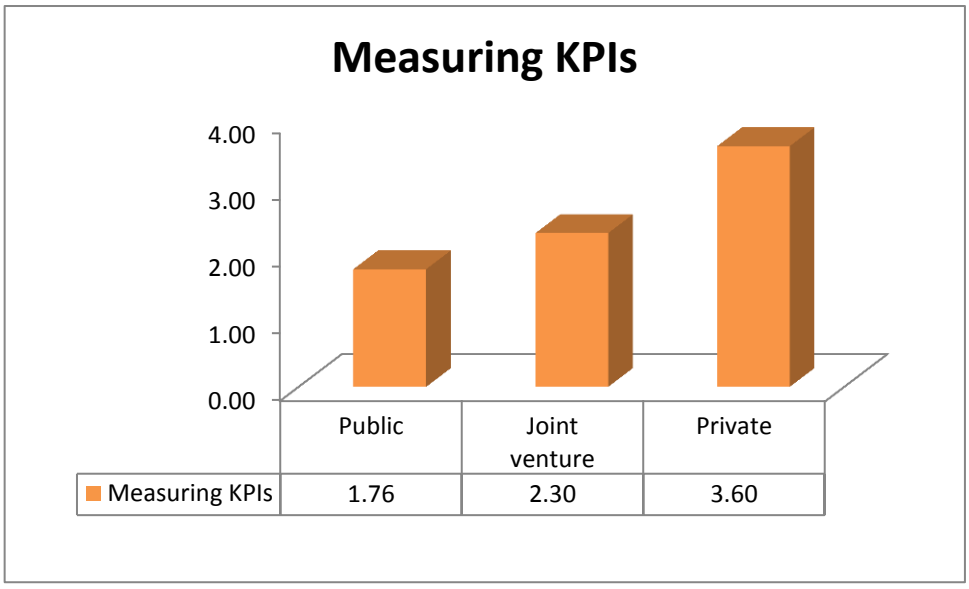
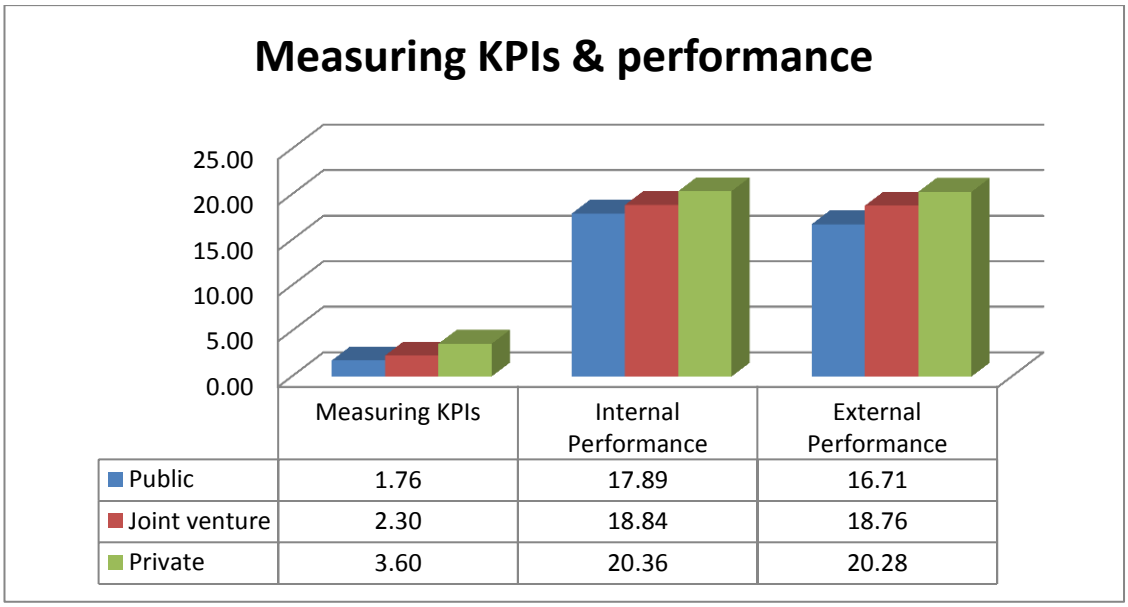


Figure 5.21: Distribution of firms' measuring KPIs based on ownership

5.2.11 The relationship between measuring the KPIs and the firms' performance

According to the Figure (5.22), the use of KPIs contributes towards superior performance of firms.



	Measuring KPIs	Internal Performance	External Performance
Public	1.76	17.89	16.71
Joint venture	2.30	18.84	18.76
Private	3.60	20.36	20.28

Figure 5.22: Distribution of firms' measuring KPIs & performance based on ownership

The use of KPIs is reported as higher among private firms than public and joint venture companies. Therefore, private firms have higher internal and external performance in Libya. Furthermore, the use of KPIs is lowest in public companies, which is associated with their lower performance. The performance of public firms is lower than that of private and joint-venture firms.

5.2.12 On the use of oil services companies

The O & G companies are involved in the process of exploration, production, extraction and transportation. The high risks and challenges have made it imperative that NOCs rely on oilfield service companies. Oilfield service companies are those specialized in drilling and other services (Ghandi & Lin, 2014).

Respondents were asked to choose five services that oil services companies provide them with. Figure (5.23) shows that firm use the oil services company in different activities, these activities differ from public to joint venture as well as to private firms. Respondents were asked to rank the main 5 services that oil services companies used for. Table 5.2 summarizes these activities based on ownership type.

Table 5.2: The main five services that oil services companies used for

Public firms	*Joint venture firms*	*Private firms*
equipment	drilling	transport of crude O & G
exploration	equipment	product and technology innovation
drilling	implementing new technology	train and develop technical people
oil condition monitoring	consultations	knowledge management
train and develop technical people	exploration	infrastructure

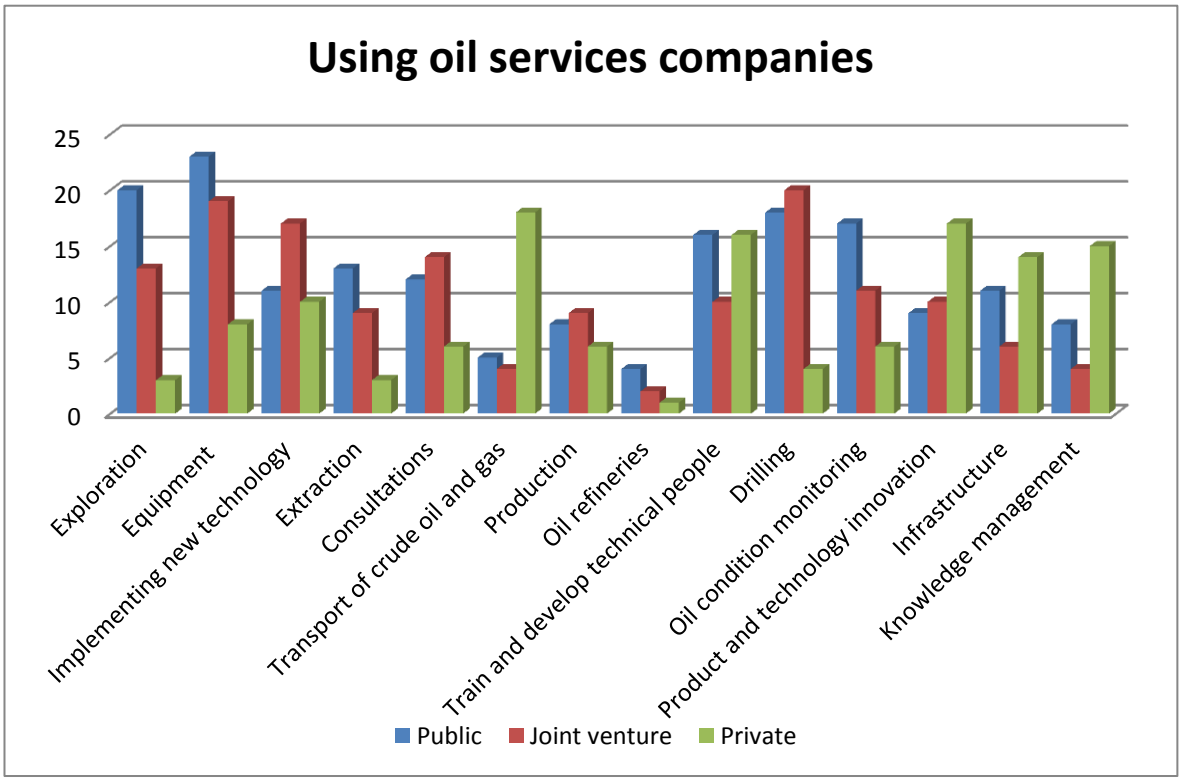


Figure 5.23: The use of oil services companies based on ownership

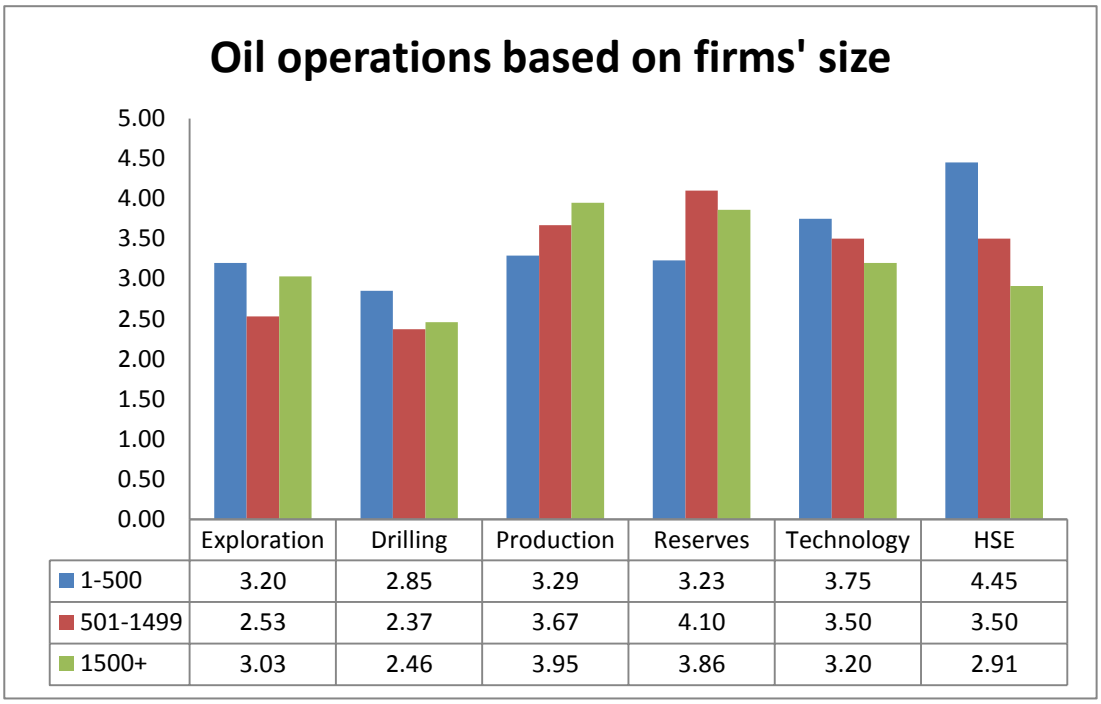
5.3 The Effect of Firms' Size on the Study Factors

5.3.1 On oil operations

In terms of oil exploration and drilling, small firms seem to have higher levels of exploration than medium and large firms. Large firms have the highest level of production and medium firms are higher than small firms in terms of production. In terms of reserves medium firms seem to have the highest level of reserves. Small firms are better in terms of technology upgrades and HSE, as shown in Figure (5.24).

The production rate of large companies is highest. This is because the large oil companies are mostly public firms. The reserves of medium-sized firms are higher than those of small

and large firms. The technology upgrades and health and safety implementation are higher among small sized firms, which indicates that these firms spend a significant portion of income on technology upgrades and health and safety (Tordo et al, 2011).

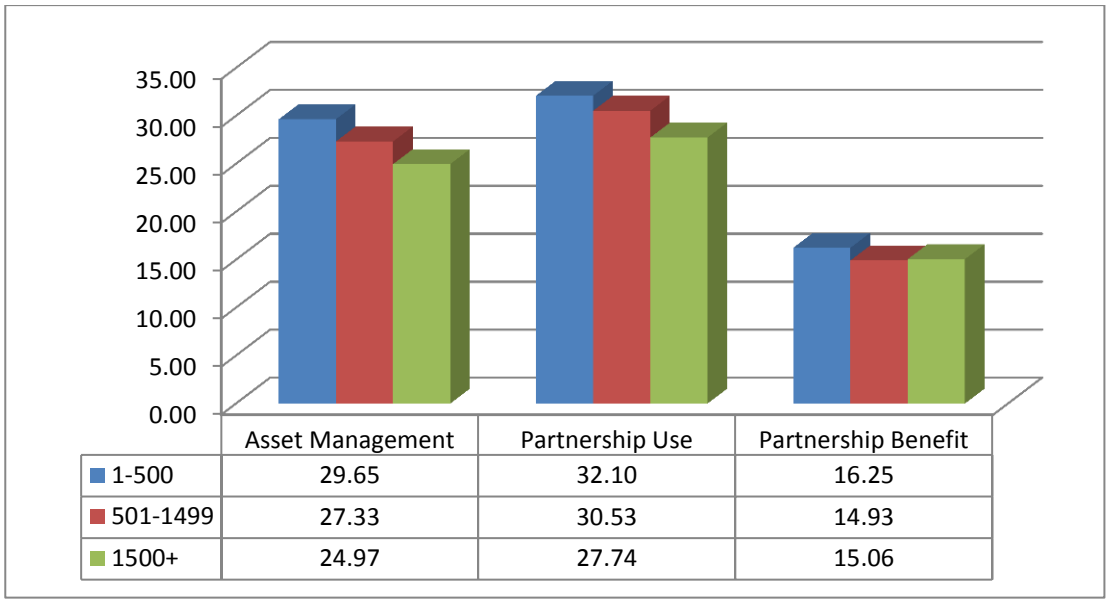


	Exploration	Drilling	Production	Reserves	Technology	HSE
1-500	3.20	2.85	3.29	3.23	3.75	4.45
501-1499	2.53	2.37	3.67	4.10	3.50	3.50
1500+	3.03	2.46	3.95	3.86	3.20	2.91

Figure 5.24: Distribution of firms' oil operations based on size

5.3.2 On asset management and partnerships

According to Figure (5.25), small firms seem to have higher level of asset management and partnership use than medium and large firms. In terms of partnership benefit, medium and large firms are nearly at the same level however small firms are at a higher level than both.

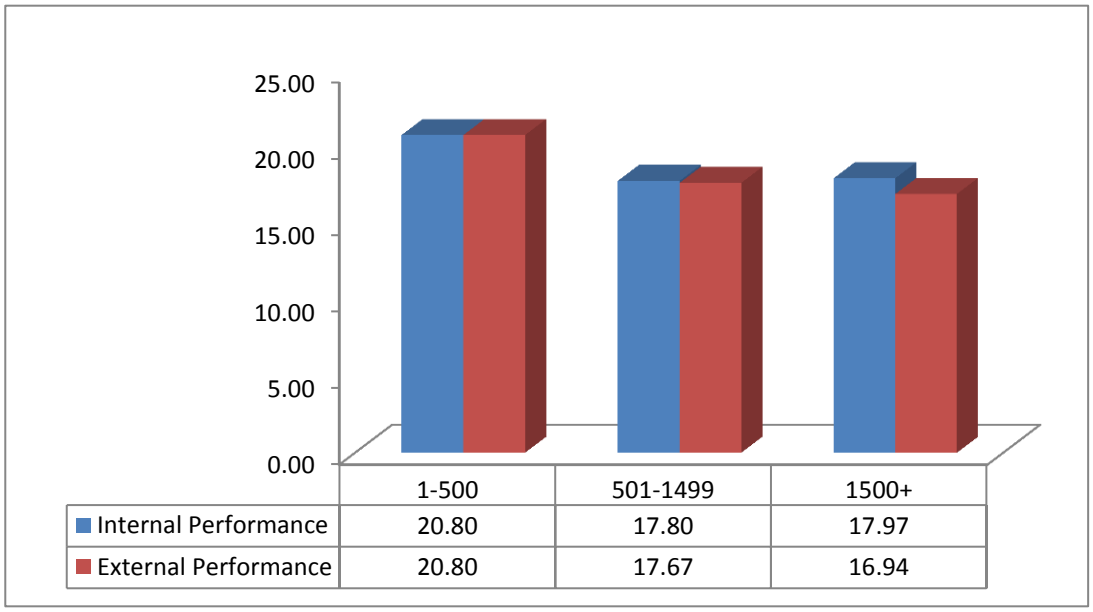


	Asset Management	Partnership Use	Partnership Benefit
1-500	29.65	32.10	16.25
501-1499	27.33	30.53	14.93
1500+	24.97	27.74	15.06

Figure 5.25: Distribution of firms' asset management and partnerships based on size

5.3.3 On firms' performance

Figure (5.26) indicates that small firms have the highest performance, medium firms are slightly higher external performance than large firms however in terms of internal performance are nearly at the same level.



	1-500	501-1499	1500+
Internal Performance	20.80	17.80	17.97
External Performance	20.80	17.67	16.94

Figure 5.26: Distribution of firms' performance based on size

5.4 Analysis of Variance (ANOVA)

ANOVA test is conducted in order to identify differences in mean of different independent groups such as ownership type, company size and scope of operation on oil operations and firms' performance. The result tables of the ANOVA test are included in the Appendix A.

5.4.1 Ownership type

In this study, ANOVA was performed on the basis of ownership of companies. Three types of companies were targeted including public, private, and joint venture. The test was conducted to determine whether ownership type of the company has caused difference in study variables or not.

Influence of companies' ownership type on oil exploration

In order to determine the effect of ownership type on exploration, comparison was conducted. The mean of different groups was compared in order to identify differences in the mean of three groups including public companies, private companies, and joint-venture companies.

Table 5.3: Descriptive data of company exploration

	N	*Mean*	*Std. Deviation*	*Std. Error*	*95% Confidence Interval for Mean*		*Minimum*	*Maximum*
					Lower Bound	*Upper Bound*		
Public	35	2.09	.951	.161	1.76	2.41	1	4
Joint venture	25	3.36	1.150	.230	2.89	3.83	1	5
Private	25	3.56	.917	.183	3.18	3.94	1	5
Total	85	2.89	1.205	.131	2.63	3.15	1	5

The number of public companies in this study is 7, joint venture companies is 5 while private companies is 5. The results show that there are differences in the mean of companies. Therefore, it can be agreed that the oil exploration activities of companies differ on the basis of ownership type.

Table 5.4: ANOVA test comparing the mean of public, private and joint venture

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	39.384	2	19.692	19.534	.000
Within Groups	82.663	82	1.008		
Total	122.047	84			

Table (5.3) indicates that the exploration mean level for public companies is 2%, compared to 3.36% and 3.56% for joint venture and private companies. Table (5.4) confirms that there is a statistically significant difference at the p<.05 level in company exploration activities scores for the three groups.

In Table (5.5) post-hoc comparisons have been presented using the Tukey HSD test. The results show that there are significant differences at p<.05 level between public and private companies as well as between public and joint venture companies. The mean score for public companies (M=2.09, SD=.951) was significantly different from joint venture (M=3.36, SD=1.150) and private companies (M=3.56, SD=.917), but there was no significant difference found between joint venture and private companies in oil exploration.

According to these results, there are differences in oil exploration activities in public and joint venture and public and private companies. However, the oil exploration companies of private and joint venture companies are not much different.

Table 5.5: Multiple comparisons, Tukey HSD (exploration)

(I) Type of ownership	*(J) Type of ownership*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
					Lower Bound	*Upper Bound*
Public	Joint venture	-1.274*	.263	.000	-1.90	-.65
	Private	-1.474*	.263	.000	-2.10	-.85
Joint venture	Public	1.274*	.263	.000	.65	1.90
	Private	-.200	.284	.762	-.88	.48
Private	Public	1.474*	.263	.000	.85	2.10
	Joint venture	.200	.284	.762	-.48	.88

*. The mean difference is significant at the 0.05 level.

Influence of companies' ownership type on oil drilling

The difference between public, private and joint venture companies was also determined on the basis of oil drilling activity. The differences were identified by comparing mean. The drilling mean level for public companies is 2.26%, joint venture companies are 2.40%, and private companies is 3%. There is a statistically significant difference in company drilling activities scores for the three groups.

According to these results, the companies studied in this research also differ on the basis of oil drilling activities. A significant difference was only found between public and private

companies. Mean score for public companies (M=2.26, SD=.950) was significantly different from private company (M=3.00, SD=.816). Joint venture did not differ significantly different from either public or private.

The differences in oil drilling companies are higher between public and private companies. However, there are not differences between public and joint venture and joint venture and private companies.

Influence of companies' ownership type on oil production

The comparison was also conducted to identify the effect of ownership type on oil production activity. The comparison was done by comparing means of public, private, and joint-venture companies.

The production mean level for public companies is 2.43%, compared to 2.40% and 2.92% for joint venture and private companies. There is no statistically significant difference in company production activities scores for the three groups.

According to these results, public, private, and joint-venture companies do not differ significantly in terms of production activities.

Influence of companies' ownership type on oil reserves

The comparison was conducted to identify the effect of ownership type on oil reserves activity. The comparison was done by comparing means of public, private, and joint-venture companies.

The reserves mean level for public companies is 2.89%, compared to 2.04% and 3% for joint venture and private companies. There is a statistically significant difference in company reserves activities scores for the three groups.

The results show that there is a significant difference between two groups, public and private also joint venture and private companies. Mean score for public companies (M=3.0, SD=.866) was significantly different from private companies (M=2.04, SD=.841), and joint venture (M=2.89, SD=1.451) was significantly different from private.

According to these results, public, private, and joint venture companies differ significantly in terms of oil reserves activities.

Influence of companies' ownership type on oil technology

The comparison was also conducted to identify the effect of ownership type on oil technology activity. The comparison was done by comparing means of public, private and joint-venture companies.

The technology mean level for public companies is 3.31%, compared to 3.48% and 3.56% for joint venture and private companies. There is no statistically significant difference in company technology scores for the three groups.

According to these results, the ownership type of a company does not affect its use of oil technology. The use of oil technology is common among public, private, and joint venture companies.

Influence of companies' ownership type on oil health, safety and environment

The comparison was also conducted to identify the effect of ownership type on oil health, safety, and environment. The comparison was done by comparing means of public, private, and joint-venture companies.

The HSE mean level for public companies is 3.89%, compared to 2.12% and 4.28% for joint venture and private companies. There is a statistically significant difference in company HSE activities scores for the three groups.

According to the results, there is a significant difference between two groups, public and joint venture also joint venture and private companies. The mean score for public companies (M=2.12, SD=.666) was significantly different from joint venture companies (M=3.89, SD=.676) and public was significantly different from private (M=4.28, SD=.891).

According to these results, consideration of health, safety, and environment differs on the basis of ownership type. These findings are consistent with previous findings, which also show that private and joint venture companies are more concerned about health, safety, and environment than public companies. The results of HSD table also show that health, safety and environment consideration was different between joint venture and public companies as well as public and private companies.

Influence of companies' ownership type on asset management

The comparison was also conducted to identify the effect of ownership type on the companies' asset management. The comparison was done by comparing means of public, private, and joint-venture companies.

The asset management mean level for public companies is 27.65%, compared to 23.72% and 29.04% for joint venture and private companies. There is a statistically significant difference in company asset management scores for the three groups.

There is a significant difference between two groups, public and joint venture also between joint venture and private companies. The mean score for public companies (M=27.65, SD=3.42) was significantly different from joint venture companies (M=23.72, SD=3.42), and joint venture was significantly different from private (M=29.04, SD=2.89).

According to the results, it can be comprehended that there are significant differences between public, private and joint venture companies in terms of asset management. The use of asset management activities is different among all these firms. These findings are consistent with the previous findings, which show that the use of asset management is highest among private companies.

Influence of companies' ownership type on partnership use

The comparison was also conducted to identify the effect of ownership type on partnership use. The comparison was done by comparing means of public, private, and joint-venture companies.

The partnership use mean level for public companies is 29.48%, compared to 28.12% and 31.76% for joint venture and private companies. There is a statistically significant difference in company partnership use activities scores for the three groups.

According to the results, there is a significant difference between joint venture and private companies. The mean score for joint venture companies (M=28.12, SD=6.09) was significantly different from private companies (M=23.72, SD=3.42) and joint venture was significantly different from private (M=31.76, SD=3.12).

These findings show that public, private and joint-venture companies also differ on the basis of partnership use. These findings are consistent with the previous results, which showed that asset management and partnership use are higher among private firms. The partnership use is higher for private firms because these firms are open to competition. The characteristics of partnership and competition are common to the strategy of private firms.

Influence of companies' ownership type on partnership benefit

The comparison was also conducted to identify the effect of ownership type on partnership benefit. The comparison was done by comparing means of public, private and joint-venture companies.

The partnership benefit mean level for public companies is 14.65%, compared to 15.36% and 16.12% for joint venture and private companies. There is no statistically significant difference in company partnership benefit activities scores for the three groups.

According to the results, there are no significant differences among public, private and joint-venture companies in terms of partnership benefit. According to previous findings, partnership benefits are higher for private firms than public and joint-venture firms. This shows that although there are differences between firms but those differences are not statistically significant.

Influence of companies' ownership type on the company internal performance outcomes

The comparison was also conducted to identify the effect of ownership type on internal performance. The comparison was done by comparing means of public, private and joint-venture companies.

The internal performance outcomes mean level for public companies is 17.88%, compared to 18.84% and 20.36% for joint venture and private companies. There is a statistically significant difference in company internal performance outcome scores for the three groups.

There is a significant difference between public and private companies. The mean score for public companies (M=17.88, SD=3.40) was significantly different from private companies (M=20.36, SD=2.07). Joint-venture companies did not differ significantly from either public or private.

According to the results, public, private, and joint-venture companies differ on the basis of internal performance. However, performance differences were higher between public and private firms than between joint venture, public, and private firms. The previous results have also indicated differences in the internal performance of public, private, and joint-venture firms.

Influence of companies' ownership type on the company external performance outcomes

The comparison was also conducted to identify the effect of ownership type on external performance outcomes. The comparison was done by comparing means of public, private, and joint-venture companies.

The internal performance outcomes mean level for public companies is 16.71%, compared to 18.76% and 20.28% for joint venture and private companies. There is a statistically significant difference in company external performance outcome scores for the three groups.

A significant difference was found only between public and private companies. The mean score for public companies (M=16.71, SD=4.09) was significantly different from private companies (M=20.28, SD=2.86), while joint venture companies did not differ significantly from either public or private.

According to the results, public, private and joint-venture companies differ significantly in terms of external performance. These findings are consistent with previous findings, which show that private firms have higher internal and external performance than public and joint venture firms. Joint venture firms seem to have better performance than public firms.

5.4.2 Companies' size

In this study, ANOVA was performed on the basis of companies' size. Three types of companies were targeted: small, medium and large companies. The test was conducted to determine whether size of the company has caused difference in study variables or not.

The data was grouped based on company size. Small companies are defined as having 500 employees or less, medium 501 to 1499 employees and large companies have 1500 employees or more.

Influence of companies' size on the oil operations

ANOVA was conducted to explore the impact of companies' size (small, medium, and large) on oil operations by comparing the means of the three groups and report the significance of their differences.

The oil operations (exploration, drilling, production, reserves, technology and HSE) mean level for small, medium and large companies.

There is a statistically significant difference in the company production and HSE scores for the three groups, however there is no statistically significant difference in company exploration, drilling, reserves and technology scores for the three groups.

A significant difference was found in production only between small and large companies. Mean score for small companies (M=3.95, SD=.759) was significantly different from large companies (M=3.29, SD=.789), In terms of HSE a significant difference was found between small and medium companies as well as between small and large.

These findings show that the oil operations of small companies are different from those of large companies just in terms of level of production and HSE, the rest of oil operations are similar regardless of their size.

Influence of companies' size on asset management, partnership use and partnership benefit

The comparison was also conducted to identify the effect of company size on the asset management, partnership use and benefit. The comparison was done by comparing means of small, medium and large organizations.

The asset management and partnership use means level for small, medium and large companies. There is a statistically significant difference in the company asset management and partnership use scores for the three groups however there is no statistically significant difference in partnership benefit scores for the three groups.

According to the results, there are significant differences between firms of different sizes in terms of asset management. The mean score of large companies was significantly different from that of small organizations. The difference was also found between medium and large organizations. The mean score for large companies is (M=24.97, SD=3.83) while

that of small companies is (M=29.95, SD=2.207). The mean score for medium sized companies is (M=27.33, SD=3.67), In terms of Partnership use a significant difference was found between small and large companies as well as between medium and large.

These findings show that company size has an effect on asset management and partnership use, between small, medium, and large organizations. The use of partnership and asset management differs among companies of different sizes.

Influence of companies' size on the company' performance

The comparison was also conducted to identify the effect of company size on company performance. The comparison was done by comparing means of small, medium, and large organizations**.**

The internal and external performance outcomes mean level for small, medium and large companies. There is a statistically significant difference in the company internal and external performance outcomes scores for the three groups.

The performance of small, medium, and large organizations is significantly different. These findings are consistent with previous findings, which have revealed that the performance of small, medium, and large organizations differs significantly.

According to the results, there are significant differences between small and medium sized companies as well as between large and small companies in terms of internal performance outcomes. The mean score for small companies is (M=20.80, SD=1.85) while or medium companies is companies (M=17,80 SD=3.89). The mean score for large companies is (M=17.97, SD=3.00).

The differences were also found in terms of external performance outcomes. There were differences between small and medium companies and small and large companies. The mean score for small companies was (M=20.80, SD=2.89), for medium companies it was (M=17.66, SD=4.57) and for large companies it was (M=16.94, SD=3.67).

According to these results, the performance outcomes of companies differ on the basis of their size. These findings are consistent with previous findings, which say that small firms have the highest performance; medium firms are slightly higher external performance than large firms however in terms of internal performance are nearly at the same level.

5.4.3 Influence of companies' department on the performance outcomes

As mentioned in the previous chapter, the study was mainly conducted among five different departments (management, planning engineering department, general services administration, operation management and financial management), therefore the data was grouped based on departments to five different groups. The comparison was also conducted to identify the effect of company department on performance outcomes. The comparison was done by comparing the means of the five groups and reports the significance of their differences.

There is no a statistically significant difference in the company internal and external performance outcomes scores for the five groups of the respondent work department.

According to the findings, the internal and external performance does not differ between different departments. It can be comprehended from these findings that the performance of companies across different departments is consistent. If a company performs well, its performance is consistent across different departments.

5.4.4 Influence of the respondents' position on the performance outcomes

The study focused on different job positions and data was grouped based on job position to general managers, corporate planning managers, logistical and services managers, operation managers and financial managers.

ANOVA was conducted to identify the effect of respondent position on the performance of companies. The mean of five groups was compared to identify differences. There is no a statistically significant difference in the company internal and external performance outcomes scores for the five groups of the respondent work position.

According to the results, the internal and external performance outcomes do not differ much on the basis of different groups of employees. These results suggest that the position of respondent has no effect on performance outcome in an organization.

5.4.5 Influence of the respondents' work experience on the performance outcomes

As mentioned previously, data was split into 3 groups based on number of working years in the O & G industry. The first group of respondents had between 5 to 9 years'

experience, the second group 10 to 19 and the last group that had 20 to 40 years' work experience.

By using ANOVA, the mean of different groups was compared in order to identify differences in performance outcomes on the basis of working experience. There is no a statistically significant difference in the company internal and external performance outcomes scores for the three groups of the work experience.

The results show that the work experience does not have an effect on performance outcomes. The performance of companies does not depend on the years of working experience their personnel have.

5.4.6 Influence of the respondents' qualifications on the performance outcomes

The effect of employees' qualifications on performance outcomes was also identified in this research. As mentioned previously, data was split into four groups based on the respondents' highest qualification. The first group of respondents have PhDs, the second group have MScs, the third group have BSc and the last group have high school diplomas.

ANOVA was conducted to explore the impact of respondent highest qualification on the company performance by comparing the means of the three groups and report the significance of their differences. There is no a statistically significant difference in the company internal and external performance outcomes scores for the four groups of qualifications.

According to the results, the education of employees has no effect on the performance outcomes. Therefore, the performance of oil companies does not depend on the educational level of employees.

5.4.7 Influence of measuring KPIs on the performance outcomes

The study used a five-point scale to measure KPIs where 1=weekly, 2=monthly, 3=quarterly, 4=midyear and 5=yearly. ANOVA was conducted to explore the impact of measuring the KPIs on the company performance by comparing the means of the five groups and report the significance of their differences.

The internal and external performance outcomes mean level for all measurement levels of KPIs. There is a statistically significant difference in the company internal and external performance outcomes scores for the five groups.

The study also aimed to determine KPIs for companies. The internal and external outcomes were assessed on the basis of weekly, monthly, quarterly, midyear and yearly performance. The mean scores show that there are differences in performance outcomes in different groups.

A significant difference was found in internal performance outcomes between all groups except one, which is weekly and monthly. Only the mean scores of measuring KPIs weekly was not significantly different from the mean of measuring KPIs monthly.

For external performance, a significant difference was found between measuring weekly and quarterly, midyear, yearly, and also between measuring monthly and quarterly, midyear and yearly, as well as between measuring quarterly and yearly. No significant difference was found between the groups of weekly and monthly, quarterly and midyear, and midyear and yearly.

5.5 Independent T-Test

An independent-samples t-test was conducted to compare the mean scores for the two groups and report the significance of their differences (Pallant, 2011). The result tables of this test are included in Appendix B.

5.5.1 Influence of companies' scope of operation on the internal performance outcomes

The data was grouped based on company country of operations. Group one includes the companies that operate exclusively in Libya, while the second group are companies that operate internationally. The results of independent t-test between the mean internal performance outcomes of companies operate locally and internationally. A significant difference was detected, indicating that there is a significant difference in terms of internal outcomes between companies operates locally and internationally. These results show that the performance of companies differs on the basis of scope of operation. The findings also suggest that the performance of a company is influenced by its country of origin.

5.5.2 Influence of companies' scope of operation on the external performance outcomes

The results of independent t-test between the mean of external performance outcomes for companies operate locally and internationally. A significant difference was detected, which indicates that there is a significant difference in terms of external outcomes between companies operating locally and internationally.

The external performance outcomes of companies differ on the basis of scope of operations. The external performance of oil companies in Libya differ on the basis of their scope of operations. The external performance outcomes of local companies are different from those of foreign companies.

A number of T-tests and ANOVA tests were conducted as explained in this chapter. Table (5.6) summarizes the results for all tests in this section.

Table 5.6: Summary for the results of this section tests

Test	*Grouping criteria*	*Dependent variable (s)*	*Level of significance (p)*	*Interpretation*
Independent t-test	Company scope of operation: Locally internationally	Internal performance outcomes	Significant ($p<0.05$)	A difference was detected between companies operate locally and internationally
Independent t-test	Company scope of operation: Locally internationally	External performance outcomes	Significant ($p<0.05$)	A difference was detected between companies operate locally and internationally
ANOVA	Ownership type public- joint venture- private	Exploration	Significant ($p<0.05$)	A difference was detected for public against both firms
ANOVA	Ownership type public- joint venture- private	Drilling	Significant ($p<0.05$)	A difference was detected only between public and private
ANOVA	Ownership type public- joint venture- private	Production	Not Significant ($p>0.05$)	No difference was detected
ANOVA	Ownership type public- joint venture- private	Resaves	Significant ($p<0.05$)	A difference was detected between public and private. JV and private firms
ANOVA	Ownership type public- joint venture- private	Technology	Not Significant ($p>0.05$)	No difference was detected

Test	*Grouping criteria*	*Dependent variable (s)*	*Level of significance (p)*	*Interpretation*
ANOVA	Ownership type public-joint venture-private	HSE	Significant ($p<0.05$)	A difference was detected for public against both firms
ANOVA	Ownership type public-joint venture-private	Asset management	Significant ($p<0.05$)	A difference was detected for JV against both firms
ANOVA	Ownership type public-joint venture-private	Partnership use	Significant ($p<0.05$)	A difference was detected only between JV and private firms
ANOVA	Ownership type public-joint venture-private	Partnership benefit	Not Significant ($p>0.05$)	No difference was detected
ANOVA	Ownership type public-joint venture-private	Internal outcomes	Significant ($p<0.05$)	A difference was detected only between public and private firms
ANOVA	Ownership type public-joint venture-private	External outcomes	Significant ($p<0.05$)	A difference was detected only between public and private firms
ANOVA	Company size small-medium-large	Exploration	Not Significant ($p>0.05$)	No difference was detected
ANOVA	Company size small-medium-large	Drilling	Not Significant ($p>0.05$)	No difference was detected
ANOVA	Company size small-medium-large	Production	Significant ($p<0.05$)	A difference was detected only between small and large firms
ANOVA	Company size small-medium-large	Reserves	Not Significant ($p>0.05$)	No difference was detected
ANOVA	Company size small-medium-large	Technology	Not Significant ($p>0.05$)	No difference was detected
ANOVA	Company size small-medium-large	HSE	Significant ($p<0.05$)	A difference was detected for small against both firms
ANOVA	Company size small-medium-large	Asset management	Significant ($p<0.05$)	A difference was detected for large against both firms
ANOVA	Company size small-medium-large	Partnership use	Significant ($p<0.05$)	A difference was detected for large against both firms
ANOVA	Company size	Partnership	Not Significant	No difference was

Test	*Grouping criteria*	*Dependent variable (s)*	*Level of significance (p)*	*Interpretation*
	small-medium-large	benefit	(p>0.05)	detected
ANOVA	Company size small-medium-large	Internal performance outcomes	Significant (p<0.05)	A difference was detected for small against both firms
ANOVA	Company size small-medium-large	External performance outcomes	Significant (p<0.05)	A difference was detected for small against both firms
ANOVA	Measuring KPIs Weekly-monthly-quarterly-midyear-yearly	Internal performance outcomes	Significant (p<0.05)	A difference was detected between weekly and (quarterly, midyear, yearly)
ANOVA	Measuring KPIs Weekly-monthly-quarterly-midyear-yearly	External performance outcomes	Significant (p<0.05)	A difference was detected between weekly and (quarterly, midyear, yearly)/between monthly and (quarterly, midyear, yearly)/between quarterly and yearly

5.6 Chapter Summary

This chapter investigated the respondents' profile in terms of their work experience, educational level, department and position. Further, it investigated the firms' characteristics such as: objectives, asset management, maintenance approaches and operations. The findings showed a significant differences between public, joint venture and private companies in Libya in terms of oil operations and firm' performance.

Furthermore, the influence of ownership, company size, scope of operations, respondents work experience, respondents qualifications and respondents departments on the model factors were examined using t-test and one-way ANOVA test to discover the differences between the groups, the findings showed a significant influence of ownership, size and scope of operation on the model factors however no influence was detected from qualifications, departments and work experience.

The next chapter will focus on the model testing and the different hypothesis relationships within the model.

CHAPTER 6: MODEL TESTING

6.1 Introduction

This chapter introduces the different models and tests used in the study. The model for this study was developed from related literatures and will be tested through multiple regression analysis, a statistical technique used when the purpose of research is to examine the relationship between variables. The variables involved in regression analysis include dependent and independent variables. Regression analysis is used to determine the effect of independent variables on dependent variables. This study aims to investigate the impact of the oil operations on the performance of oil firms in developing countries. The data is collected from 17 oil firms in Libya, which covers all the active firms during the period of data collection. Therefore, the number of respondents for this research is (N=85). Table (6.1) shows different tests used in the study.

Table 6.1: Tests used

Test name	*Description*
Cronbach's alpha	Assesses the degree to which a set of measures which make up the scale are sharing high inter-consistency (DeVellis, 2003).
Normality	The distribution of a variable should follow a normal distribution (Hair et al, 2010).
Multicollinearity	Examines the correlation between independent variables; high correlation affects the regression coefficient and statistical significance (Hair et al, 2010).
Regression analysis	Explores the relationship between one dependent variable and a number of independent variables or predictors (Field, 205; Pallant, 2011).
Independent t-test	To compare the scores of two different groups or conditions (Field, 2005; Pallant, 2011)
One-way analysis of variance (ANOVA)	To compare the scores of three or more different groups or conditions (Field, 2005; Pallant, 2011)

The different tests adopted in the study include reliability test (Cronbach's alpha), normality test, multicollinearity test, independent t-test and ANOVA. All of these tests hold significant importance for this study. The reliability test has been conducted to check the consistency of the research instrument. The reliability test is mainly associated with the instrument used for data collection (Field, 2005). The results of reliability test help researchers understand whether the scale could give consistent results or not. When analysing data, it is important for the researcher to ensure that the distribution of data is

normal. In order to ensure this, distribution test is conducted. The results of the test determine whether the distribution of each variable is normal or not.

The extent to which variables used in the study are correlated with each other needs to be confirmed prior to regression analysis. Multicollinearity is an important assumption associated with regression analysis. Hence, multicollinearity analysis was also conducted in order to determine whether the variables are independent of each other or not (Field, 2005). When the researcher aims to compare the results of two groups independent t-test is conducted, while when two or more than two populations are present, ANOVA is used.

6.2 Reliability Test (Cronbach's Alpha)

Reliability is the yardstick for measuring consistency. As suggested by classical test theory, every test score is influence by different factors. The true score is one, which is based on all factors associated with consistency. There are several reasons for testing reliability in a research. It helps measure the extent to which the results represent random measurement error. Furthermore, reliability is considered to be the precursor to validity. If there is no consistency in the instrument and results, it is not possible to conclude that they are valid. Validity refers to the extent to which results are accurate. Cronbach's alpha test provides a measure of the extent to which items in a scale provide consistent information (Field, 2005).

One of the tests used in the study was reliability test. This test was conducted in order to study the properties of items used in the test. The reliability of items is indicated by Cronbach's alpha. It is a measure of internal consistency of items. The reliability of items through Cronbach's alpha could be tested with the help of SPSS version 18 software. The items are said to be reliable if their values fall within the acceptable range. According to Tomlinson (2010) and Pallant (2010), the values of alpha must not be less than 0.70. Table (6.2) shows that the reliability values of factors are more than 0.70. However, the average reliability score is 0.8. These values indicate the high reliability of the study.

Table 6.2: Cronbach α test results (N= 85)

Factor	*Cronbach Alpha (α)*
Asset management	0.75
Partnership use	0.80
Partnership benefit	0.79
Oil operations	0.78
Internal outcomes	0.80
External outcomes	0.91

6.3 Overview of Multiple Regression Analysis

Regression analysis is a statistical test used for the investigation of relationships between different variables. When using regression analysis, the researcher aims to investigate the relationship between different variables. The use of regression analysis is helpful in identifying the effect of one variable on the other (Field, 2005). For example, regression analysis could be used to study the effect of changes in money supply on inflation. In order to explore relationship among variables, the researcher gather related to variables and employs regression analysis to estimate the quantitative effect of one variable on the other. With regression analysis, the researcher also assesses the significance of estimated relationship among variables.

Multiple regression analysis is used when a large number of variables are present in a study. When using multiple regression analysis, researchers classify variables into dependent and independent variables. The independent variables are those that influence other variables.

According to Field (2005) and Pallant (2010), multiple regression analysis involves mathematical expression that represents the behaviour of phenomenon. Multiple regression analysis could be defined as a statistical technique that is used for the prediction of scores on the basis of previous scores. The explanation of multiple regression analysis has also been provided by Braimah (2008) who has defined multiple regression analysis as a statistical technique that is used for predicting the effect on independent variables on dependent variable. The multiple regression is calculated through the following equation:

$$Y=a + b_1X_1 + b_2X_2 + b_3X_3 + ….. + b_nX_n$$

Y is the value of the dependent variable (Y), what is being predicted or explained

a (Alpha) is the constant or intercept

b_1 is the slope for X_1

X_1 first independent variable that is explaining the variance in Y

B_2 is the slope for X_2

X_2 second independent variable that is explaining the variance in Y

B_3 is the slope for X_3

X_3 third independent variable that is explaining the variance in Y

The difference between regression and correlation has been presented by Field (2005). The correlation analysis is not helpful in predicting variables. On the other side, multiple regression analysis is helpful in explaining interrelation among variables. This technique could be used to determine how certain variables could be used to predict the outcome. The most commonly used regression analysis technique is standard multiple regression analysis. In the study, standard regression technique was employed for studying the relationship between asset management, partnership benefit, and partnership use and oil operations as well as between oil operations and performance.

6.3.1 Regression assumptions

Before conducting multiple regression analysis, it is important to check a few assumptions including multicollinearity, normality, linearity and outliers.

Data screening

Before entering data into SPSS, it is important to examine it to determine whether missing values are present or not. There are different factors associated with data screening. It is important to check whether the surveys were completely filled by respondents or not. The missing data is present in the form of missing responses to certain questions.

According to Sekran (2000), research in marketing and social science is based on surveys. Therefore, it is not always possible to get complete data. The problem of missing data is one in which the researcher fails to get finished questionnaires from respondents. In this

research, the researcher discarded questionnaires, which were not completely finished by respondents. Therefore, the chance of missing data was ignored.

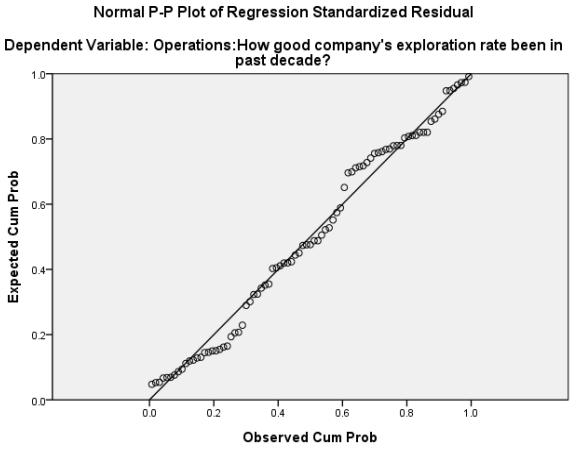
Normality and linearity

In multiple regression, it is important to estimate relationship between dependent and independent variables. The relationship between these variables must be linear in nature. If the relationship is not linear, the regression analysis will not yield effective results (Pallant, 2010).

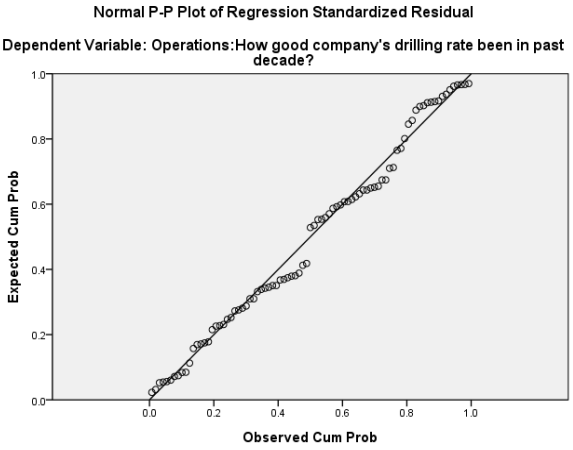
In regression analysis, it is assumed that variables have normal distribution. The non-normally distributed variables can have a negative effect on regression analysis. There are several pieces of information that could be used to test the assumption of normality including data plots, kurtosis and skewness (Pallant, 2010).

The normality assumption could be checked with the help of probability plot. According to Pallant (2010) and Field (2005), regression standardized residual and scatter plots could be used to check normality. The distribution of residuals must be normal. According to Field (2005: 136), the residuals are *"the differences between the values of the outcome predicted by the model and the values of the outcome observed in the sample"*. Skewness can be defined as a measure of regularity, or more precisely. A distribution can be symmetric if it looks the same to the right and left of the center point on the other hand, the Standard Error of Skewness displays the deviation that can be existed between the values of Skewness in multiple samples that will be taken randomly from the same underlying population distribution as the sample of analysis (Field, 2005). Kurtosis can be defined as a measure of whether the data are flat or peaked relative to a normal distribution. Data sets with high kurtosis tend to have a different peak near the mean and data sets with low kurtosis tend to have a flat top near the mean on the other hand, The Standard Error of Kurtosis displays the deviation that can be existed between the values of Kurtosis in multiple samples that will be taken randomly from the same underlying population distribution as the sample of analysis, the higher values demonstrate higher deviation of the underlying distribution of the sample from a symmetric distribution (Field, 2005). The values of skewness and kurtosis could also be used for checking normality. The values must be within ±3.0. In this research, as shown in Table (6.3), the values are within the acceptable range; therefore, distribution is said to be normal.

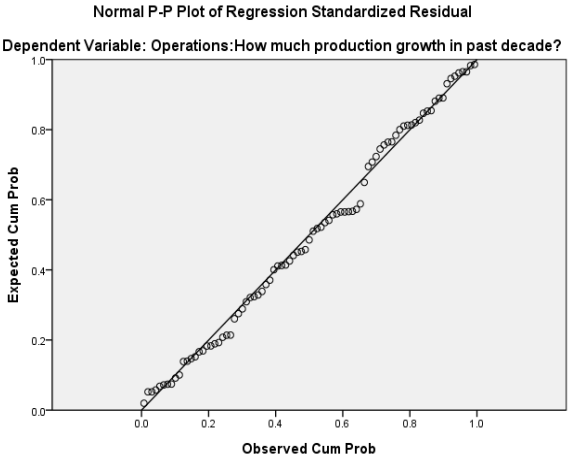
The assumption of linearity could be checked with graph. If the line on graph is straight, the relationship is linear. The following figures demonstrate that the relationship between variables is linear as the values of Y are the outcome and the values of X are the predictors.



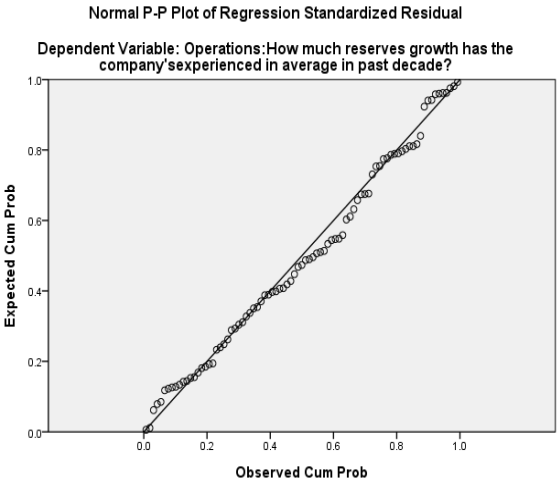
A. Dependent variable: Exploration



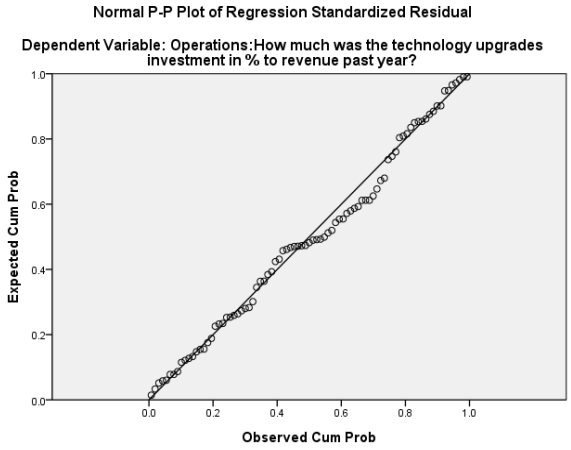
B. Dependent variable: Drilling



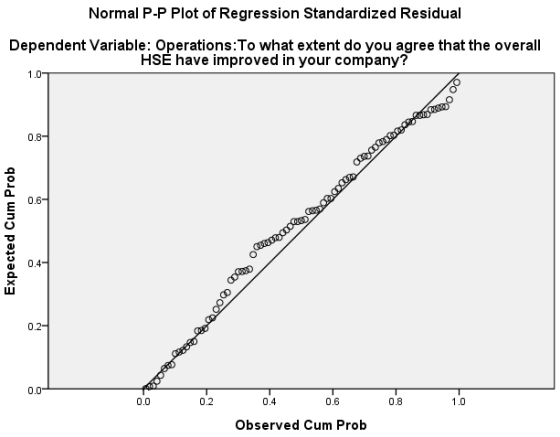
C. Dependent variable: Production



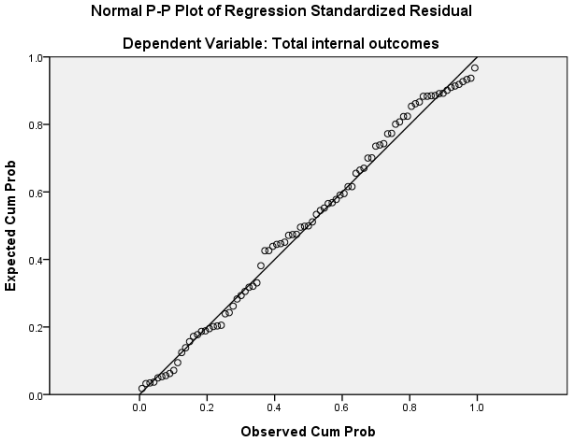
D. Dependent variable: Reserves



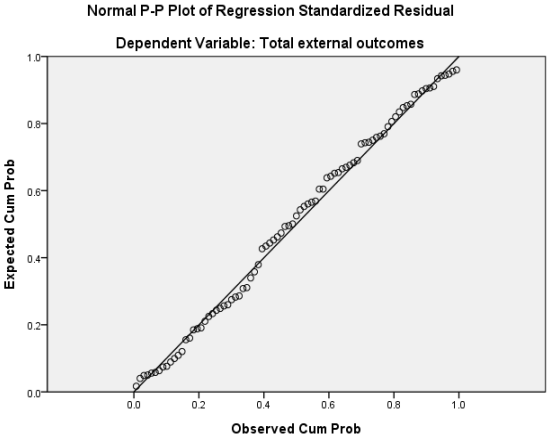
E. Dependent variable: Technology



F. Dependent variable: HSE



G. Dependent variable: Internal outcomes



H. Dependent variable: External outcomes

Figure 6.1: Normal P-P plot of regression standardized residual

Table 6.3: Skewness and Kurtosis scores

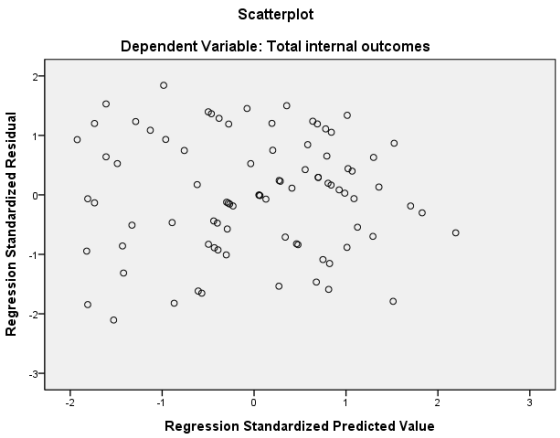
Variable	*Skewness*		*Kurtosis*	
	Statistic	Std. Error	Statistic	Std. Error
Asset management	-0.544	0.261	-0.331	0.571
Partnership use	-0.744	0.261	-0.190	0.571
Partnership benefit	-0.598	0.261	-0.371	0.571
Exploration	-0.0481	0.261	-0.920	0.571
Drilling	0.032	0.261	-0.912	0.571
Production	-0.169	0.261	-1.271	0.571
Reserves	-0.163	0.261	-1.131	0.571
Technology	0.141	0.261	-0.883	0.571
HSE	-0.091	0.261	-0.835	0.571
Internal outcomes	-0.515	0.261	-0.157	0.571
External outcomes	-0.395	0.261	-0.834	0.571

Outliers

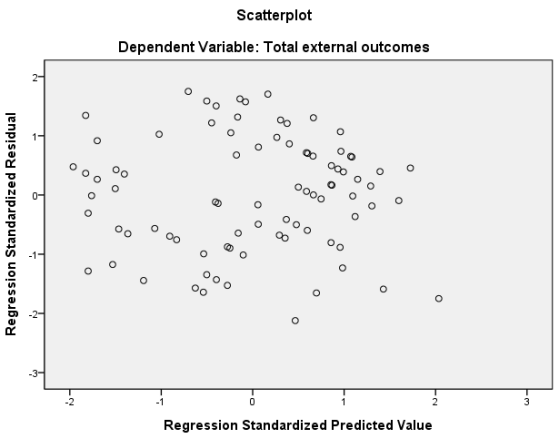
The presence of outliers also has an effect on the results of regression analysis. However, in all cases, it is not required to remove outliers. Outliers could be transformed through square root transformation, log transformation, and inverse transformation. The transformation of outliers could result in improving normality (Pallant, 2010).

The scatter plot indicates the presence of outliers in the study. The values with a standardized residual of more than +3.3 or less than -3.3 are outliers (Pallant, 2010; Tabachnick & Fidell, 2006). The outliers in data could occur because of incorrect entry of data, failure to identify error, and others. In the scatter plot, there are no visible outliers. From the scatterplot shown in Figure (6.2), we cannot detect the presence of outliers with a standard residual of more than +3.3 and less than -3.3, which means that there are no outliers.

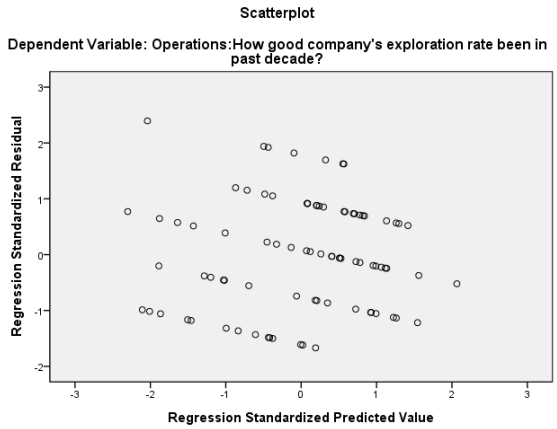
The scatter plots of variables: exploration, drilling, technology, internal and external outcomes, HSE, production and reserves have been presented in Figure (6.2).



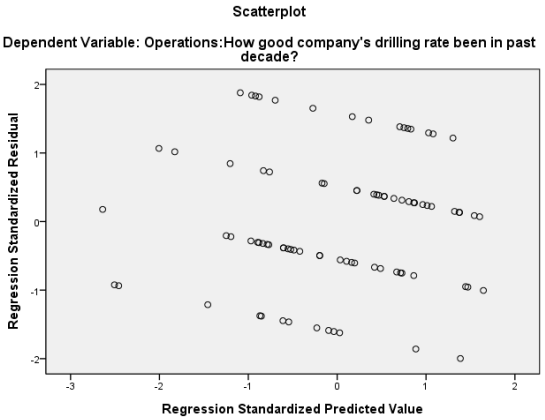
A. Dependent variable: Internal outcomes



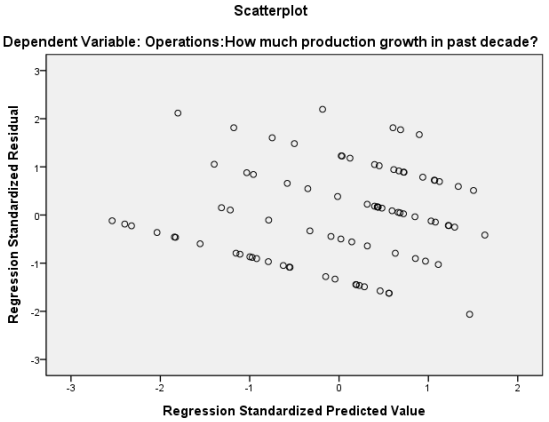
B. Dependent variable: Internal outcomes



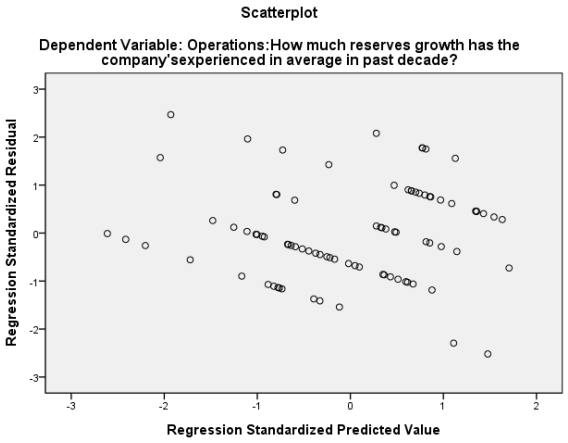
C. Dependent variable: Exploration



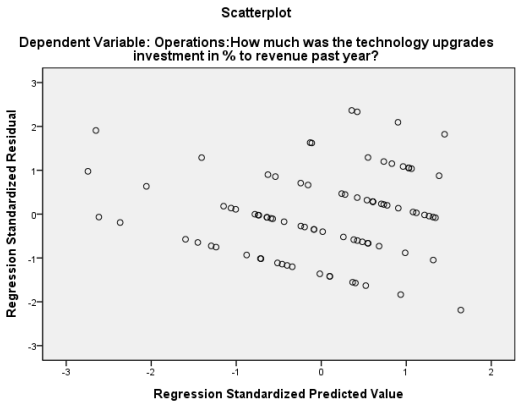
D. Dependent variable: Drilling



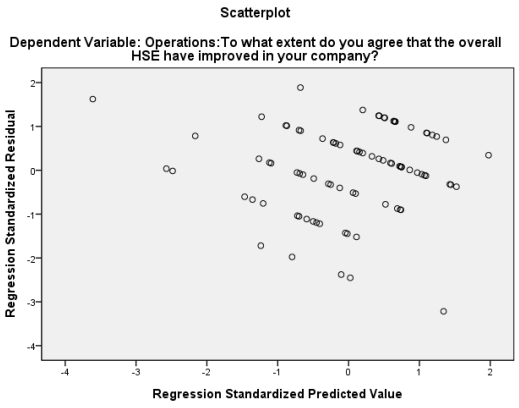
E. Dependent variable: Production



F. Dependent variable: Reserves



G. Dependent variable: Technology



H. Dependent variable: HSE

Figure 6.2: Scatterplot showing distribution of residuals for each dependent variable

Multicollinearity

Multicollinearity shows the relationship between different variables used in the study. According to Hair et al (2010), the presence of multicollinearity could result in huge analysis intervals. Furthermore, this also results in strange P values of independent variables. The p-value tests the null hypothesis (no influence). A low p-value (<0.05) indicates that the null hypothesis can be rejected. Additionally, a predictor that has a low p-value is likely to be important to the model. Pallant (2010) argued that it is important to check correlation among variables and to test that the value of correlation must not be too high (0.9). In the following table, the values of correlation have been given. Table 6.4 shows the highest value of correlation coefficient is 0.783 which is between internal and external performance and it is less than 0.9. This shows that multicollinearity does not exist (Pallant, 2010).

Multicollinearity is the condition where two or more than two explanatory variables in a research overlap. As a result of the overlap, the analysis does not explain explanatory variables differently from others. Multicollinearity could also be explained as the presence of high degree of correlation among different independent variables. The symptoms of multicollinearity include wide changes in parameter estimates because of small changes in data. In other words, coefficients have high standard errors and significance levels (Pallant, 2010).

The tolerance and VIF values of collinearity also can be checked to determine collinearity. Tolerance is the indicator of variability of independent variable. On the other side, VIF is the variance inflation factor, which is the inverse of tolerance. The acceptable values of tolerance and VIF are 0.1 for tolerance and 10 for VIF (Hair et al, 2010). As can be seen in Tables (6.5-6.12), the values of tolerance for each variable are not less than 0.1, therefore the multicollinearity assumption is not violated. This is also supported by the VIF value, which is less than 10 for each variable.

Table 6.4: Pearson's correlation matrix

Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
1.Asset	1										
2.Partner use	.463**	1									
3.Partner benefit	.488**	.509**	1								
4.Exploration	.136	.239*	.283**	1							
5.Drilling	.161	.217*	.179	.728**	1						
6.Production	.336**	.381**	.409**	.463**	.602**	1					
7.Reserves	.342**	.452**	.445**	.324**	.306**	.624**	1				
8.Technology	.321**	.262*	.303**	.484**	.421**	.424**	.510**	1			
9.HSE	.378**	.355**	.306**	.383**	.378**	.465**	.437**	.444**	1		
10.Internal outcomes	.481**	.417**	.546**	.491*	.263	.448**	.544**	.580**	.490**	1	
11.External outcomes	.556**	.560**	.590**	.471**	.423**	.503**	.523**	.543**	.527**	.783**	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

6.4 Regression and Hypotheses Testing

Multiple regression analysis is the extension of simple regression. This technique is used for predicting the value of a variable. The value is predicted on the basis of the value of two or more than two other variables. The variable predicted in this technique is known as the dependent variable. The variables used for prediction are known as independent variables. This technique is helpful in determining the overall fit of the model. Regression analysis is also used to indicate the contribution of each predictor variable. In this research, multiple regression analysis was used to test hypotheses. Figure (6.3) presents the research model of this study.

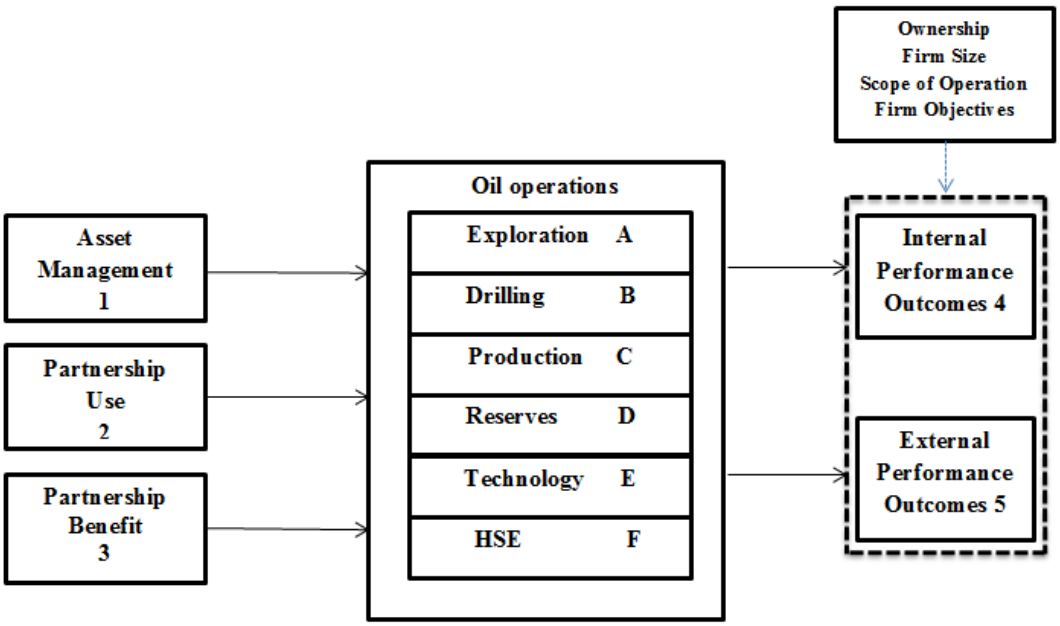


Figure 6.3: Conceptual model

6.4.1 The first part of the multiple regression (Model 1)

In this part of the analysis we focus on the impact of asset management, partnership use and partnership benefit on oil operations (exploration, drilling, production, reserves, technology and HSE). The first part of the model is shown in Figure (6.4).

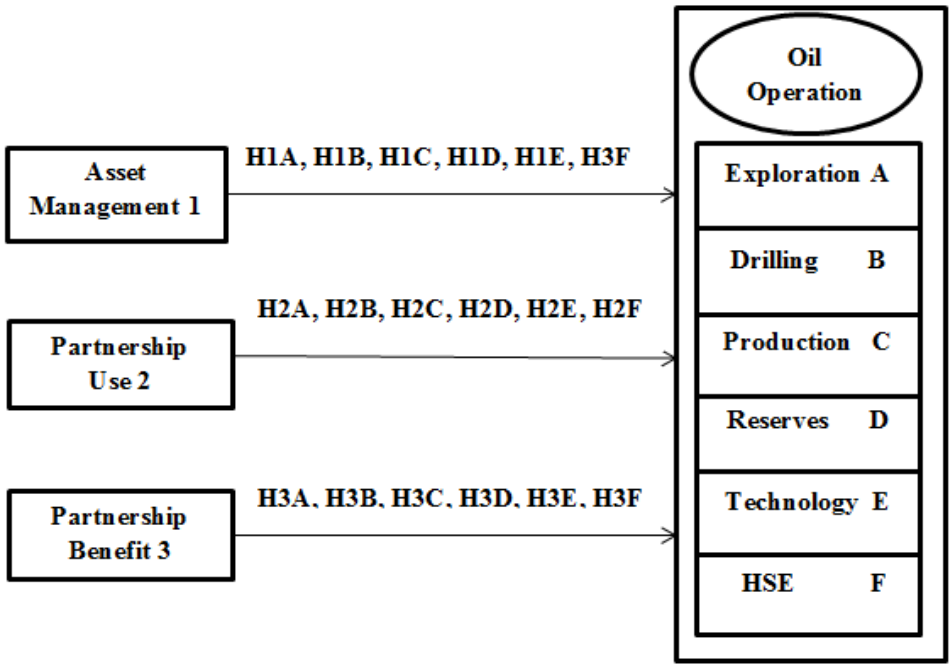


Figure 6.4: Model 1 regression analysis (influence of asset management and partnerships on oil operations)

6.4.2 Model 1 hypotheses

H1A. Asset management positively influences the oil exploration.

H1B. Asset management positively influences the oil drilling.

H1C. Asset management positively influences the oil production.

H1D. Asset management positively influences the oil reserves.

H1E. Asset management positively influences the oil technology.

H1F. Asset management positively influences the oil health, safety and environment.

H2A. Partnership use positively influences the oil exploration.

H2B. Partnership use positively influences the oil drilling.

H2C. Partnership use positively influences the oil production.

H2D. Partnership use positively influences the oil reserves.

H2E. Partnership use positively influences the oil technology.

H2F. Partnership use positively influences the oil health, safety and environment.

H3A. Partnership benefit positively influences the oil exploration.

H3B. Partnership benefit positively influences the oil drilling.

H3C. Partnership benefit positively influences the oil production.

H3D. Partnership benefit positively influences the oil reserves.

H3E. Partnership benefit positively influences the oil technology.

H3F. Partnership benefit positively influences the oil health, safety and environment.

The effect of partnership use, partnership benefit and asset management on oil operations is tested using multiple regression analysis. Six stages of multiple regression analyses are presented in Tables (6.5 - 6.10) as the variables group of (partnership use, benefit and asset

management) were independent variables, while each construct in oil operations was a dependent variable.

Stage 1 tests on the effects of the two partnerships (use and benefit) and asset management on exploration

The results from Table (6.5) show that partnership use has a significant relationship with exploration however, partnership benefit and asset management have no significant relationship with exploration, thus supporting H2A and rejecting H1A and H3A. From the results, only partnership use makes a significant contribution to oil exploration. VIF values indicate there is no sign of multicollinearity, as (VIF<10) (Hair et al, 2010: 200).

It can be comprehended from these findings that the use of partnership is beneficial for oil companies in terms of exploration activities. However, partnership benefits and oil asset management could not be associated with exploration activities of oil companies.

Table 6.5: Multiple regression analysis - exploration

Model		*Unstandardized Coefficients*		*Standardized Coefficients*	*T*	*Sig.*	*Collinearity Statistics*	
		B	*Std. Error*	*Beta*			*Tolerance*	*VIF*
1	(Constant)	.597	1.081		.552	.582		
	Asset Management	.019	.036	.060	.521	.604	.849	1.178
	Partnership Use	.130	.059	.277	2.207	.030	.718	1.394
	Partnership Benefit	-.007	.032	-.026	-.204	.839	.701	1.426

Stage 2 tests on the effects of the variables (partnership use and benefit) and (asset management) on drilling

The results from Table (6.6) show that partnership use has a significant relationship with drilling, however partnership benefit and asset management have no significant relationship with drilling, thus supporting H2B and rejecting H1B and H3B. From the results, only partnership use makes a significant contribution to oil drilling. VIF values indicate there is no sign of multicollinearity, as (VIF<10) (Hair et al, 2010: 200).

Table 6.6: Multiple regression analysis - drilling

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.393	.865		.455	.651		
Asset Management	.009	.026	.043	.339	.735	.701	1.426
Partnership Use	.050	.029	.201	1.735	.046	.849	1.178
Partnership Benefit	.035	.047	.092	.732	.466	.718	1.394

a. Dependent Variable: Operations: Drilling

Stage 3 tests the effect of the predictor variables partnerships and asset management on oil production

Table (6.7) indicates that both partnership use and benefit as well as asset management have a significant impact on the company production; therefore H1C, H2C and H3C are accepted. The highest absolute value of beta come from asset management, with beta=0.335. According to (Pallant, 2010), the beta coefficient allows us to make comparisons and to evaluate the strength of the relationship between each predictor variable to the dependent variable. The beta value is a measure of how strongly each predictor variable influences the (dependent) variable. Hence, the higher the beta value is the greater the impact of the predictor variable on the dependant variable. This means that asset management makes the strongest contribution to oil production. According to the VIF values, there is no sign of multicollinearity (VIF<10) (Hair et al, 2010: 200).

Table 6.7: Multiple regression analysis - production

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-1.659	1.064		-1.559	.023		
	Asset Management	.169	.035	.335	2.912	.005	.849	1.178
	Partnership Use	.097	.032	.264	1.844	.037	.701	1.426
	Partnership Benefit	.160	.058	.324	2.760	.007	.718	1.394

a. Dependent Variable: Operations: Production

Stage 4 tests on the effects of the independent variables partnerships (use and benefit) and asset management on oil reserves

Table (6.8) suggests that partnership benefit and asset management have a significant influence on reserves, which confirms the H1D and H3D, on the other hand partnership use does not have significant influence with reserves therefore H2D is rejected. From the results, the highest absolute value of beta come from asset management, with beta=0.312. This means that asset management makes the strongest contribution to oil reserves. According to the VIF values, there is no sign of multicollinearity (VIF<10) (Hair et al, 2010: 200).

The oil reserves of oil companies are highly dependent on asset management activities of organizations. Therefore, in order to increase the efficiency of reserves system, it is important for oil companies to carry out asset management activities in an efficient manner.

Table 6.8: Multiple regression analysis - reserves

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	-2.568	.953		-2.696	.009		
Asset Management	.096	.032	.312	3.051	.003	.849	1.178
Partnership Use	.025	.028	.098	.867	.389	.701	1.426
Partnership Benefit	.125	.052	.269	2.415	.018	.718	1.394

a. Dependent Variable: Operations: Reserves

Stage 5 tests on the effects of the independent variables partnerships (use and benefit) and asset management on oil technology

Table (6.9) suggests that partnership use and asset management have a significant influence on technology, which confirms H1E and H2E, on the other hand partnership benefit does not have significant influence with technology therefore H3E is rejected. The highest absolute value of beta come from partnership use, with beta=0.253. This means that partnership use makes the strongest contribution to oil technology. According to the VIF values, there is no sign of multicollinearity (VIF<10) (Hair et al, 2010: 200).

The technology adoption and utilization are significant activities of oil companies. The results of regression analysis have shown that partnership use and asset management

activities have an effect on technology. These findings have important implications for oil companies. Oil companies could increase their technology adoption and utilization if they are successfully managing partnership use and asset management activities.

Table 6.9: Multiple regression analysis - technology

	Unstandardized Coefficients		*Standardized Coefficients*			*Collinearity Statistics*	
Model	*B*	*Std. Error*	*Beta*	*T*	*Sig.*	*Tolerance*	*VIF*
1 (Constant)	-1.837	.940		-1.953	.054		
Asset Management	.065	.031	.223	2.076	.041	.849	1.178
Partnership Use	.093	.028	.253	2.396	.026	.701	1.426
Partnership Benefit	.066	.051	.150	1.279	.205	.718	1.394

a. Dependent Variable: Operations: Technology

Stage 6 tests on the effects of the independent variables partnerships (use and benefit) and asset management on health, safety and environment

Table (6.10) suggests that asset management has significant influence on HSE, which confirms H1F; on the other hand partnership use and benefit do not have a significant influence on HSE, so H2F and H3F are rejected. Results show that the highest absolute value of beta come from asset management, with beta=0.459. This means that asset management makes the strongest contribution to HSE. According to the VIF values, there is no sign of multicollinearity (VIF<10) (Hair et al, 2010: 200).

The consideration for HSE is significant for oil companies because of the presence of hazardous materials and operations, which can incur catastrophic reparations in the event of mishap (e.g. the BP/Gulf of Mexico oil spill). According to the results, firms perform better in terms of HSE if they are efficient in asset management. This suggests that firms that are better in asset management also perform better in regard to health, safety and the environment.

Table 6.10: Multiple regression analysis - HSE

Model	*Unstandardized Coefficients*		*Standardized Coefficients*	*T*	*Sig.*	*Collinearity Statistics*	
	B	*Std. Error*	*Beta*			*Tolerance*	*VIF*
1 (Constant)	-.710	.936		-.758	.450		
Asset Management	.137	.031	.459	4.421	.000	.849	1.178
Partnership Use	.044	.028	.180	1.573	.120	.701	1.426
Partnership Benefit	-.052	.051	-.115	-1.022	.310	.718	1.394

a. Dependent Variable: Operations: HSE

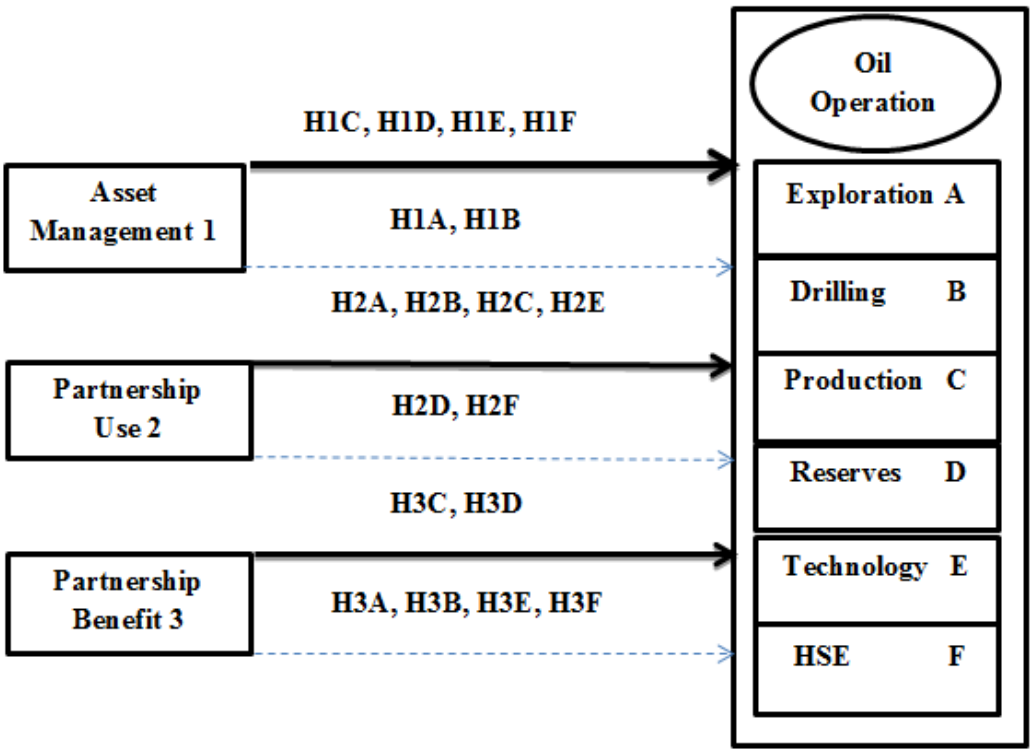


Figure 6.5: Revised Model 1 based on regression analysis

Dash lines indicate non-significant effect, solid lines indicate significant effect

6.4.3 The second part of the multiple regressions (Model 2)

In this part of the analysis we examine the influence of oil operations including exploration, drilling, production, reserves, technology and HSE on the internal performance outcomes. The second part of the research model is shown in Figure (6.6).

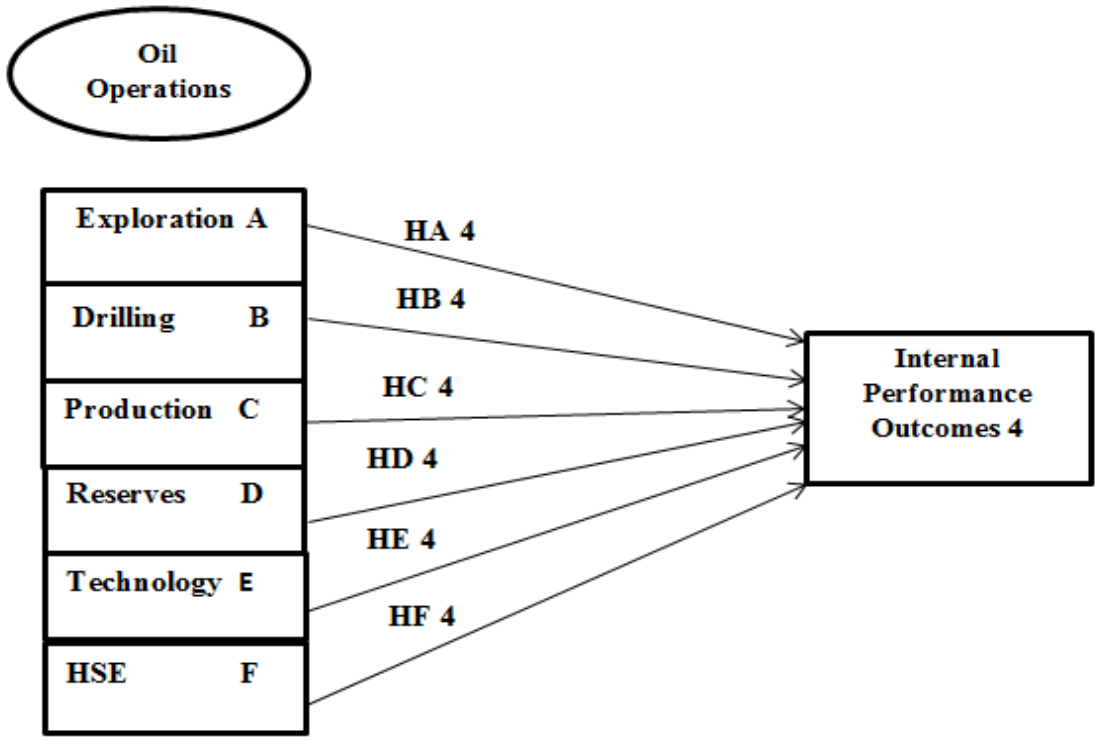


Figure 6.6: Model 2 regression analysis of influence of oil operations on internal performance outcome

6.4.4 Model 2 hypotheses

HA4. Exploration positively influences the internal performance outcome.

HB4. Drilling positively influences the internal performance outcome.

HC4. Production positively influences the internal performance outcome.

HD4. Reserves positively influence the internal performance outcome.

HE4. Technology positively influences the internal performance outcome.

HF4. HSE positively influences the internal performance outcome.

Hypotheses test

Those hypotheses are tested using multiple regression analysis. Each construct of the oil operations was an independent variable, while the internal performance outcome was a dependent variable.

Table (6.11) suggests that exploration, production and technology have significant influences on the company internal performance outcomes, which confirms HA4, HC4 and HE4. On the other hand, drilling, reserves and HSE do not have a significant influence with the internal performance outcomes, which rejects HB4, HD4 and HF4 hypotheses. The highest absolute value of beta come from "technology", with beta=0.383. This means that technology makes the strongest contribution to the company internal performance outcomes. The R^2 suggests that the independent variables (exploration, drilling, production, reserves, technology and HSE) are responsible for about 41% of the variance in the company internal performance outcomes. According to the VIF values, there is no sign of multicollinearity (VIF<10) (Hair et al, 2010: 200).

The internal performance outcomes of oil companies were measured through different variables including exploration, drilling, production, reserves, technology and HSE. The variables cause 41% of changes in the internal performance outcomes of oil companies. This suggests that the remaining variance is caused by other factors. However, in order for oil companies to improve their performance, it is important to give significant attention to these factors.

Table 6.11: Multiple regression analysis – internal performance

	Unstandardized Coefficients		*Standardized Coefficients*			*Collinearity Statistics*	
Model	*B*	*Std. Error*	*Beta*	*t*	*Sig.*	*Tolerance*	*VIF*
(Constant)	12.809	.995		12.868	.000		
Exploration	.904	.315	.364	2.871	.005	.418	2.392
Drilling	-.237	.423	-.076	-.559	.578	.365	2.738
Production	.624	.257	.318	2.181	.008	.569	1.758
Reserves	.390	.277	.156	1.405	.164	.544	1.837
Technology	1.020	.281	.383	3.628	.001	.602	1.662
HSE	.023	.257	.009	.090	.929	.673	1.485

a. Dependent Variable: internal performance outcomes

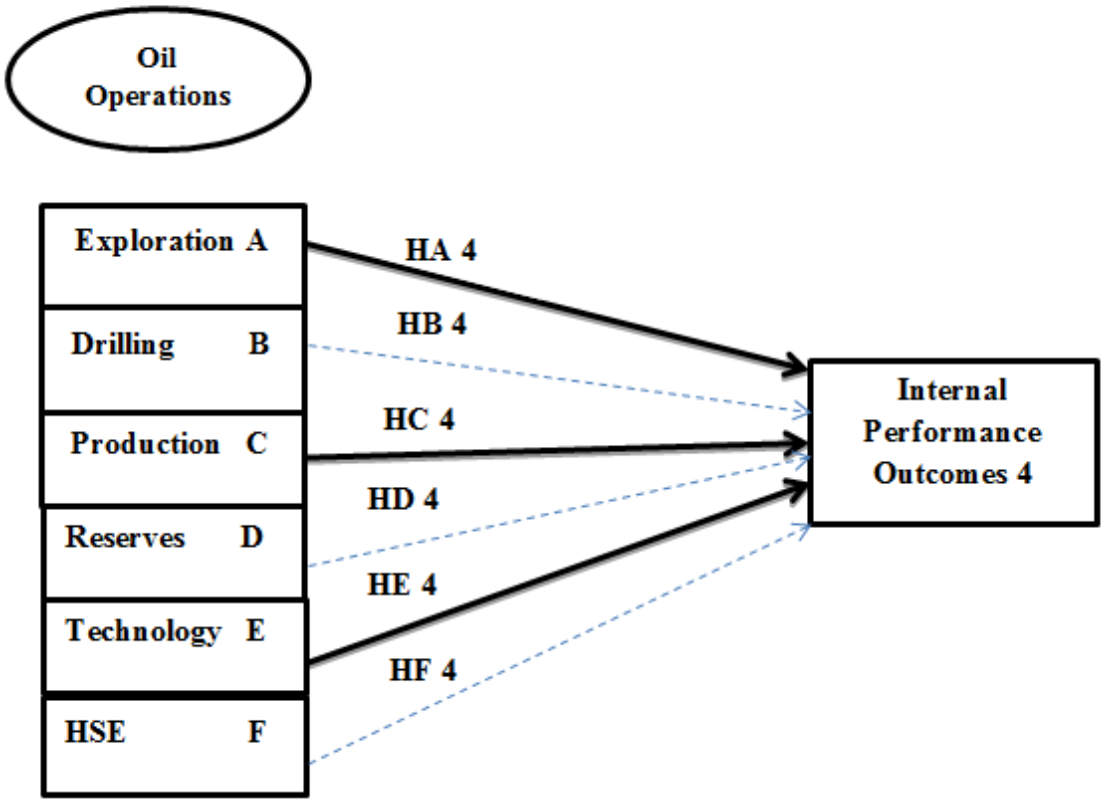


Figure 6.7: Revised Model 2 based on regression analysis

Dash lines indicate non-significant effect, solid lines indicate significant effect

6.4.5 The third part of the multiple regression (Model 3)

In this part of the analysis we examine the influence of oil operations including exploration, drilling, production, reserves, technology and HSE on the external performance outcomes. The third part of the research model is shown in Figure (6.8).

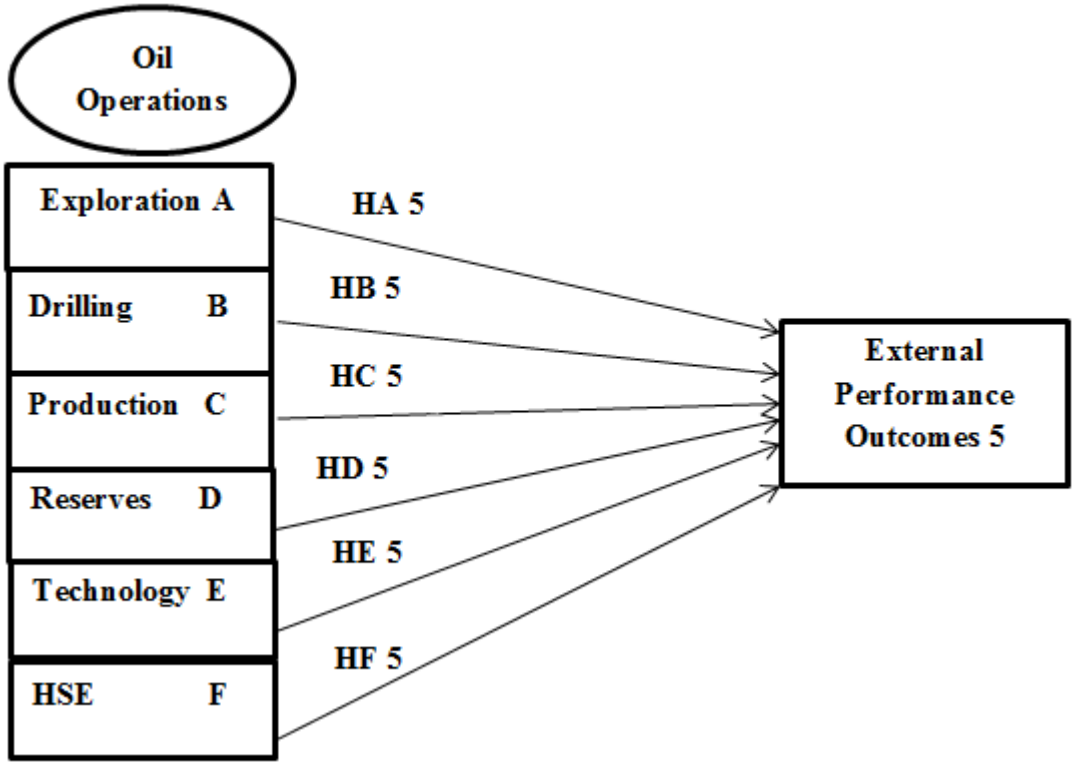


Figure 6.8: Model 3 regression analysis (influence of oil operations on external performance outcome)

6.4.6 Model 3 hypothesis

HA5. Exploration positively influences the external performance outcome.

HB5. Drilling positively influences the external performance outcome.

HC5. Production positively influences the external performance outcome.

HD5. Reserves positively influence the external performance outcome.

HE5. Technology positively influences the external performance outcome.

HF5. HSE positively influences the external performance outcome.

Hypotheses test

Those hypotheses are tested using multiple regression analysis, as each construct of the oil operations was an independent variable, while external performance outcome was a dependent variable.

Table (6.12) suggests that exploration, production, reserves, technology and HSE have significant influence on the company external performance outcomes which confirms hypotheses HA5, HC5, HD5, HE5 and HF5. On the other hand, drilling does not have a significant influence with external performance outcomes, which rejects HB5. The highest absolute value of t and beta come from reserves, with t=3.878 and beta=0.375. This means that reserves make the strongest contribution to the company's external performance outcomes. The R^2 suggests that the independent variables (exploration, drilling, production, reserves, technology and HSE) are responsible for about 48% of the variance in the company external performance outcomes. According to the VIF values, there is no sign of multicollinearity (VIF<10) (Hair et al, 2010: 200).

These results suggest that the external performance of oil companies is influenced by exploration, production, reserves, technology and HSE. Therefore, for improving external performance, it is important for firms to maximize efficiency in these factors.

Table 6.12: Multiple regression analysis – external performance

	Unstandardized Coefficients		*Standardized Coefficients*			*Collinearity Statistics*	
Model	*B*	*Std. Error*	*Beta*	*t*	*Sig.*	*Tolerance*	*VIF*
(Constant)	11.516	1.359		8.476	.000		
Exploration	1.131	.430	.338	2.633	.010	.418	2.392
Drilling	-.403	.578	-.101	-.698	.487	.365	2.738
Production	.985	.350	.284	2.185	.030	.569	1.758
Reserves	1.314	.378	.375	3.878	.002	.544	1.837
Technology	1.153	.383	.355	3.008	.004	.602	1.662
HSE	.921	.351	.228	1.671	.043	.673	1.485

a. Dependent Variable: external performance outcomes

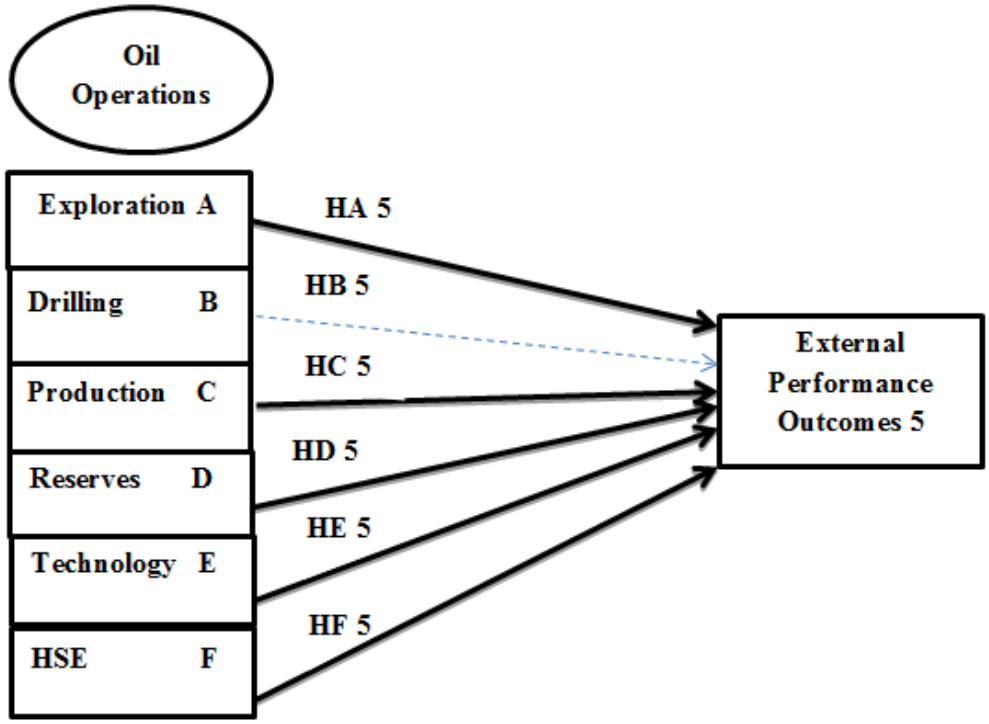


Figure 6.9: Revised model 3 based on regression analysis

Dash lines indicate non-significant effect, solid lines indicate significant effect

After completing this part of the regression analysis, all the research hypotheses have been examined. Table (6.13) summarises the results of the multiple linear regression and indicates the supported and rejected hypotheses.

Table 6.13: Summary of accepted and rejected hypotheses as a result of regression analyses

Hypothesis	*Independent variable*	*Dependent variable*	*Result of testing*
HA1	Asset management	Exploration	Rejected (p=0.604)
HB1	Asset management	Drilling	Rejected (p=0.086)
HC1	Asset management	Production	Accepted (p=0.005)
HD1	Asset management	Reserves	Accepted (p=0.003)
HE1	Asset management	Technology	Accepted (p=0.041)
HF1	Asset management	HSE	Accepted (p=0.000)
HA2	Partnership use	Exploration	Accepted (p=0.030)
HB2	Partnership use	Drilling	Accepted (p=0.046)
HC2	Partnership use	Production	Accepted (p=0.037)
HD2	Partnership use	Reserves	Rejected (p=0.389)
HE2	Partnership use	Technology	Accepted (p=0.026)
HF2	Partnership use	HES	Rejected (p=0.120)
HA3	Partnership benefit	Exploration	Rejected (p=0.839)
HB3	Partnership benefit	Drilling	Rejected (p=0.466)
HC3	Partnership benefit	Production	Accepted (p=0.007)
HD3	Partnership benefit	Reserves	Accepted (p=0.018)

Hypothesis	*Independent variable*	*Dependent variable*	*Result of testing*
HE3	Partnership benefit	Technology	Rejected (p=0.205)
HF3	Partnership benefit	HES	Rejected (p=0.310)
HA4	Exploration	Internal outcomes	Accepted (p=0.005)
HB4	Drilling	Internal outcomes	Rejected (p=0.578)
HC4	Production	Internal outcomes	Accepted (p=0.008)
HD4	Reserves	Internal outcomes	Rejected (p=0.164)
HE4	Technology	Internal outcomes	Accepted (p=0.001)
HF4	HSE	Internal outcomes	Rejected (p=0.929)
HA5	Exploration	External outcomes	Accepted (p=0.010)
HB5	Drilling	External outcomes	Rejected (p=0.487)
HC5	Production	External outcomes	Accepted (p=.0030)
HD5	Reserves	External outcomes	Accepted (p=0.002)
HE5	Technology	External outcomes	Accepted (p=0.004)
HF5	HSE	External outcomes	Accepted (p=0.043)

6.5 Revised Research Model

The revised model as shown in Figure (6.10) is based on the results of regression analysis performed in the study. The original model aimed to study different factors that have an effect on the activities of oil companies as well as their internal and external performance. The summary of key findings shows that exploration and drilling is not affected by asset management. Therefore, the revised model excludes these relations. The factors including reserves and health, safety and environment are not affected by partnership use. In addition factors including exploration, drilling, technology and HSE are not affected by partnership benefit; therefore, all of these relations are excluded from the revised model.

The external performance outcomes do not depend on drilling activity. Similarly, internal performance outcomes do not depend on drilling, reserves and HSE. Therefore, the revised model would exclude the variable of drilling. Hence, the target is to identify the firms' activities that can achieve higher performance.

Table (6.14) demonstrates a summary of the results from the regression tests.

Table 6.14: Key findings from regression test

Factor	*Dependent variable*	*Sig (p)*	*t-value*	*Beta*	*Hypothesis*
Asset management	Exploration	(p=0.604)			Rejected
	Drilling	(p=0.086)			Rejected
	Production	(p=0.005)	2.912	0.335	Accepted
	Reserves	(p=0.003)	3.051	0.312	Accepted
	Technology	(p=0.041)	2.076	0.223	Accepted
	HSE	(p=0.000)	4.421	0.459	Accepted
Partnership use	Exploration	(p=0.030)	2.207	0.277	Accepted
	Drilling	(p=0.046)	1.735	0.201	Accepted
	Production	(p=0.037)	1.844	0.264	Accepted
	Reserves	(p=0.389)			Rejected
	Technology	(p=0.026)	2.396	0.253	Accepted
	HES	(p=0.120)			Rejected
Partnership benefit	Exploration	(p=0.839)			Rejected
	Drilling	(p=0.466)			Rejected
	Production	(p=0.007)	2.760	0.324	Accepted
	Reserves	(p=0.018)	2.415	0.269	Accepted
	Technology	(p=0.205)			Rejected
	HES	(p=0.310)			Rejected
Exploration	Internal outcomes	(p=0.005)	2.871	0.364	Accepted
Drilling		(p=0.578)			Rejected
Production		(p=0.008)	2.181	0.318	Accepted
Reserves		(p=0.164)			Rejected
Technology		(p=0.001)	3.628	0.383	Accepted
HSE		(p=0.929)			Rejected
Exploration	External outcomes	(p=0.010)	2.633	0.338	Accepted
Drilling		(p=0.487)			Rejected
Production		(p=.0030)	2.185	0.284	Accepted
Reserves		(p=0.002)	3.878	0.375	Accepted
Technology		(p=0.004)	3.008	0.355	Accepted
HSE		(p=0.043)	1.671	0.228	Accepted

The revised model consists of different factors that have been found to have a significant effect by this research. The revised factors include asset management, partnership use, partnership benefit, exploration, production reserves, HSE, and technology. These factors have been included in the revised model because they can explain 41% variance of the internal performance of oil companies. Similarly, these factors could explain 48% variance in the external performance of firms. This shows that the factors included in revised model have a significant effect on the internal and external performance of firms. Therefore, the factors included in the revised model could determine the performance of oil companies.

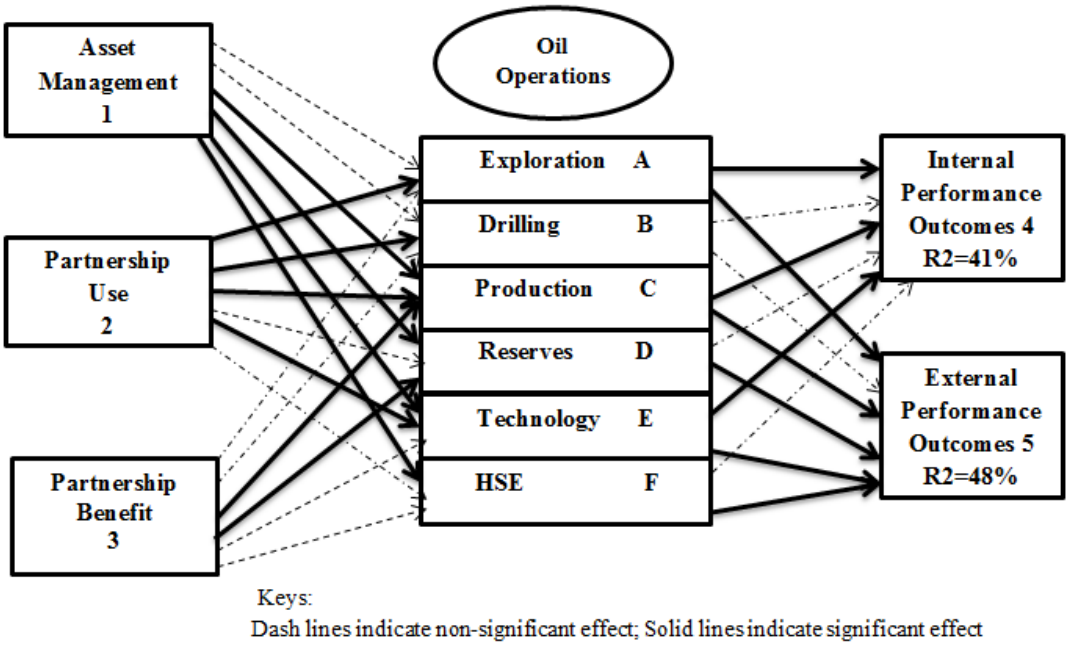


Figure 6.10: Revised model based on regression results

6.6 Validation of the Revised Research Model

In order to validate findings of the study, the researcher has conducted semi-structured interviews. The purpose of conducting interviews was to support model developed, which have been derived from questionnaire. The questions asked in the interview were related to those asked in the questionnaire; such as internal and external performance outcomes of oil companies (see appendix E).

The interviews were conducted with four managers of O & G companies in Libya. The managers were selected from different departments. The interviews were conducted in August 2014 in Libya. The duration of interviews was 45 minutes to 1.5 hours.

The findings from the interviews were helpful in supporting the findings from questionnaire. This resulted in increasing the validity of research. The following table shows the profile of interview participants. It can be seen that all managers are highly experienced in their areas, with 15 to 27 years of experience. Furthermore, to increase the

validity of research findings, the managers were selected from different departments and both public and private sector firms.

Table 6.15: Interviewee profile

Number	*Position*	*Firm*	*Years of work experience*
1	Operation manager	Public	22
2	General manager	Private	27
3	Accounting manager	Private	15
4	Drilling coordinator	Public	18

6.6.1 Validation interviews results

Internal performance

The results obtained from the survey questionnaire showed that exploration, production and technology have positive influence on the firms' internal performance.

- Exploration

According to the participants, the level of exploration has a positive effect on the internal performance of oil companies. This is largely because of the fact that if the level of exploration is good, less pressure is exerted on jobs or any unexpected tasks.

Therefore, it can be agreed that the activities such as exploration, production, and technology have an effect on the internal performance of oil companies.

- Production

The adequate production levels and effective functioning of production result in superior performance of organization, because the adequate functioning of production makes employees and management feel relaxed.

The production function has an effect on performance in such a manner that the smooth operation of this function allows employees and managers to perform their tasks in an efficient manner. Therefore, this results in improving the internal performance of organizations.

- Technology

The interview participants agreed that technology has an effect on internal performance of oil companies. When technology is well-implemented in organizations, it becomes easier for oil companies to perform their daily tasks.

The technology adoption and utilization has an effect on performance because technology results in increasing the easiness of task.

The results obtained from the survey questionnaire showed that drilling, reserves and HSE have no influence on the firms' internal performance.

- Drilling

The interview participants believed that drilling has no direct effect on a firms' internal performance. It is considered to be a technical service, which under the exploration and production activities. Furthermore, companies usually hire other service companies to do the drilling activity for them.

According to questionnaire findings, drillings does not affect internal performance of oil companies. These findings have also been supported by interviews.

- Reserves

The interviewees stated that reserves of oil companies indicate how big a firm is. However, the presence of reserves has no effect on daily tasks performed by employees. Therefore, reserves do not directly affect internal performance.

The reserves do not have an effect on internal performance of an organization because this activity is not directly associated with the daily jobs and activities of employees.

- HSE

Three of the interviewees stated that they are not surprised, because generally HSE is well implemented in most oil companies and managers and employees do not feel too worried about this issue. One of them claimed that he is not quite sure if this relation should be positive or negative. This could be because of the lack of awareness of employees regarding the significance of HSE.

External performance

The results obtained from the survey questionnaire showed that exploration, production, technology, reserves and HSE have positive influence on the firms' external performance.

- A. Exploration

According to interviewees, exploration has a direct effect on production level, which will generate more income. Therefore, the increase in the success of exploration activities could result in enhancing the external performance of oil companies.

- Production

Interviewees believed that production level is the fundamental measure for the company income. Therefore, if the production level goes down or stops then the company performance will go down immediately. Hence, production is directly related to performance.

Production is one of the significant activities performed by oil companies. Therefore, the production level could be used as an adequate measure to determine external performance of oil companies. If the production level is high, the performance of oil companies is superior.

- Technology

All interviewees agreed that having advanced technology helps the company in discovering and producing with less risk and less cost. Therefore, technology is said to be positively associated with external performance of oil companies. Therefore, in order to enhance external performance, it is important for oil companies to adopt advanced technology. Technology is a significant factor because it is associated with both internal and external performance of oil companies.

- Reserves

The external performance of an oil company could be determined through its reserves. If a firm has big reserves, it is expected to perform better than others. Reserves tell how the big and powerful company is. Hence, the firms with more reserves perform better than firms with fewer reserves. Oil companies can increase their external performance by increasing

their reserves. However, reserves are not associated with internal performance of oil companies.

- HSE

According to participants, the health and safety standards have a direct effect on performance of oil companies. They stated if the health and safety is not observed correctly, this will negatively affect the external company's performance. One of the interviewees reported that he was working years ago when oil spills occurred in one of its fields because of health and safety issues, which resulted in losing money and time to fix it as well as environmental degradation. Therefore, the external performance of oil companies could be improved by their activities associated with health, safety and the environment. This could be associated with an increase in the importance of environment safety and health and safety of employees.

The results obtained from the survey questionnaire showed that drilling has no influence on the firms' external performance.

- Drilling

Three of the participants agreed with the results of the survey questionnaire that drilling has no direct effect on the external performance of oil companies, as they see it as a part of exploration and production.

One of the interviewees claimed that drilling should have positive impact of the company performance. Overall, it can be seen that the drilling activity has no direct association with the external performance of oil companies. Therefore, it is not an adequate measure of a firms' external performance in the O & G sector.

Asset management

All interviewees agree that asset management is very important tool for oil firms and it has an influence on firms' operations and confirmed the findings. Therefore, it can be agreed that asset management has an effect on the performance of oil companies.

One of the interviewees stated that public firms should pay more attention to managing their assets equally in all areas. One of the interviewees suggested that more investigation

should be done regarding drilling, as he thinks that asset management positively influences drilling.

The importance of asset management has been highlighted by the findings of both questionnaire and interviews. Therefore, it can be agreed that for oil companies to improve performance, it is important to bring efficiency to asset management.

Partnership use

Interviewees agreed with the relationships founded and confirmed that partners are very important for their firms. The use of partnership assists firms in managing their operations and activities. Therefore, partnership results in improving the performance of organizations.

One of the interviewees from public firm reported that all the firms' drilling activities as well as the exploration are operated by partners, and they need to use partners more in training the human resources and using advanced technology. Other stated that partnership use did not have positive relationships with some operations, which is not surprising because partners are not used in all firms' activities.

The use of partners has a positive effect on operational performance because partners assist in performing several activities, which are critical for oil companies. The use of partners not only results in sharing resources, but also expertise, which ultimately benefits the firm.

Partnership benefit

The interviewees agreed that partnership benefits result in increasing the capacity of firms. The use of partners also allows firms to maximize reserves and therefore, enhances performance.

These findings again support the argument that partners provide necessary expertise, skills, and resources that maximize the performance of oil companies.

6.7 Interviews Summary

The purpose of conducting interviews was to support the findings of the questionnaire. Therefore, interviews were conducted with managers of O & G companies in Libya. The

findings of the interview have supported the model. The findings have revealed that exploration, production, reserves, technology and HSE are activities that have an effect on the performance of oil firms.

The findings of the interviews have also validated the revised research model. The findings of the interview did not reveal any major issue or concern regarding the revised model.

6.8 Chapter Summary

This chapter started with the presentation of the tests performed in this study, including the reliability tests suggested through the Cronbach's alpha value, correlation test, t-test, ANOVA test and regression, to examine the proposed model and the related hypotheses.

This chapter also represented how Libyan firms responded to the research survey. It seems that ownership type plays major role in oil operations, performance, asset management and partnerships. The size of a company has an effect on the production of oil. The performance of oil companies differs on the basis of their size. The charts in this chapter also show that there are differences in local and international firms in terms of performance. Furthermore the chapter covered the analysis data using t-test, ANOVA test and regression analysis in order to examine whether the factors identified in this study have a statistically significant impact on firms' performance.

In addition, the model in this research was tested using regression analysis. The empirical findings indicate the important role of different factors in the internal and external performance of oil companies. The factors identified in the study include exploration, production and technology with R^2 of 41% for internal performance and factors include exploration, production, reserves, technology and HSE with R^2 of 48% for external performance.

CHAPTER 7: DISCUSSION

7.1 Firm Objectives

According to Stevens (2008), the objectives of NOCs reflect their purported national mission, which can be multifaceted, hard to understand, and usually conflicting. As with conventional firms, the root purposes of NOCs is the maximization of shareholder value; however, because of their 'national' status and political sensitivity, NOCs are subject to ethical and ecological limitations not borne by non-O & G firms. The shareholder of an NOC is the government; consequently, NOCs are expected to perform on behalf of the whole country rather than being simple O & G enterprises (Marcel, 2006; McPherson, 2003; Stevens, 2008; Van der Linde, 2000). Comparisons among NOCs and international oil companies are not helpful given the present divergences in targets and objectives. Diverse distinctions exist between NOCs together with their performance for the achievement of commercial as well as non-commercial targets (CEE, 2007).

The firms surveyed were asked to highlight the most five important objectives. The results displayed in Table (5.1) are in-line with the results of studies conducted by Stevens (2008), CEE (2007) and Tordo et al (2011), which found that the objectives of state-owned and private firms differ. In addition to this, the results are also similar to the findings of previous studies conducted by Nore (1980), Grayson (1981), Horn (1995) and McPherson (2003), who discussed that national petroleum firms have non-commercial targets, such as employment generation and provision of social and other infrastructure (e.g. schools, hospitals and roads).

NOCs can be employed to attain socioeconomic targets, for instance service creation for indigenous people, expansion of business and technological ability, supply of communal as well as other infrastructure, income relocation by mean of financed prices, as well as assisting government borrowing (Gayson, 1981; Horn, 1995; McPherson, 2003; Nore 1980). Non-commercial objectives may finely influence the business performance together with productivity of NOCs, but simultaneously they do not essentially diminish efficiency. Non-profit practices can be delivered resourcefully and efficiency should be calculated with respect to objectives (Tordo et al, 2011).

The Performance of NOCs should be assessed with respect to their objectives however, mission and objectives differ broadly among NOCs, relying on the policy targets of shareholders. Commonly they usually contain a few from the following: the safeguard of country-wide hydrocarbon assets, which needs the national oil company to exploit the recovery constituent on fields as well as optimize sources in proportion to the depletion plan of the country; to stimulate economic expansion, which requires NOCs to utilize financial and productive linkages at its best and to support the political concerns of the nation abroad, which implies the target function of NOCs is the conception of value for overall society (Stevens, 2008).

7.1.1 The relationship between firm objectives and performance

The role and objectives of an NOC are reported to be affected by the purposes and objectives of the country in connection with energy and petroleum strategy, and such efficiency breaks have been moderately defensible by the intricacy of objectives chased by NOCs related to the plain maximization of shareholders' returns on capital tracked by private oil companies (Tordo et al, 2011).

The survey demonstrated that firms having a limited breath of objectives including increase in production, reserves, employment and development of new wells perform lower than other firms which have other type of objectives. Conversely, organizations with the targets of improving goods and services, entering new technology fields, investment into employees, dedication to health, safety and environment and maximization of shareholder capital are reported to have greater performance. Organizations which have the objectives of high production, increasing stocks, introducing new wells, production protection and reduction of production expenditure were reported to give somewhere between superior and poor performance. These results corroborate previous studies (Al-Obaidan & Scully, 1991; Hartley & Medlock, 2008; Victor, 2007; Wolf & Pollit, 2008; Tordo et al, 2011), which found that semi-privatizations can increase the efficiency of petroleum firms.

Alternatively a repeated disapproval of privatization research works is that state and non-state organizations cannot be eloquently contrasted on the foundation of business performance specifically in profitability on account of their intrinsically diverse target functions (Bozec et al, 2006). Wholly state-governed firms usually track non-profitable

socio-political objectives, so that fewer returns do not certainly symbolize elevated expenditures as well as technical inefficiencies, rather they may indicate community outputs (Wolf, 2008). Additionally, non-profitable targets may ultimately influence the long-term profitable performance as well as productivity of NOCs.

In light of these results, the important objectives that need to be devised by petroleum firms consist of entering new technology fields, enhancement of quality of product and service, investment into employees, commitment towards health and safety and lastly maximization of investor capital. This study shows petroleum firms with such targets can do better as compared to those firms that concentrate on high production.

7.2 Ownership

The effect of ownership on entrepreneurial performance has been commonly inspected in the economic context; the ownership configuration affects the mission and objectives of NOCs together with the existence of inducements that encourage cost competence together with novelty. On the whole, national oil organizations that are entirely held by the government lean towards bigger state targets and smaller quantity of inducements to improve effectiveness compared to semi-private national oil organizations (Tordo et al, 2011).

In light of the results shown in chapter 5, the portion of state-owned firms is 41% whereas joint project firms comprise 30%; the remaining 29% is wholly private firms. The results show that public division holds the maximum portion of possession in Libya. The survey results show that petroleum exploration as well as drilling has higher level in the private firms as compared to the joint venture together with state-owned firms.

Al-Obaidan & Scully (1991) found that the level of efficiency in state-owned companies averages 61-65% in comparison with the private firms based on profit maximization. In the same vein, Victor (2007) examined the comparative efficiency of national and private oil organizations to convert sources into production as well as revenue. It was concluded that the private organizations were one-third more efficient than NOCs in converting reserves into real output, and they were inclined to produce appreciably more returns per unit of output. Likewise, Wolf & Pollitt (2008) studied 28 NOCs from 20 diverse states from 1977

to 2004 and reached the conclusion that privatization is related with elevated profitability, better functional effectiveness, greater return and reduced employment.

Hartley & Medlock (2013) studied 61 companies from 2001-09 to evaluate the income efficiency. They concluded that NOCs are usually less efficient than shareholder-owned firms. They also revealed that semi-privatizations enhance operational efficiency. Conversely, Hartley & Medlock (2008) discussed that a good amount of ineffectiveness of NOCs is in-line with the proposition that the state as owner directs resources to diverse organizational targets. It was also discussed in their research that political push is expected to compel NOCs to vend their products at prices lower than the usual market prices, and also to provide work for more employees than they actually require. However, Wolf (2008) highlighted that neither the hypothetical nor experiential literature have up to now been capable of supplying significant facts as to whether government or non-state ownership is naturally better in encouraging economic efficiency, or whether privatization is a suitable instrument to develop organizational performance and effectiveness. He stated that most academics consider that in the conditions of aggressive market competition, non-state owned firms are more efficient and profitable.

Exploration is an uncertain business despite the fact that the possibility of success of exploration drilling has been progressively growing in recent years (Tordo et al, 2011). There are diverse reasons that could be related to these outcomes. However, petroleum exploration as well as drilling does not merely need important resources but also data concerning relevant positions. It also needs scientific ability together with project management proficiency. As exploration involves greater risks, organizations want risk-administration techniques for this practice. According to Ghandi & Lin (2014) & Tordo et al (2011), non-state organizations are normally risk takers, whereas state firms circumvent risk; hence, the success level of exploration as well as drilling is greater among private firms.

According to Tordo et al (2011), progression in production together with the reserve replacement rate are typical indicators of upstream efficiency, whereas the exploration achievement rate might be taken as a supplementary measure of technological as well as geophysical capability as it is already incompletely captured by the reserve replacement rate. Another cause could be related to these findings: state-owned firms generally hire the services of petroleum firms for the exploration as well as drilling practices. In measures of

oil production as well as stocks, the findings showed that state-owned firms have a greater scale of petroleum production together with reserves as compared to private and joint venture firms equally. NOCs together with their state of origin, not international petroleum firms and their shareholders, mainly direct the progress of upstream petroleum resources (Victor, 2007).

The results of the study are in-line with the earlier work of Victor (2007) as well as CEE (2007), which could be related to the organizational targets as discussed together with schemes on the production of petroleum reserves available. In addition, the findings showed that private firms have a greater level of petroleum technology than both state-owned as well as joint venture firms. On the other hand, state-owned firms seem to have the lowest scale of technology improvement. Technological improvement is a very significant element in the petroleum sector (Steven, 2008; Tordo et al, 2011; Victor, 2007). In order to attain success, it is imperative for enterprises to modernize technology so as to deal with changing requirements.

Tordo et al (2011) found that NOCs tend to deal with and maintain the asset base that was passed to them, and most failed to spend on the improvement of facilities or novel technologies. Further, Stevens (2004) discussed that the majority of NOCs lack technical capability and lost the capacity to start more advanced projects independently. Concerning health, safety and the environment, again the survey findings showed that private firms perform better possibly linked to technology, because these firms spend an important portion of income on technology upgrades that include health and safety equipment (Tordo et al, 2011). Moreover, the state owned firms are greatly reliant on oil services companies for many operational practices.

According to survey results, private firms reported higher performance than public and joint venture firms, while joint venture firms outperformed public firms. These results verify earlier research work concluding that NOCs are generally significantly less efficient than private international oil firms (Al-Obaidan & Scully, 1991; Hartley & Medlock, 2008; Steven, 2008; Victor, 2007; Wolf, 2008; Tordo et al, 2011). There are several potential reasons for this. For example, NOCs tend to be overstaffed and their employees are often overpaid relative to average income per occupation (Waelde, 1995). In addition to this, NOCs were accused for employing considering relatives or tribal instead of relying on requirement together with performance (Al-Mazeedi, 1992).

There are motivating and necessary features of good national oil company performance, for instance, human capital as well as talent base, technical ability, as well as industrial partnerships (Tordo et al, 2011). Wolf (2008) emphasized that because profit is not a key consideration of NOCs, lower cost efficiency cannot be considered a credible benchmark of success as other drivers than profit maximization are the core of the organizational mission.

7.3 Size

As stated in chapter 5, the firms were divided into groups on the foundation of the number of workers to large, medium-sized as well as small firms (all are characteristically private firms).

It was found that most organizations in Libyan O & G are large firms owned by the state. Petroleum operations inside these petroleum firms are pretty alike as far as the extent of the firm is concerned, which backs up the findings of Victor (2007), who proposed that size counts as less of an issue in the petroleum industry compared to ownership, particularly for NOCs.

In measures of petroleum exploration, drilling, technology improvement together with health, safety and environment, smaller firms appear to perform more effectively than medium and large firms. Large firms have the greatest scale of petroleum production, whereas medium firms are greater in reserves. These findings could be explained by the ownership type, as large firms are totally state owned while small firms are private companies.

7.4 Firms' Practices for KPIs

According to PESD (2006), making use of KPIs appropriately hypothetically can be accessed from dissimilar perspectives, as they are directly linked with the entrepreneurial policy or directly participate to the organizational strategic objectives.

The survey findings regarding petroleum firms' KPIs, as can be seen in the Table (7.1) that private firms appear to measure their KPIs more regularly (e.g. on a weekly basis), joint project firms calculate them periodically and on monthly foundations, but state-owned firms calculate KPIs midyear.

Table 7.1: Measuring KPIs based on ownership

Public firms	*Joint venture firms*	*Private firms*
midyear	monthly	weekly
yearly	quarterly	monthly

The employment of fundamental performance indicators appeared as effectual in reaching desired outcomes. Firms that make use of KPIs are more efficient than firms that do not make use of such indicators. The results of the research propose that in Libya, the employment of KPIs is greater among private as well as joint venture firms as compared to the public firms, which again revealed the bureaucratic setting of state owned firms (Al-Mazeedi, 1992; CCE, 2007; Wolf, 2008).

The employment of KPIs adds towards better performance of firms. The utilization of KPIs is apparent from the survey as greater among private firms as compared to public and joint venture firms; consequently, private firms have higher performance in Libya. In addition to this, the utilization of KPIs is least in state-owned firms, which may relate to their lower performance. The performance of public firms is lower as compared to private and joint-venture firms.

7.5 Oil Services Companies

According to survey results, firms use oil services companies in different activities, which differ from state owned to joint venture as well as to private firms. Table (7.2) summarizes these activities based on ownership type.

Table 7.2 The main five activities that oil services companies used for based on ownership

Activity	*Ownership type*
exploration	public & joint venture
equipment	public & joint venture
drilling	public & joint venture
train and develop technical people	public
oil condition monitoring	public
implementing new technology	joint venture
consultations	joint venture
product and technology innovation	private
knowledge management	private
infrastructure	private
transport of crude oil and gas	private
train and develop technical people	private

Such results revealed that petroleum firms benefit from employing the activities of shipping of crude oil, training together with expansion of technical employees, product together with technology innovation, infrastructure expansion as well as knowledge management so as to prove superior performance. This backed up the point that an efficient organization would make use of partnerships as segment of a detailed and comprehensive scheme to manage risk as well as to focus in fields of relative gain (PESD 2006).

Petroleum field services contain an amount of secondary services in the exploration and production processes, for instance environmental together with geophysical appraisals and examination, drilling, tools supply, and engineering ventures, as they outline an essential segment of the general petroleum and power industry (Tordo et al, 2011).

The business procedures of petroleum producing firms are multifaceted, whereby petroleum reservoirs are acknowledged by the support of ecological work area. Large firms, such as Exxon Mobil, do not make the tools but they deal with business and industrialized companies for the procedure, whereas the service companies supply required infrastructure, tools and services.

The petroleum firms are engaged in the process of exploration, production, extraction, and shipping. According to Ghandi & Lin (2014), the greater risks as well as challenges have made it crucial that national petroleum firms are dependent upon the oilfield service companies, because oilfield companies are those that are expert in drilling together with supplementary services.

7.6 The Impact of Oil Operations on Firms' Performance

Figure 7.1 shows the proposed oil operations and objectives examined in this research for the attainment of higher performance. Upstream industry is known as exploration and production, drilling is taken as a part of the E & P activity, as can be seen in Figure (7.1), which shows that the two main operations are production and reserves. This is so because reserves are existing result of exploration and drilling while the production process starts by producing these reserves. Organizational objectives as mentioned in the literature influence the operations, technology upgrades and health, safety and environment, which affect the operations and thus the overall performance.

The study outcomes validates that firms are different in terms of targets. Previous studies (Marcel, 2006; McPherson, 2003; Stevens, 2008) reported the significance of organization targets on the organizational performance, for example the objectives of NOCs take in profitable and non-profitable targets which can be multifaceted, but private firms have obvious objectives, and for this reason they diverge in their performance, and also they have an efficiency gap.

The results of the regression analysis show that the performance of the oil firms has been measured via various variables which include exploration, drilling, production, reserves, technology, as well as health, safety and environment. The variables showed to be causing around 48% changes within the firms' performance, which means that the leftover variance or changes are caused by some other factors as well (Victor, 2007). The regression analysis indicates that oil organizations' performance is definitely influenced by exploration, production, reserves, technology, and health, safety and environment. The results suggest which of the firm operations should be paid more attention to for enhancing greater performance.

This aligns with the finding by Victor (2007), who suggested that production and reserves have major impact on the firm performance. Also, Steven (2008) and CEE (2007) reported that exploration, production, reserves, technology and health, safety and environment are considered to be performance indicators for the oil organizations. Further, the results highlight that reserves have the largest influence on the firms' performance however, drilling has no significant impact on performance, which could be related to the upstream oil sector (including drilling) commonly being under E & P. Besides, the drilling was considered to be a factor of the research model after the pilot study feedback.

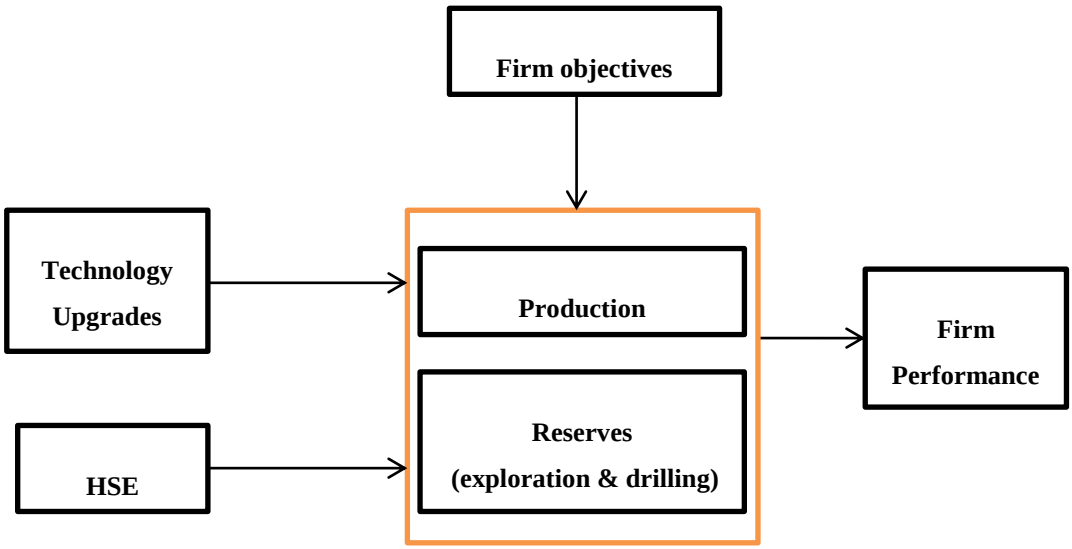


Figure 7.1: Oil operations and firm objectives proposed and examined in this research for improved performance

7.7 The influence of asset management and partnerships

Figure (7.2) demonstrates proposed asset management and partnerships examined in this research in order to achieve advanced operations performance.

The results of the regression analysis suggest that oil exploration and drilling are not influenced by asset management, however, the regression analysis indicates that asset management has a significant impact on the other factors of production, reserves, technology upgrades and health, safety and environment. Moreover, the results report that asset management significantly has the largest impact on health, safety and environment is. The finding suggests that the firm should focus more on managing the asset in order to enhance the firm operations.

This aligns with the work of Schuman & Brent (2005), who discussed that asset management reduces the working expenses by maximizing fortification setting up, therefore the key gains of an asset management strategy are higher asset reach together with performance in conjunction with optimized process and safety efficiency. The study of Kongezos & Jellum (2012) is verified by the results obtained through Schuman & Brent

(2005), suggesting that management of assets in the modern industrial period is the motivation for higher revenues by employing assets in the most efficient way.

The regression analysis highlights that factors like reserves and health, safety and environment do not get influenced by partnerships; on the other hand, the regression results report that the partnerships have high influence on oil exploration as well as drilling, production and technology upgrades. Hence, the results suggest that to enhance the enterprise operation activities, it is highly recommended for firms to work along with partners for those activities. This supports the work of the Tordo et al (2011), which observed that oilfield services entail extensive supplementary services in the exportation and production progression. They constitute a central element of the whole petroleum industry. In addition to this, Ghandi & Lin (2014) discussed that the national petroleum firms are based greatly on oilfield service companies due to greater risks and threats.

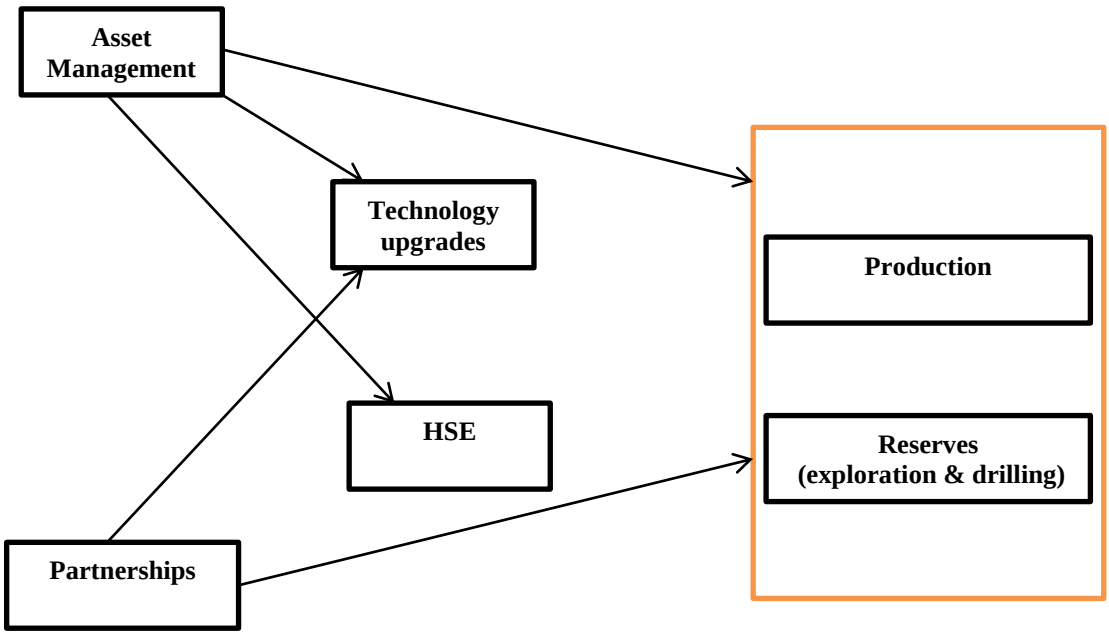


Figure 7.2: Asset management and partnerships proposed and examined in this research for higher firms' operations performance

7.8 Chapter Summary

This chapter examined the research data using the t-test, ANOVA test, and regression analysis. It was found that exploration, production, reserves, technology upgrades and

health, safety and environment have significant positive impacts on Libyan oil firms' performance. Firm' objectives that need to be devised by petroleum firms were highlighted including entering new technology fields, enhancement of quality of product and service, investment into employees, commitment towards health and safety and lastly maximization of investor capital further, the role of ownership was highlighted in this research and the survey results showed that private firms have higher performance than public and joint venture firms. The finding suggests that the firms should focus more on managing the asset in order to enhance the firm operations. In addition, the results suggest that to enhance the enterprise operation activities, it is highly recommended for firms to work along with partners for those activities. The next chapter will conclude this research by highlighting academic and practical implications, limitations, and suggestions for future studies.

CHAPTER 8: CONCLUSIONS

8.1 Introduction

The major aim of the research is to examine the associated evolution of operational performance management and metrics for oil companies and propose a model for performance measures for monitoring oil operations.

The regression analysis of the survey results showed that the overall oil exploration and drilling were less influenced by asset management practices, however, asset management has an influence on all the other factors. The examination of business partners showed all factors except reserves and health, safety along with environment are influenced by the involvement of partners. The internal performance outcomes with R^2 of 41% rely on all factors except drilling activity, reserves and HSE. Similarly, the external performance outcomes with R^2 of 48% rely on all factors except drilling activity.

The field research data was analysed using reliability test, normality test, multicollinearity test, independent t-test, and ANOVA. ANOVA test results show that the 7 public companies, 5 joint venture companies and 5 private companies have different levels of oil operation activities, mainly depending on their type of ownership, which also has a significant influence on firms' objectives.

As per the first and second research questions (what aspects of oil operations have the greater influence on performance?) and (To what extent do asset management and partnerships influence oil operations?), the study identifies all elements which have a major influence on the operations and performance of firms for which an effective quantitative analysis was conducted through SPSS via the correlation and regression test. Factors like asset management and partnerships have influences over oil operations showed some fruitful insights, which would help in controlling the performance management of Libyan oil firms in the long run.

The descriptive analysis of the research helped in framing down numerous characteristics like exploration, drilling, production, reserves, technology upgrades, HSE and firms' objectives, which impact the overall performance, which explains the third and fourth research questions (What level of influence does the firms' objectives have on

performance?) and (What are the characteristics of oil firms in Libya in terms of oil operations?)

Further, maintenance approaches, firm' objectives, partnerships and asset management have also been highlighted and studied to understand their influence on the operations of Libyan oil firms. In the earlier chapters of this thesis the research model and hypotheses were tested while discussing the data analysis and results. Wrapping up this thesis, this section will shed light on the significance, practical implications, theoretical contributions, limitations and recommendations of this study.

8.2 Summary of Research Findings

The wide gap between the private, public and joint ventures was evident in the oil sector of Libya. The difference in the core objectives of the public and private sector, when it concerns the oil firms of Libya, was put forward by all those who were surveyed. While private sector's prime concern was to improve on the product and service factor, the main purpose of the public firms in the sector was to increase production. The private sector has an upper hand when it comes to the average score for the oil exploration and drilling, while the public sector and the joint ventures have an edge over the private firms when it comes to the amount of reserves and production. On average, private firms also have an edge when it concerns the HSE and technology upgrades as compared to the public sector.

The size of the firm is also very significant when it concerns the production level and health, safety and environment. The production of oil is remarkably different for the large and smaller firms in terms of capacity. Similarly, HSE also varies greatly according to the size of the firm. When the classification of the oil companies is used to examine the asset management priority and its practices, the difference between the three major divisions is clearly substantive. Operation and maintenance, facilities management, health, safety and environment are included as some of the prime concerns for the private organization within the oil sectors, while the public and joint ventures of Libyan oil sector focuses more on the reservoir management while keeping the operations and maintenance, health, safety and environment in check.

Partnership pattern also differentiates the private sector from the others when it comes to the oil industry of Libya. Partners are generally favoured by the private firms who have the

independence of choosing the oil service partners. The joint ventures are least likely to come up with the possibility of using partners. However, when it comes to the production and monitoring, the public and joint ventures are more likely to opt for partners than their private counterparts. Similarly, private firms are more likely to take partners on board when it concerns the improvement of facilities, system upgrades, infrastructure, logistics and supply. Hence there are extensive differences in all three divisions of the oil sector in Libya when it comes to performance with private sector outperforming the other two.

In terms of internal versus the external performance: small firms reported to have the highest performance, medium firms have better external performance while medium and large firms are nearly equal when it concerns their internal performance. Private firm boast lower costs while public firms incur higher maintenance costs compared to the other two divisions of the oil sector in Libya.

It was found during the survey that private companies favour time based maintenance and total productive maintenance more than the other two divisions in the oil sector, which rely on the corrective measures and conditions based maintenance within their firms. Similarly, when it concerns the evaluation and measuring of KPIs for the oil sector, there is a wide gap in all three divisions. Since private firms are more concerned with output and maximization of the efficiency of the input resources, these firms put more emphasis on the KPIs which affect the overall financial performance of the firm than the other two divisions of the oil sector in Libya.

8.3 Research Findings from Regression Analysis

The findings as per the regression analysis are as follows:

With Beta 0.227, the partnership use makes a significant contribution to oil exploration.

With Beta 0.201, partnership use makes a significant contribution to oil drilling.

With Beta 0.335, asset management makes the strongest contribution to oil production. Thus, company production is significantly affected by both the asset management and use and benefits of being in a partnership.

With Beta 0.312, the benefits of partnership and asset management have a significant effect on the reserves while ensuring a stronger contribution for asset management.

With Beta 0.253, oil technology is strongly supported by partnership. Thus partnership use and asset management have a positive impact on the technology.

With Beta 0.459, health, safety and environment are also significantly impacted by asset management.

With Beta 0.383, technology heavily contributes to the internal performance outcome of the company. It is fair to say that technology along with production and exploration provides for significant impact on the internal performance outcome. The R^2 for these factors is 41%.

With Beta 0.375, the company performance outcome for external performance is heavily impacted by the reserves present. Thus, company external performance outcome is strongly influenced by the technology, production, reserves, exploration, health, safety and environment. The R^2 for these factors is 48%.

8.4 Research Contribution to Knowledge

1) This study represents an original attempt that the criteria for performance management was broken down into more practical practices that can be used to reasonably evaluate the performances of a firm within the oil sector.

2) The asset management, partnership and the oil operations theories within a firm is integrated within the proposed model for the first time in this study. This is likely to enhance the firms' chances of improved performances and accessing external knowledge and expertise.

3) This research is one of the first empirical studies that attempts to explain the synergy between asset management and partnerships in the context of oil industry both within the public and private sectors of developing countries and their impact on the firms' operations. Further, this research explains which operation practices positively impact the firms' performance, consequently leading to higher performance.

4) This study is one of the very few studies that quantitatively examined the Libyan oil firms based upon their performances. This contributes to the body of knowledge regarding the performance of oil firms and also fills a large gap due to the unavailability of any substantial relevant data.

5) With its focus on a developing country, this study has definitely brought some valuable insights to the existing literature concerning oil performance measurement as far as its pragmatic evidence is concerned, which identifies numerous factors such as; exploration, production, reserves, HSE and technology upgrades that have a major influence over the performance of the firm in the oil sector.

6) This particular study has developed an incorporated model for oil operations, which can aid business decision makers within the oil industry to monitor their overall performance hence, gaining more knowledge about the areas of improvements.

8.5 Theoretical Contributions

All the findings of this particular study offer numerous implications for academics concerning about factors that would influence the implementation of oil operations along with the performance of firm within the developing countries. This research offers quantitative data pertaining to the practices of Libyan firms and their performance, while revealing the differences between the performance practices of private, joint venture and public firms.

Theoretically this study has filled a large gap of knowledge which on the capabilities of Libyan oil firms. The factors discussed in detail within the research are some of the most integral elements that Libya needs to give most attention to and a strong reference for other developing countries.

Firstly, this study provides an empirical evidence for the existing body of literature concerning oil firms to better understand the phenomena in developing countries.

Secondly, the implications of this research are likely to be very significant because the study incorporated a number of very important factors for empirical evaluation of the oil firms' performance by the integration of asset management and partnerships in the

proposed model. The overall explanatory power was found to be R^2=48% (external) and R^2=41% (internal).

Thirdly, in terms of literature on performance measurement of oil firms, this research has actually supported and complemented a number of their results, mainly the significance of upgrades of exploration, production, reserves, HSE and technology in obtaining good performance.

Finally, the results which have been obtained from Libya can be worked upon other developing countries, because this study has taken up private companies which function internationally mainly in other developing countries.

8.6 Managerial Implications

The study helps future decision makers to make informed decisions based on the knowledge in this study regarding the improvement in the firms' performance. This research showed numerous findings as far as the factors which influence the performance of Libyan firm is concerned. These findings help to understand numerous valuable realistic implications while offering the managers with a handy tool to comprehend the main drivers as well as the situation of the firm for obtaining higher performance. Technology upgrades have been studied as an important factor linked to independent variables that work for the internal performance outcomes of the company (beta=0.383, R^2 for all factors is 41%). Reserves was considered to be the most integral factor amongst all independent variables, which contribute along with the external performance outcomes of the company (beta=0.375 and R^2 for these factors is 48%).

As mentioned earlier, this particular research offers integral business decision makers with significant elements that help in monitoring the performance of the firm. Firstly, the study recognized some important strategic routines which would aid the firms to utilize their resources in a much more efficient manner, such as its findings on the benefits of using partners, asset management, services provided by oil services companies, measuring KPIs and applying maintenance approaches and then understanding the firms' operations along with recognizing which of the operations are more influential with the firms' performance, and which of them are making greater contributions.

The results also revealed that private firms get good upgrades of technology compared to public firms within Libya, which explains why Libyan public firms have lower performance than private firms. The results also revealed that oil drilling does not much have an impact on the performance of the oil firm.

As far as partnership is concerned, it is important within the operations of a firm that there should be partners' support in the firms' performance, and this particular research actually specifies all the activities of the business that firms should consider to work out partnership. As far as asset management is concerned, this research also highlights the business activities that should be given a priority for asset management.

8.7 Achieving the Research Objectives

The objectives within this study have been obtained by applying two different approaches. First, an extensive review of related literature produced a thorough understanding of the background of performance measurement as well as oil operations. Secondly, field research developed and investigated a conceptual framework that included performance measures for current as well as future oil operations along with asset management, which empirically confirmed the factors that influence the performance of oil firms.

The first objective of carrying out a comprehensive literature review was achieved, particularly regarding three main areas: performance management, operation management and oil operations, as presented in chapters 2 and 3.

The second and third objectives were obtained by carrying out the statistical tests that studied reliability, correlation and regression test, presented in detail in chapter 6.

The fourth objective was accomplished by carrying out interviews with managers of Libyan oil firms, also presented in chapter 6.

8.8 Answering the Research Questions

The following research questions have been addressed and studied concerning oil firms' performance in Libya along with factors influencing their operations. If oil companies understand these factors, they can easily enhance their services and performance:

Research question 1: What aspects of oil operations have greater influence on performance?

For identifying what elements have the greatest influences on the firms' performance, statistical and quantitative analysis was conducted using SPSS via the correlation and regression test. The analysis and results can be viewed in chapter 6.

Research question 2: To what extent do asset management and partnerships influence oil operations?

Again, the correlation and regression test were carried out to understand this particular question as analysed in chapter 6.

Research question 3: What level of influence do the firm objectives have on performance?

The descriptive analysis presents different characteristics, including different oil operations activities as well as the objectives of the firm. A detailed account of this can be viewed in chapter 5.

Research question 4: What are the characteristics of oil firms in Libya in terms of oil operations?)

Again, the descriptive analysis presents different characteristics, including different oil operations activities, the objectives of the firm, as well as asset management and partnership practices. A detailed account of this can be viewed in chapter 5.

8.9 Research Limitations

Even though the researcher has given the best of his time and effort, there are inevitably limitations in every study. Firstly, performance measurement is mainly a complicated management topic and this particular study mainly aims on the perspective of the firm rather than the individual perspective. Hence, this study mainly aims to investigate the practices applied by firms to take advantage of all resources which are available, encompassing partnerships. This study did not encompass the characteristics or skills of the employee, even though the perspective of the individual level was equally important within the study of firm performance as it can give a better and bigger picture of how firms might augment their performance. This reveals the fact that it would have been better to

include both firm-level and individual-level data, however that would have made the research objectives unreasonable because of the limited time as well as resources available.

The data collected is cross-sectional, which signifies that not only the independent but also the dependent variables have been measured at the same time. Even though such a kind of data is well accepted in organizational research, it has its own set of limitations for offering a cause-and-effect relationship of what has been investigated. Other than this, the data itself is mainly based on active firms only during the data collection period, therefore, there are limitations to generalize the results to other absent firms. Furthermore, even though the researcher made great efforts in the deployment of mixed methods, the limited time and limited resources resulted in using quantitative approach more which led to greater weight on quantitative study and limited number of interviews could not provide a detailed study of the research compared to qualitative study, particularly as this is an developing area of research (particularly as it relates to Libya) that could have benefitted from a more qualitative perspective.

8.10 Conclusions

This research was undertaken to understand how oil firms could increase their performance. An intensive literature review was conducted with a focus on the firm level. In a thematic fashion, the literature integrates three main areas of knowledge including performance measurement and management, oil operations and operation management. As a result, a research model was conceptualised. Methodologically, the research is quantitative-dominant. The data were collected from 17 oil firms in Libya including private, joint venture and public firms. Using 85 responses, the data were analysed and the research model was revised and validated through qualitative research.

It is found that the public, joint venture and private companies have different levels of oil operation activities and objectives, mainly depending on their type of ownership. It was also found that oil private firms in Libya have higher internal and external performance compared to joint venture and public firms.

Asset management and partnership practices are important for the oil operation activities; oil companies could increase their operations efficiency if they are successfully managing partnership and asset management activities. Asset management has an influence on

production, reserves, technology upgrades along with health, safety and environment. Similarly, business partners have an impact on exploration, drilling, production and technology upgrades.

Moreover, the research highlighted different factors used to measure the performance of oil firms. The internal performance relies on exploration, production and technology upgrades. Similarly, the external performance outcome relies on factors including exploration, production, reserves, technology upgrades and health, safety and environment. The technology upgrades make the strongest contribution to the company internal performance in the same way, the reserves makes the strongest contribution to the company external performance. These findings help the oil firms monitoring their performance and have clearer picture about the areas of investment to obtain higher performance.

8.11 Recommendations for Future Research

The following are some recommendations for future research directions, which can be taken up by researchers:

1. Future work is recommended for complementing this study by analysing the individual perspective of the research model. It would be better to study practices including employees' attitude and how they add value to the performance of a firm.

2. One of the interviewees also suggested that more investigation should be carried out on drilling, as he thinks that asset management has a positive influence on oil drilling.

3. The researcher advises further research from other developing countries to examine the oil operation management practices and performance measures. Global perspectives are important to set an example or more likely a standard of what helps and what does not.

4. The asset management and partnerships practices studied in this research represent a basis for key performance indicators for oil operations, Other research may expand this particular work by developing KPI tools, mainly by applying the practices of asset management and partnerships studied within this research to support firms operations and monitor their performance practices.

5. This study can be replicated to find out more about the partnership benefit with greater focus on motivators and inhibitors from the perspective of employees working along with partners within the oil firms and the manner in which they can not only influence but also benefit from this specific relation.

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APPENDICES

APPENDIX A: ANOVA RESULTS

Table A.1 Descriptive data of company drilling

	N	*Mean*	*Std. Deviation*	*Std. Error*	*95% Confidence Interval for Mean*		*Minimum*	*Maximum*
					Lower Bound	*Upper Bound*		
Public	35	2.26	.950	.161	1.93	2.58	1	4
Joint venture	25	2.40	.957	.191	2.00	2.80	1	4
Private	25	3.00	.816	.163	2.66	3.34	1	4
Total	85	2.52	.959	.104	2.31	2.72	1	4

Table A.2 ANOVA test comparing the mean of public, private and joint venture

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	8.538	2	4.269	5.096	.008
Within Groups	68.686	82	.838		
Total	77.224	84			

Table A.3 Multiple comparisons, Tukey HSD (drilling)

(I) type of ownership	(J) type of ownership	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Public	Joint venture	-.143	.240	.823	-.71	.43
	Private	-.743*	.240	.007	-1.31	-.17
Joint venture	Public	.143	.240	.823	-.43	.71
	Private	-.600	.259	.059	-1.22	.02
Private	Public	.743*	.240	.007	.17	1.31
	Joint venture	.600	.259	.059	-.02	1.22

*. The mean difference is significant at the 0.05 level.

Table A.4 Descriptive data of company production

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public	35	2.92	.954	.191	2.53	3.31	1	4
Joint venture	25	2.43	1.354	.271	1.84	2.96	1	5
Private	25	2.40	1.378	.233	1.96	2.90	1	5
Total	85	2.56	1.267	.137	2.29	2.84	1	5

Table A.5 ANOVA test comparing the mean of public, private and joint venture

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.483	2	2.241	1.409	.250
Within Groups	130.411	82	1.590		
Total	134.894	84			

Table A.6 Descriptive data of company reserves

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public	35	3.00	.866	.173	2.64	3.36	1	5
Joint venture	25	2.89	1.451	.245	2.39	3.38	1	4
Private	25	2.04	.841	.168	1.69	2.39	1	4
Total	85	2.67	1.199	.130	2.41	2.93	1	5

Table A.7: ANOVA test comparing the reserves mean of public, private and joint venture

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	14.274	2	7.137	5.495	.006
Within Groups	106.503	82	1.299		
Total	120.776	84			

Table A.8: Multiple comparisons, Tukey HSD (reserves)

(I) type of ownership	*(J) type of ownership*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
					Lower Bound	*Upper Bound*
Public	Joint venture	.114	.298	.922	-.83	.60
	Private	.960*	.322	.011	-1.73	-.19
Joint venture	Public	-.114	.298	.922	-.60	.83
	Private	.846*	.298	.016	-1.56	-.13
Private	Public	-.960*	.322	.011	.19	1.73
	Joint venture	-.846*	.298	.016	.13	1.56

Table A.9: Descriptive data of company technology

	N	*Mean*	*Std. Deviation*	*Std. Error*	*95% Confidence Interval for Mean*		*Minimum*	*Maximum*
					Lower Bound	*Upper Bound*		
Public	35	3.31	.900	.152	3.01	3.62	2	5
Joint venture	25	3.48	.770	.154	3.16	3.80	2	5
Private	25	3.56	.917	.183	3.18	3.94	2	5
Total	85	3.44	.865	.094	3.25	3.62	2	5

Table A.10 ANOVA test comparing the technology mean of public, private and joint venture

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	.951	2	.476	.630	.535
Within Groups	61.943	82	.755		
Total	62.894	84			

Table A.11 Descriptive data of company HSE

					95% Confidence Interval for Mean			
	N	*Mean*	*Std. Deviation*	*Std. Error*	*Lower Bound*	*Upper Bound*	*Minimum*	*Maximum*
Public	35	2.12	.666	.133	1.85	2.39	1	3
Joint venture	25	3.89	.676	.114	3.65	4.12	3	5
Private	25	4.28	.891	.178	3.91	4.65	1	5
Total	85	3.48	1.161	.126	3.23	3.73	1	5

Table A.12 ANOVA test comparing the HSE mean of public, private and joint venture

	Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Between Groups	68.001	2	34.000	61.651	.000
Within Groups	45.223	82	.551		
Total	113.224	84			

Table A.13 Multiple Comparisons, Tukey HSD (HSE)

(I) type of ownership	(J) type of ownership	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Public	Joint venture	-1.766*	.194	.000	-2.23	-1.30
	Private	-2.160*	.210	.000	-2.66	-1.66
Joint venture	Public	1.766*	.194	.000	1.30	2.23
	Private	-.394	.194	.112	-.86	.07
Private	Public	2.160*	.210	.000	1.66	2.66
	Joint venture	.394	.194	.112	-.07	.86

*. The mean difference is significant at the 0.05 level.

Table A.14 Descriptive data of company asset management.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public	35	27.6571	3.42948	.57969	26.4791	28.8352	20.00	33.00
Joint venture	25	23.7200	3.42199	.68440	22.3075	25.1325	16.00	29.00
Private	25	29.0400	2.89367	.57873	27.8456	30.2344	23.00	33.00
Total	85	26.9059	3.88717	.42162	26.0674	27.7443	16.00	33.00

Table A.15 ANOVA test comparing the asset management mean of public, private and joint venture

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	387.361	2	193.681	18.009	.000
Within Groups	881.886	82	10.755		
Total	1269.247	84			

Table A.16 Multiple comparisons, Tukey HSD (asset management)

(I) type of ownership	(J) type of ownership	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Public	Joint venture	3.93714*	.85876	.000	1.8873	5.9870
	Private	-1.38286	.85876	.247	-3.4327	.6670
Joint venture	Public	-3.93714*	.85876	.000	-5.9870	-1.8873
	Private	-5.32000*	.92756	.000	-7.5341	-3.1059
Private	Public	1.38286	.85876	.247	-.6670	3.4327
	Joint venture	5.32000*	.92756	.000	3.1059	7.5341

*. The mean difference is significant at the 0.05 level.

Table A.17 Descriptive data of company partnership use.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public	35	29.4857	4.23134	.71523	28.0322	30.9392	17.00	35.00
Joint venture	25	28.1200	6.09863	1.21973	25.6026	30.6374	16.00	34.00
Private	25	31.7600	3.12623	.62525	30.4696	33.0504	25.00	39.00
Total	85	29.7529	4.76322	.51664	28.7255	30.7803	16.00	39.00

Table A.18 ANOVA test comparing the partnership use mean of public, private and joint venture

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	169.869	2	84.934	4.012	.022
Within Groups	1735.943	82	21.170		
Total	1905.812	84			

Table A.19 Multiple Comparisons, Tukey HSD (Partnership use)

(I) type of ownership	(J) type of ownership	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Public	Joint venture	1.36571	1.20485	.496	-1.5103	4.2417
	Private	-2.27429	1.20485	.149	-5.1503	.6017
Joint venture	Public	-1.36571	1.20485	.496	-4.2417	1.5103
	Private	-3.64000*	1.30138	.017	-6.7464	-.5336
Private	Public	2.27429	1.20485	.149	-.6017	5.1503
	Joint venture	3.64000*	1.30138	.017	.5336	6.7464

*. The mean difference is significant at the 0.05 level.

Table A.20 Descriptive data of company partnership benefit

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public	35	14.6571	2.91994	.49356	13.6541	15.6602	9.00	19.00
Joint venture	25	15.3600	2.39583	.47917	14.3711	16.3489	10.00	20.00
Private	25	16.1200	1.98578	.39716	15.3003	16.9397	11.00	20.00
Total	85	15.2941	2.56730	.27846	14.7404	15.8479	9.00	20.00

Table A.21 ANOVA test comparing the partnership benefit mean of public, private and j-v

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	31.361	2	15.681	2.462	.092
Within Groups	522.286	82	6.369		
Total	553.647	84			

Table A.22 Descriptive data of company internal performance outcomes.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public	35	17.8857	3.40217	.57507	16.7170	19.0544	11.00	23.00
Joint venture	25	18.8400	2.64071	.52814	17.7500	19.9300	13.00	23.00
Private	25	20.3600	2.07926	.41585	19.5017	21.2183	17.00	24.00
Total	85	18.8941	2.99612	.32498	18.2479	19.5404	11.00	24.00

Table A.23 ANOVA test comparing the internal performance outcomes mean of public, private and joint venture

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	89.384	2	44.692	5.514	.006
Within Groups	664.663	82	8.106		
Total	754.047	84			

Table A.24 Multiple Ccmparisons, Tukey HSD (internal performance outcomes)

(I) type of ownership	(J) type of ownership	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Public	Joint venture	-.95429	.74553	.410	-2.7339	.8253
	Private	-2.47429*	.74553	.004	-4.2539	-.6947
Joint venture	Public	.95429	.74553	.410	-.8253	2.7339
	Private	-1.52000	.80526	.149	-3.4422	.4022
Private	Public	2.47429*	.74553	.004	.6947	4.2539
	Joint venture	1.52000	.80526	.149	-.4022	3.4422

*. The mean difference is significant at the 0.05 level.

Table A.25 Descriptive data of company external performance outcomes

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Public	35	16.7143	4.09858	.69279	15.3064	18.1222	10.00	24.00
Joint venture	25	18.7600	3.43123	.68625	17.3437	20.1763	13.00	23.00
Private	25	20.2800	2.86531	.57306	19.0973	21.4627	13.00	24.00
Total	85	18.3647	3.84475	.41702	17.5354	19.1940	10.00	24.00

Table A.26 ANOVA test comparing the external performance outcomes mean of public, private and joint venture

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	190.951	2	95.476	7.451	.001
Within Groups	1050.743	82	12.814		
Total	1241.694	84			

Table A.27 Multiple Comparisons, Tukey HSD (external performance outcomes)

(I) type of ownership	(J) type of ownership	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Public	Joint venture	-2.04571	.93737	.080	-4.2832	.1918
	Private	-3.56571*	.93737	.001	-5.8032	-1.3282
Joint venture	Public	2.04571	.93737	.080	-.1918	4.2832
	Private	-1.52000	1.01248	.296	-3.9368	.8968
Private	Public	3.56571*	.93737	.001	1.3282	5.8032
	Joint venture	1.52000	1.01248	.296	-.8968	3.9368

*. The mean difference is significant at the 0.05 level.

Table A.28 Descriptive data of operations based on company size

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Exploration	1-500	20	3.20	1.005	.225	2.73	3.67	1	5
	501-1499	30	2.53	1.252	.229	2.07	3.00	1	5
	1500+	35	3.03	1.224	.207	2.61	3.45	1	5
	Total	85	2.89	1.205	.131	2.63	3.15	1	5
Drilling	1-500	20	2.85	.875	.196	2.44	3.26	1	4
	501-1499	30	2.37	1.033	.189	1.98	2.75	1	4
	1500+	35	2.46	.919	.155	2.14	2.77	1	4
	Total	85	2.52	.959	.104	2.31	2.72	1	4
Production	1-500	20	3.29	.789	.170	3.59	4.31	2	5
	501-1499	30	3.67	.922	.168	3.32	4.01	2	5
	1500+	35	3.95	.759	.133	3.01	3.56	2	5
	Total	85	3.58	.864	.094	3.39	3.76	2	5
Reserves	1-500	20	3.23	1.357	.248	2.73	3.74	1	5
	501-1499	30	4.10	.788	.176	3.73	4.47	2	5
	1500+	35	3.86	5.180	.876	2.08	5.64	1	33
	Total	85	3.69	3.430	.372	2.95	4.43	1	33
Technology	1-500	20	3.75	.851	.190	3.35	4.15	2	5
	501-1499	30	3.50	.777	.142	3.21	3.79	2	5
	1500+	35	3.20	.901	.152	2.89	3.51	2	5
	Total	85	3.44	.865	.094	3.25	3.62	2	5
HSE	1-500	20	4.45	.605	.135	4.17	4.73	3	5
	501-1499	30	3.50	1.106	.202	3.09	3.91	1	5
	1500+	35	2.91	1.095	.185	2.54	3.29	1	5
	Total	85	3.48	1.161	.126	3.23	3.73	1	5

Table A.29 ANOVA test comparing the oil operations mean of small, medium and large companies

		Sum of Squares	df	Mean Square	F	Sig.
Exploration	Between Groups	6.409	2	3.204	2.272	.110
	Within Groups	115.638	82	1.410		
	Total	122.047	84			
Drilling	Between Groups	3.021	2	1.511	1.669	.195
	Within Groups	74.202	82	.905		
	Total	77.224	84			
Production	Between Groups	5.993	2	2.997	4.329	.016
	Within Groups	56.760	82	.692		
	Total	62.753	84			
Reserves	Between Groups	10.595	2	5.297	.444	.643
	Within Groups	977.452	82	11.920		
	Total	988.047	84			
Technology	Between Groups	4.044	2	2.022	2.817	.066
	Within Groups	58.850	82	.718		
	Total	62.894	84			
HSE	Between Groups	30.031	2	15.015	14.800	.000
	Within Groups	83.193	82	1.015		
	Total	113.224	84			

Table A.30 Multiple comparisons, Tukey HSD (oil operations) based on companies' size

Dependent Variable	(I) employees	(J) employees	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Exploration	1-500	501-1499	.667	.343	.133	-.15	1.48
		1500+	.171	.333	.864	-.62	.97
	501-1499	1-500	-.667	.343	.133	-1.48	.15
		1500+	-.495	.295	.220	-1.20	.21
	1500+	1-500	-.171	.333	.864	-.97	.62
		501-1499	.495	.295	.220	-.21	1.20
Drilling	1-500	501-1499	.483	.275	.190	-.17	1.14
		1500+	.393	.267	.309	-.24	1.03
	501-1499	1-500	-.483	.275	.190	-1.14	.17
		1500+	-.090	.237	.923	-.66	.47
	1500+	1-500	-.393	.267	.309	-1.03	.24
		501-1499	.090	.237	.923	-.47	.66
Production	1-500	501-1499	.283	.240	.469	-.29	.86
		1500+	.664*	.233	.015	.11	1.22
	501-1499	1-500	-.283	.240	.469	-.86	.29
		1500+	.381	.207	.163	-.11	.88
	1500+	1-500	-.664*	.233	.015	-1.22	-.11
		501-1499	-.381	.207	.163	-.88	.11
Reserves	1-500	501-1499	-.867	.997	.661	-1.51	3.25
		1500+	.243	.968	.966	-2.07	2.55
	501-1499	1-500	.867	.997	.661	-3.25	1.51
		1500+	-.624	.859	.749	-2.67	1.43
	1500+	1-500	-.243	.968	.966	-2.55	2.07
		501-1499	.624	.859	.749	-1.43	2.67
Technology	1-500	501-1499	.250	.245	.565	-.33	.83
		1500+	.550	.237	.059	-.02	1.12
	501-1499	1-500	-.250	.245	.565	-.83	.33
		1500+	.300	.211	.334	-.20	.80
	1500+	1-500	-.550	.237	.059	-1.12	.02
		501-1499	-.300	.211	.334	-.80	.20
HSE	1-500	501-1499	.950*	.291	.004	.26	1.64
		1500+	1.536*	.282	.000	.86	2.21
	501-1499	1-500	-.950*	.291	.004	-1.64	-.26
		1500+	.586	.251	.056	-.01	1.18
	1500+	1-500	-1.536*	.282	.000	-2.21	-.86
		501-1499	-.586	.251	.056	-1.18	.01

*. The mean difference is significant at the 0.05 level.

Table A.31 Descriptive data of asset management, partnership use and partnership benefit based on company size

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Asset Management	1-500	20	29.6500	2.20705	.49351	28.6171	30.6829	26.00	33.00
	501-1499	30	27.3333	3.67032	.67011	25.9628	28.7039	21.00	33.00
	1500+	35	24.9714	3.83088	.64754	23.6555	26.2874	16.00	32.00
	Total	85	26.9059	3.88717	.42162	26.0674	27.7443	16.00	33.00
Partnership Use	1-500	20	32.1000	3.02446	.67629	30.6845	33.5155	26.00	39.00
	501-1499	30	30.5333	3.95434	.72196	29.0568	32.0099	17.00	35.00
	1500+	35	27.7429	5.44676	.92067	25.8718	29.6139	16.00	34.00
	Total	85	29.7529	4.76322	.51664	28.7255	30.7803	16.00	39.00
Partnership Benefit	1-500	20	16.2500	1.74341	.38984	15.4341	17.0659	11.00	20.00
	501-1499	30	14.9333	3.02784	.55281	13.8027	16.0639	9.00	18.00
	1500+	35	15.0571	2.46078	.41595	14.2118	15.9025	10.00	20.00
	Total	85	15.2941	2.56730	.27846	14.7404	15.8479	9.00	20.00

Table A.32 ANOVA test comparing the asset management and partnerships mean of small, medium and large companies

		Sum of Squares	df	Mean Square	F	Sig.
Asset Management	Between Groups	287.059	2	143.529	11.983	.000
	Within Groups	982.188	82	11.978		
	Total	1269.247	84			
Partnership Use	Between Groups	269.859	2	134.930	6.763	.002
	Within Groups	1635.952	82	19.951		
	Total	1905.812	84			
Partnership Benefit	Between Groups	24.145	2	12.072	1.870	.161
	Within Groups	529.502	82	6.457		
	Total	553.647	84			

Table A.33 Multiple comparisons, Tukey HSD (asset management, partnerships) based on companies' size

Dependent Variable	*(I) employees*	*(J) employees*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
						Lower Bound	*Upper Bound*
Asset Management	1-500	501-1499	2.31667	.99908	.059	-.0681	4.7015
		1500+	4.67857*	.97011	.000	2.3629	6.9942
	501-1499	1-500	-2.31667	.99908	.059	-4.7015	.0681
		1500+	2.36190*	.86110	.020	.3065	4.4173
	1500+	1-500	-4.67857*	.97011	.000	-6.9942	-2.3629
		501-1499	-2.36190*	.86110	.020	-4.4173	-.3065
Partnership Use	1-500	501-1499	1.56667	1.28940	.448	-1.5111	4.6445
		1500+	4.35714*	1.25202	.002	1.3686	7.3457
	501-1499	1-500	-1.56667	1.28940	.448	-4.6445	1.5111
		1500+	2.79048*	1.11132	.037	.1377	5.4432
	1500+	1-500	-4.35714*	1.25202	.002	-7.3457	-1.3686
		501-1499	-2.79048*	1.11132	.037	-5.4432	-.1377
Partnership Benefit	1-500	501-1499	1.31667	.73356	.178	-.4343	3.0677
		1500+	1.19286	.71229	.221	-.5074	2.8931
	501-1499	1-500	-1.31667	.73356	.178	-3.0677	.4343
		1500+	-.12381	.63225	.979	-1.6330	1.3854
	1500+	1-500	-1.19286	.71229	.221	-2.8931	.5074
		501-1499	.12381	.63225	.979	-1.3854	1.6330

*. The mean difference is significant at the 0.05 level.

Table A.34 Descriptive data of company performance outcomes based on company size

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Internal performance outcomes	1-500	20	20.8000	1.85245	.41422	19.9330	21.6670	18.00	24.00
	501-1499	30	17.8000	3.89872	.71181	16.3442	19.2558	8.00	24.00
	1500+	35	17.9714	3.00476	.50790	16.9393	19.0036	9.00	23.00
	Total	85	18.5765	3.35011	.36337	17.8539	19.2991	8.00	24.00
External performance outcomes	1-500	20	20.8000	2.89464	.64726	19.4453	22.1547	13.00	24.00
	501-1499	30	17.6667	4.57379	.83506	15.9588	19.3745	9.00	24.00
	1500+	35	16.9429	3.67778	.62166	15.6795	18.2062	8.00	23.00
	Total	85	18.1059	4.11739	.44659	17.2178	18.9940	8.00	24.00

Table A.35 ANOVA test comparing the performance outcomes mean of small, medium and large companies

		Sum of Squares	df	Mean Square	F	Sig.
Internal performance outcomes	Between Groups	129.782	2	64.891	6.545	.002
	Within Groups	812.971	82	9.914		
	Total	942.753	84			
External performance outcomes	Between Groups	198.295	2	99.147	6.633	.002
	Within Groups	1225.752	82	14.948		
	Total	1424.047	84			

Table A.36 Multiple comparisons, Tukey HSD (performance outcomes) based on companies' size

Dependent Variable	*(I)employees*	*(J)employees*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
						Lower Bound	*Upper Bound*
Internal performance outcomes	1-500	501-1499	3.00000*	.90895	.004	.8303	5.1697
		1500+	2.82857*	.88260	.005	.7218	4.9353
	501-1499	1-500	-3.00000*	.90895	.004	-5.1697	-.8303
		1500+	-.17143	.78342	.974	-2.0414	1.6986
	1500+	1-500	-2.82857*	.88260	.005	-4.9353	-.7218
		501-1499	.17143	.78342	.974	-1.6986	2.0414
External performance outcomes	1-500	501-1499	3.13333*	1.11610	.017	.4692	5.7975
		1500+	3.85714*	1.08374	.002	1.2702	6.4440
	501-1499	1-500	-3.13333*	1.11610	.017	-5.7975	-.4692
		1500+	.72381	.96196	.733	-1.5724	3.0200
	1500+	1-500	-3.85714*	1.08374	.002	-6.4440	-1.2702
		501-1499	-.72381	.96196	.733	-3.0200	1.5724

*. The mean difference is significant at the 0.05 level.

Table A.37 ANOVA test comparing the performance outcomes mean of different departments

		Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Internal outcomes	Between Groups	26.988	4	6.747	.589	.671
	Within Groups	915.765	80	11.447		
	Total	942.753	84			
External outcomes	Between Groups	31.929	4	7.982	.459	.766
	Within Groups	1392.118	80	17.401		
	Total	1424.047	84			

Table A.38 ANOVA test comparing the performance outcomes mean of different positions

		Sum of Squares	df	Mean Square	F	Sig.
Internal outcomes	Between Groups	26.988	4	6.747	.589	.671
	Within Groups	915.765	80	11.447		
	Total	942.753	84			
External outcomes	Between Groups	31.929	4	7.982	.459	.766
	Within Groups	1392.118	80	17.401		
	Total	1424.047	84			

Table A.39 ANOVA test comparing the performance outcomes mean of different work experience

		Sum of Squares	df	Mean Square	F	Sig.
Internal outcomes	Between Groups	20.803	2	10.401	.925	.401
	Within Groups	921.950	82	11.243		
	Total	942.753	84			
External outcomes	Between Groups	38.947	2	19.474	1.153	.321
	Within Groups	1385.100	82	16.891		
	Total	1424.047	84			

Table A.40 ANOVA test comparing the performance outcomes mean of different qualifications

		Sum of Squares	df	Mean Square	F	Sig.
Internal outcomes	Between Groups	1.295	3	.432	.037	.990
	Within Groups	941.458	81	11.623		
	Total	942.753	84			
External outcomes	Between Groups	36.366	3	12.122	.708	.550
	Within Groups	1387.681	81	17.132		
	Total	1424.047	84			

Table A.41 Descriptive data of company performance outcomes based on measuring KPIs

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Internal outcomes	Weekly	12	21.6667	1.49747	.43228	20.7152	22.6181	20.00	24.00
	Monthly	33	20.2121	1.86677	.32496	19.5502	20.8741	17.00	23.00
	Quarterly	18	17.8333	2.77064	.65305	16.4555	19.2111	11.00	23.00
	Midyear	19	15.6842	2.28650	.52456	14.5822	16.7863	11.00	19.00
	Yearly	3	11.0000	4.35890	2.51661	.1719	21.8281	8.00	16.00
	Total	85	18.5765	3.35011	.36337	17.8539	19.2991	8.00	24.00
External outcomes	Weekly	12	22.0833	1.83196	.52884	20.9194	23.2473	18.00	24.00
	Monthly	33	20.5758	2.47526	.43089	19.6981	21.4534	13.00	24.00
	Quarterly	18	15.8889	3.37620	.79578	14.2099	17.5678	11.00	23.00
	Midyear	19	14.5789	2.19382	.50330	13.5216	15.6363	10.00	19.00
	Yearly	3	10.6667	3.78594	2.18581	1.2619	20.0715	8.00	15.00
	Total	85	18.1059	4.11739	.44659	17.2178	18.9940	8.00	24.00

Table A.42 ANOVA test comparing the performance outcomes mean of different KPIs measurement

		Sum of Squares	df	Mean Square	F	Sig.
Internal outcomes	Between Groups	543.966	4	135.991	27.281	.000
	Within Groups	398.787	80	4.985		
	Total	942.753	84			
External outcomes	Between Groups	881.994	4	220.498	32.543	.000
	Within Groups	542.053	80	6.776		
	Total	1424.047	84			

Table A.43 Multiple Comparisons, Tukey HSD (performance outcomes) based on measuring KPIs

Dependent Variable	*(I) How frequently measure KPIs*	*(J) How frequently measure KPIs*	*Mean Difference (I-J)*	*Std. Error*	*Sig.*	*95% Confidence Interval*	
						Lower Bound	*Upper Bound*
Internal outcomes	Weekly	Monthly	1.45455	.75263	.309	-.6460	3.5551
		Quarterly	3.83333*	.83207	.000	1.5111	6.1556
		Midyear	5.98246*	.82326	.000	3.6848	8.2802
		Yearly	10.66667*	1.44119	.000	6.6444	14.6890
	Monthly	Weekly	-1.45455	.75263	.309	-3.5551	.6460
		Quarterly	2.37879*	.65421	.004	.5529	4.2047
		Midyear	4.52791*	.64297	.000	2.7334	6.3224
		Yearly	9.21212*	1.34635	.000	5.4545	12.9698
	Quarterly	Weekly	-3.83333*	.83207	.000	-6.1556	-1.5111
		Monthly	-2.37879*	.65421	.004	-4.2047	-.5529
		Midyear	2.14912*	.73437	.035	.0995	4.1987
		Yearly	6.83333*	1.39232	.000	2.9474	10.7192
	Midyear	Weekly	-5.98246*	.82326	.000	-8.2802	-3.6848
		Monthly	-4.52791*	.64297	.000	-6.3224	-2.7334
		Quarterly	-2.14912*	.73437	.035	-4.1987	-.0995
		Yearly	4.68421*	1.38707	.010	.8129	8.5555
	Yearly	Weekly	-10.66667*	1.44119	.000	-14.6890	-6.6444
		Monthly	-9.21212*	1.34635	.000	-12.9698	-5.4545
		Quarterly	-6.83333*	1.39232	.000	-10.7192	-2.9474
		Midyear	-4.68421*	1.38707	.010	-8.5555	-.8129
Total external outcomes	Weekly	Monthly	1.50758	.87747	.429	-.9414	3.9566
		Quarterly	6.19444*	.97008	.000	3.4870	8.9019
		Midyear	7.50439*	.95982	.000	4.8256	10.1832
		Yearly	11.41667*	1.68024	.000	6.7272	16.1062
	Monthly	Weekly	-1.50758	.87747	.429	-3.9566	.9414
		Quarterly	4.68687*	.76272	.000	2.5581	6.8156
		Midyear	5.99681*	.74962	.000	3.9046	8.0890
		Yearly	9.90909*	1.56967	.000	5.5282	14.2900
	Quarterly	Weekly	-6.19444*	.97008	.000	-8.9019	-3.4870
		Monthly	-4.68687*	.76272	.000	-6.8156	-2.5581
		Midyear	1.30994	.85618	.546	-1.0796	3.6995
		Yearly	5.22222*	1.62326	.016	.6917	9.7527
	Midyear	Weekly	-7.50439*	.95982	.000	-10.1832	-4.8256
		Monthly	-5.99681*	.74962	.000	-8.0890	-3.9046
		Quarterly	-1.30994	.85618	.546	-3.6995	1.0796
		Yearly	3.91228	1.61715	.121	-.6011	8.4257
	Yearly	Weekly	-11.41667*	1.68024	.000	-16.1062	-6.7272
		Monthly	-9.90909*	1.56967	.000	-14.2900	-5.5282
		Quarterly	-5.22222*	1.62326	.016	-9.7527	-.6917
		Midyear	-3.91228	1.61715	.121	-8.4257	.6011

*. The mean difference is significant at the 0.05 level.

APPENDIX B: T-TEST RESULTS

Table B.1 Independent samples test between the mean internal outcomes of (locally & internationally) companies

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
internal outcomes	Equal variances assumed	7.162	.009	-4.511	83	.000	-3.00286	.66563
	Equal variances not assumed			-4.934	80.442	.000	-3.00286	.60856

Table B.2 Independent samples test between the mean external outcomes of (locally & internationally) companies

		Levene's Test for Equality of Variances		*t-test for Equality of Means*				
		F	*Sig.*	*t*	*df*	*Sig. (2-tailed)*	*Mean Difference*	*Std. Error Difference*
External outcomes	Equal variances assumed	6.118	.015	-5.153	83	.000	-4.09429	.79460
	Equal variances not assumed			-5.493	82.987	.000	-4.09429	.74542

APPENDIX C: SURVEY QUESTIONNAIRE IN ENGLISH

Performance measurement

This survey is being conducted by Adel Nouara for the completion of PhD degree thesis at Brunel University, London-UK.

All information provided by the companies will be strictly kept confidential and used for academic issues only.

Thank you in advance for your contribution to this study.

If you have any questions or concerns about completing the questionnaire, do not hesitate to contact me on: email address adel.nouara@brunel.ac.uk or phone number: +218 917818163 - +44 7400171700

General information about the questionnaire:

Questions will be answered in 1 to 5 Likert Scale. The meaning of the numbers in the Likert Scale should be considered as:

1: Very low 2: Low 3: Average 4: High 5: Very high

1: Strongly disagree 2: Disagree 3 : Neither disagree nor agree 4: Agree 5: Strongly agree

PERFORMANCE MEASUREMENT IN OIL OPERATIONS

All questions contained in this questionnaire are strictly confidential

COMPANY PROFILE:	
Company name:	**Your department:**
Country of operation:	
Your current position:	**Highest qualification:**
Your work experience in this company in year:	**Type of ownership:** Private ☐ Public ☐ Joint venture ☐
Total number of full-time employees:	

STRATEGIC COMPANY OBJECTIVES:

1) Please select five priorities which can represent the objectives of your department/company:

1. Increase production ☐ **2. Increase reserves** ☐ **3. Improve the quality of product and service** ☐

4. Maximization of shareholder value ☐ **5. Investment into employees** ☐ **6.Maximize employment** ☐

7. Modernise productive infrastructure ☐ **8.Production safety** ☐ **9.Reduce production cost** ☐

10.Enter new technology fields ☐ **11.Introduce new wells/services** ☐ **12.Improve yield or reduce material consumption** ☐

13. Commitment to health, safety and environment ☐ **14. Effective utilization of the (country/company) hydrocarbon sector** ☐ **15. Develop other economic sectors (refining, petrochemical and other industries)** ☐

Others 16..... ☐
17..... ☐

ASSET MANAGEMENT:

2) To what extent do you use the asset management approaches in oil operations?

	VERY LOW	→			VERY HIGH
A)We believe the asset management principles are important.	1	2	3	4	5
B)We use the asset management in the oil operations.	1	2	3	4	5

3) From your perspective, please rate the priority of the following management areas:

Priority areas	VERY LOW	⟶			VERY HIGH
A)Well and reservoir management	1	2	3	4	5
B)Operation and maintenance management	1	2	3	4	5
C)Facilities management	1	2	3	4	5
D)Health, safety and environment management	1	2	3	4	5
E)Drilling management	1	2	3	4	5

From your perspective do you have any comment on Asset management:.....

.....

.....

.....

MAINTENANCE:

4)To what extent do you use the following maintenance approaches?

Maintenance approaches	NEVER	RARELY	SOMETIMES	FREQUENTLY	ALWAYS
A) Condition-based maintenance.	1	2	3	4	5
B) Time-based maintenance.	1	2	3	4	5
C) Corrective maintenance.	1	2	3	4	5
D) Total productive maintenance.	1	2	3	4	5

5) How much does the maintenance cost in percentage of company's operation expenses per year?

About 0 – 10 % ☐, 11 – 19 % ☐, 20 – 29 % ☐, 30 – 39 % ☐, 40 % and over ☐

Any comment:.....

.....

.....

.....

OPERATIONS:

6) What was your research and development /technology upgrades investment as approximate % to revenue in the past year?
About 0 – 5 %☐, 6 – 10 % ☐, 11 – 15 % ☐, 16 – 19 % ☐, 20% and over ☐

7) To what extent do you agree that the overall HSE (health, safety & environment) is well implemented in your company?
strongly disagree ☐ Disagree ☐ Neither agree nor disagree ☐ Agree ☐ Strongly agree ☐

8) How good has company's exploration success rate been in the past decade?
About 0 – 10 % ☐, 11 – 19 % ☐, 20 – 29 % ☐, 30 – 39 % ☐, 40 % and over ☐

9) How good has company's drilling success rate been in the past decade?
About 0 – 10 % ☐, 11 – 19 % ☐, 20 – 29 % ☐, 30 – 39 % ☐, 40 % and over ☐

10) How much production growth has the company's experienced in average in the past decade?
About 0 – 10 % ☐, 11 – 19 % ☐, 20 – 29 % ☐, 30 – 39 % ☐, 40 % and over ☐ /per annum.

11) How much reserves replacement growth has the company's experienced in average in the past decade?
About 0 – 10 % ☐, 11 – 19 % ☐, 20 – 29 % ☐, 30 – 39 % ☐, 40 % and over ☐

Regarding the operations, Any other point you want to mention or explain: .....

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PARTNERSHIPS:

12) To what extent do you agree with the following:

Use of partnerships	STRONGLY DISAGREE	→			STRONGLY AGREE
A) The current use of the partnership is useful for ongoing activities.	1	2	3	4	5
B) The past use of the partnership was useful for projects.	1	2	3	4	5
C) The use of the partnership in future will be useful.	1	2	3	4	5

13) Please indicate the current use of the business partners in the areas of business:

Business activities	NEVER	RARELY	SOMETIMES	FREQUENTLY	ALWAYS
A) Production.	1	2	3	4	5
B) Monitoring.	1	2	3	4	5
C) Facilities development.	1	2	3	4	5
D) Infrastructure and system upgrade.	1	2	3	4	5
E) Logistics and supplies.	1	2	3	4	5

14)To what extent do you agree with each of the following is beneficial:

Partnership benefit	STRONGLY DISAGREE	DISAGREE	NEITHER DISAGREE NOR AGREE	AGREE	STRONGLY AGREE
A) Gaining recognition and respect from others in the sector.	1	2	3	4	5
B) Developing collaborative relationships with other agencies.	1	2	3	4	5
C) Building my organization's capacity.	1	2	3	4	5
D) Helping my organization with funding.	1	2	3	4	5

Any other comment about partnerships:.....

.....

.....

OIL SERVICES COMPANIES:

15)Please select five services that Oil services companies could/do provide:

1. Exploration ☐	2. Equipment ☐	3. Implementing new technology ☐
4. Extraction ☐	5. Consultations ☐	6.Transport of crude oil and gas ☐
7. Production ☐	8. Oil refineries ☐	9.Train and develop technical people ☐
10. Drilling ☐	11. Oil condition monitoring ☐	12.Product and technology innovation ☐
13. Infrastructure ☐	14. Knowledge management ☐	

Others

15..... ☐ 16..... ☐

Please comment:

.....

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.....

.....

ORGANISATIONAL PERFORMANCE:

16) How frequently do you measure KPIs (key performance indicators) for operation and maintenance process?

Weekly ☐ Monthly ☐ Quarterly ☐ Midyear ☐ Yearly ☐

17)To what extent you agree to each of the following:

Management capabilities	STRONGLY DISAGREE	→			STRONGLY AGREE
A) The purpose of each project or department item is defined and kept in mind.	1	2	3	4	5
B) Employees stay with the task.	1	2	3	4	5
C) I'm usually clear about my role as a manager.	1	2	3	4	5
D) Current priorities are clearly defined.	1	2	3	4	5
E) Employees seem well-informed and up to date and understand what's going on at all times.	1	2	3	4	5

18) How well do you perform comparing to your sector?

	POOR	BELOW AVERAGE	AVERAGE	GOOD	VERY GOOD
A) Productivity (e.g. Return on total assets).	1	2	3	4	5
B) Production growth (e.g. Barrel/day).	1	2	3	4	5
C) Revenue increases (e.g. Million $).	1	2	3	4	5
D) Profitability (e.g. Net profit/employee).	1	2	3	4	5
E) Reserves level (e.g. "BOE" barrel of oil equivalent).	1	2	3	4	5

Please comment:

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.....

19) Any other comment or any problem/point you want to mention?

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Thank you for your time.

Appendix D: Survey Questionnaire in Arabic

تطوير الاداء

هذه الدراسة هى جزء من دراسة الدكتوراة للباحث عادل عمر ابونوارة في جامعة برونيل البريطانية.تم تصميم هذه الدراسة بعناية فائقة لاستيضاح مستوى الاداء في الشركات النفطية ومعرفة العناصر الرئيسية المؤثرة على هذا الاداء ومدى امكانية تطويره.

تستطيع الحصول على نتائج وتحليل الاستطلاع بمشاركتك واكمالك الاستبانة,مشاركتك تستغرق تقريبا 10 دقائق وهى محل تقدير وشكر حيث ان الاستطلاع له قيمة جوهرية لكل من البحوث العلمية والدراسات التجارية.

لك كامل الحرية في المشاركة اوعدمها ولن يتم نشر اي اسماء لافراد اوشركات في هذه الدراسة.

ملاحظة:مقياس الاجوبة في هذه الاستبانة من 1 الى 5 حيث ان:-

1 منخفض جدا ,2 منخفض ,3 متوسط , 4 عالي , 5 عالي جدا
1 لا اوافق بشدة , 2 لا اوافق , 3 لا وافق ولا اعترض , 4 اوافق , 5 اوافق بشدة

لاي استفسار يرجى الاتصال بي على البريد الالكتروني: adel.nouara@brunel.ac.uk

او رقم الهاتف +44 7400171700 - +218 917818163

شكرا جزيلا لك لمساهمتك في هذه الدراسة

تقييم الاداء لعمليات التقط

ملف الشركة:	
اسم الشركة :	القسم :
بلد العمليات :	
أعلى شهادة:	منصبك الحالي :
عدد سنوات الخبرة في هذا المجال:	عدد الموظفين بالشركة:
نوع الشركة: عامة □ خاصة □ اخرى(.....)	

أهداف الشركة الاستراتيجية

1) الرجاء اختيار 5 اولويات التي توضح اهداف قسمك/ شركتك

1.زيادة الانتاج □ 2. زيادة الاحتياطات □ 3. تطوير الجودة للمنتوج والخدمات □ 4. زيادة قيمة الاسهم للمساهمين □

5. تطوير الموظفين□ 6. زيادة نسبة الوظائف □ 7. تطوير البنية التحتية الانتاجية □ 8. سلامة العمليات الانتاجية □

9. تخفيض تكلفة الانتاج □ 10. الدخول في مجالات تكنولوجيا جديدة □ 11 .تقديم ابار/خدمات جديدة □

12.التقليل من استهلاك المواد □ 13. الالتزام بالصحة والسلامة والبيئة □ 14.الاستفادة المثلى من قطاع النفط والغاز □

15.تطوير القطاعات الاقتصادية الاخرى مثل المصافي والبتروكيماويات.....الخ □

اخرى:

16. ..... 17 .....

ادارة الاصول

2) مدى استخدام طرق ادارة الاصول في العمليات التقطية

	منخفض جدا	←			عالي جدا
أ. نعتقد ان مبادئ ادارة الاصول مهمة.	1	2	3	4	5
ب. نستخدم ادارة الاصول في العمليات التقطية.	1	2	3	4	5

3)من وجهة نظرك من جانب ادارة الاصول الرجاء اختيار معدل الاولوية في ادارة الوحدات التالية

ادارة الوحدات	منخفظ جدا				عالي جدا
أ.ادارة الابار والخزانات	1	2	3	4	5
ب.ادارةالعمليات والصيانة	1	2	3	4	5
ج.ادارةالمرافق(Facilities)	1	2	3	4	5
د.ادارةالامن والسلامة والبيئة	1	2	3	4	5
و.ادارة الحفر	1	2	3	4	5

من وجهة نظرك حول الاسئلة الماضية لادارة الاصول هل توجد لديك اي ملاحظة اوتعليق:.....

.....

.....

.....

الصيانه

4)الى اي مدى تستخدم شركتك/قسمك اساليب الصيانة التالية:

اساليب الصيانه:	لا تستخدم ابدا	نادرا	احيانا	بتكرار	دائما
أ.صيانة بعد ظهور مؤشرات تبين وقوع عطل مستقبلا	1	2	3	4	5
ب.صيانة دورية كل فترة زمنية معينة(مثل كل شهرين او 6 اشهر.....الخ)	1	2	3	4	5
ج.صيانة تصحيحية لاعادة التشغيل بعد وقوع العطل	1	2	3	4	5
د.صيانة خفيفة دوما لتحديد الاعطال المتوقع حدوثها لتجنبها بالاستخدام الامثل للمعدات	1	2	3	4	5

5) كم نسبة تكاليف الصيانة السنوية نسبة الى المصاريف الاجمالية السنوية المنفقة على العمليات؟

حوالي 0 – 10 % ☐ , 11 – 19 % ☐ , 20 – 29 % ☐ , 30 – 39 % ☐ , 40 او اكثر ☐

اي اضافة او تعليق:.....

.....

.....

العمليات

6)ماتسبة المنفق على الابحاث والتطوير وتنمية الاستثمار في السنة الماضية نسبة الى الدخل؟

حوالي 0 – 5 % ☐ , 6 – 10 % ☐ , 11 – 15 % ☐ , 16 – 19 % ☐ , 20 او اكثر ☐

7)الى اي مدى توافق ان الصحة والسلامة والبيئة(HSE) نفذت بشكل جيد في شركتك/قسمك؟

لااوافق بشدة ☐ , لااوافق ☐ , لااوافق ولا ارفض ☐ , اوافق ☐ , اوافق بشدة ☐

8) ماتسبة نجاح الشركة في الاستكشاف في العقد الماضي؟

حوالي 0 – 10 % ☐ , 11 – 19 % ☐ , 20 – 29 % ☐ , 30 – 39 % ☐ , 40 او اكثر ☐

9) ماتسبة الزيادة في الحفر للشركة في العقد الماضي؟

حوالي 0 – 10 % ☐ , 11 – 19 % ☐ , 20 – 29 % ☐ , 30 – 39 % ☐ , 40 او اكثر ☐ /في السنة

10)ماتسبة الزيادة في الانتاج للشركة في العقد الماضي؟

حوالي 0 – 10 % ☐ , 11 – 19 % ☐ , 20 – 29 % ☐ , 30 – 39 % ☐ , 40 او اكثر ☐ /في السنة

11) ما تسبة الزيادة في الاحتياطيات للشركة في العقد الماضي؟

حوالي 0 – 10 % ☐ , 11 – 19 % ☐ , 20 – 29 % ☐ , 30 – 39 % ☐ , 40 او اكثر ☐ /في السنة

بالنسبة للعمليات وحسب خبرتك في هذا المجال,هل عندك اي توضيح او اضافة:.....
.....
.....

الشّراكات

12)الى اي مدى توافق مع الاتي؟

استخدام الشّراكات	لا اوافق بشدة				اوافق بشدة
أ. الاستخدام الحالي للشّركاء مفيد للانشطة الجارية.	1	2	3	4	5
ب.الاستخدام السابق للشّركاء كان مفيدا للمشاريع.	1	2	3	4	5
ج.استخدامنا للشّركاء في المستقبل سيكون مفيدا.	1	2	3	4	5

13)الرجاء توضيح مدى الاستخدام الحالي للشركاء في الانشطة التالية:

مجالات العمل	لا تستخدم ابدا	نادرا	احيانا	بتكرار	دائما
أ. الانتاج	1	2	3	4	5
ب. الملاحظة (المرافبة)	1	2	3	4	5
ج. تطوير المرافق	1	2	3	4	5
د. البنية التحتية وتطوير المنظومة	1	2	3	4	5
و.الخدمات اللوجستية(تخطيط,تنفيذ.....الخ)	1	2	3	4	5

14)الى اي مدى توافق ان الشركاء مفيدين في النقاط التالية:

القائدة من الشراكة	لا اوافق بشدة	←			اوافق بشدة
أ.اكتساب اعتراف واحترام من الاخرين في القطاع.	1	2	3	4	5
ب. تطوير علاقات تعاونية مع مؤسسات/شركات اخرى.	1	2	3	4	5
ج. توسعة قدرة مؤسستي.	1	2	3	4	5
د. مساعدة مؤسستي في رأس المال.	1	2	3	4	5

اي اضافة حول الشراكة:.....

.....

.....

شركات الخدمات النفطية

15) الرجاء اختيار خمس خدمات من الخدمات التي يتم تزويدك/ تستطيع تزويدك بها شركات الخدمات النفطية:

1.الاستكشاف ☐ 2. المعدات ☐ 3. تنفيذ تقنية جديدة ☐ 4. الاستخلاص ☐ 5. استشارات ☐

6. نقل النفط والغاز ☐ 7.الانتاج ☐ 8.المصافي ☐ 9. تدريب وتطوير العاملين ☐ 10. الحفر ☐

11. الملاحظة (المراقبة) ☐ 12. تطوير المنتوج وابتكارتقنية جديدة ☐ 13. البنية التحتية ☐ 14.ادارة المعلومات ☐

اخرى:

15.....16.....

اي اضافة :.....

.....

.....

.....

معدل الاداء

16) كم عدد المرات يتم قياس مؤشرات الاداء الرئيسية (KPI) للعمليات والصيانة؟

اسبوعي ☐ شهري ☐ كل ثلاث شهور ☐ نصف سنوي ☐ سنوي☐

17) الى اي مدى توافق مع الاتي؟

قدرات الادارة	لا اوافق بشدة	←			اوافق بشدة
أ. الغرض من اي مشروع اوقسم إدارة معروف وموضوع في الاعتبار	1	2	3	4	5
ب.الموظفين كل ملتزم مع مهامه	1	2	3	4	5
ج. دوري كمدير عادة واضح	1	2	3	4	5
د. الاولويات الحالية في العمل واضحة	1	2	3	4	5
و.الموظفين على علم وفهم بكل مايحدث في المؤسسة في كل الاوقات	1	2	3	4	5

18) مامدي اداء الشركة مقارنة بقطاعك؟

	ضعيف جدا	ضعيف	متوسط	جيد	جيد جدا
أ. الانتاجية (مثل العائد على اجمالي الاصول)	1	2	3	4	5
ب. نمو الانتاج (مثل برميل/يوم)	1	2	3	4	5
ج. زيادة الايرادات (مثل ملايين الدولارات/الدينارات)	1	2	3	4	5
د.الارباح (مثل الارباح الصافية/موظف)	1	2	3	4	5
و.مستوى الاحتياطيات (مثل برميل نفط)	1	2	3	4	5

19) اي اضافة او مشكلة او اي نقطة اخرى تريد اظهارها ؟

.....
.....
.....

الشكر الجزيل لمتحاوتكم وتعاونكم

Appendix E: Interviews Questionnaire

Dear Sir

This interview is part of my PhD Thesis at Brunel University London. It is designed to understand the influence of oil operations on firm's performance in developing countries.

Your participation is voluntary and will contribute in survey success and it is appreciated.

This interview will take approximately 30 to 45 minutes of your valuable time and the provided information will be confidential and used only for this research purpose.

If you have any concern, please do not hesitate to contact me:

Adel Nouara

Brunel University, London

School of Engineering and Design

adel.nouara@brunel.ac.uk

Current position: …….. work experience: ……

1. Do you think the relationships within the attached framework are reasonable?

Yes…….. No……..

2. Tell me your opinion in the next relations: there are positive relationships between asset management and:

A. Production……
b. Reserves……
C. Technology ……..
D. HSE…….

3. Tell me your opinion in the next relations: there are negative relationships between asset management and:

A. Exploration……
B. Drilling…….

4. Tell me your opinion in the next relations: there are positive relationships between partnership use and:

A. Exploration……
B. Drilling……
C. Production……
D. Technology……

5. Tell me your opinion in the next relations: there are negative relationships between partnership use and:

A. Reserves ……
B. HSE……

6. Tell me your opinion in the next relations: there are positive relationships between partnership benefit and:

A. Production……
B. Reserves……

7. Tell me your opinion in the next relations: there are negative relationships between partnership benefit and:

A. Exploration……
B. Drilling……..
C. Technology ……
D. HSE…….

8. Tell me your opinion in the next relations: there are positive relationships between internal performance outcomes and:

A. Exploration……

B. Production……
C. Technology……

9. Tell me your opinion in the next relations: there are negative relationships between internal performance outcomes and:

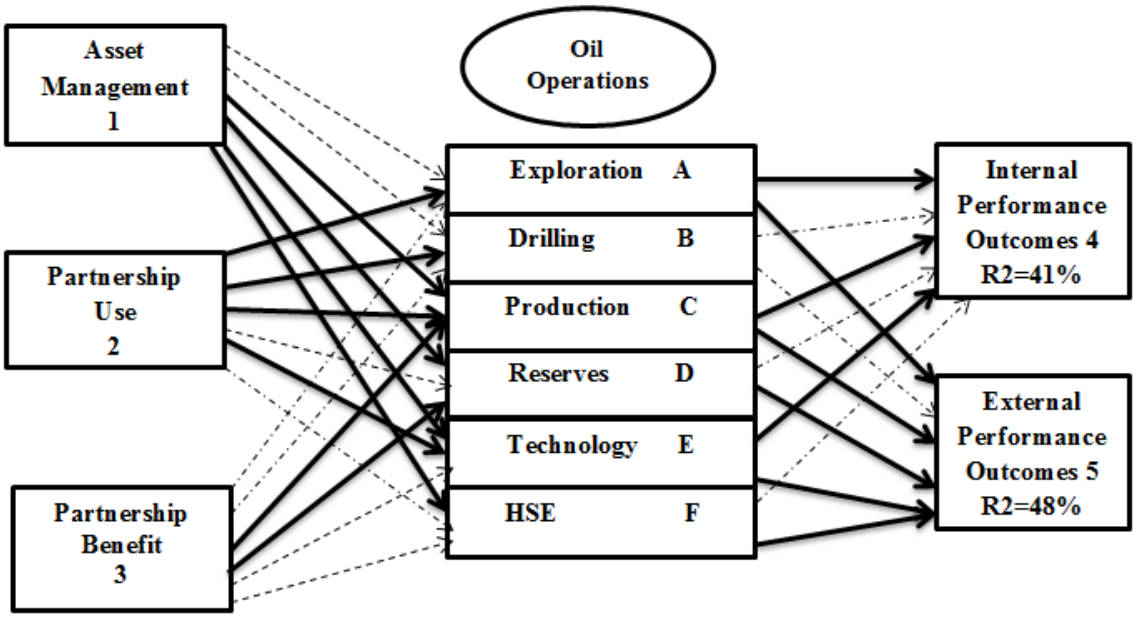
A. Drilling……
B. Reserves……
C. HSE……

10. Tell me your opinion in the next relations: there are positive relationships between external performance outcomes and:

A. Exploration……
B. Production……
C. Reserves……
D. Technology……
E. HSE……

11. Tell me your opinion in the next relations: there are negative relationships between external performance outcomes and:

A. Drilling……



Keys:
Dash lines indicate non-significant effect; Solid lines indicate significant effect

APPENDIX F: LETTER OF APPROVAL FROM THE LIBYAN EMBASSY IN LONDON TO THE LIBYAN NATIONAL OIL COOPERATION

Libyan Embassy
Cultural Attaché - London

سفارة ليبيا
الملحقية الثقافية – لندن

وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education & Scientific Research

التاريخ : 03-06-2013
الرقم الاشاري : 2013-06-7949
رقم الملف : 8484
رقم قرار الإيفاد: 34/2011
بداية الصرف : 01/03/2011
نهاية الصرف : 28/02/2013
اشهر المنحة : 24

اسم الطالب : عادل عمر زايد نوارة
الدرجة العلمية : دكتوراة
التخصص : هندسة ميكانيكية

إلى الأخوة بالمؤسسة الوطنية للنفط

بعد التحية ،،،

الموضوع / تعريف طالب لدراسة حقلية

تشهد الملحقية الثقافية بأن الأخ /عادل عمر زايد نوارة أحد الطلبة الموفدين لدراسة الدكتوراه في مجال الهندسة على حساب المجتمع في المملكة المتحدة البريطانية ويرغب الطالب فى جمع بعض البيانات والمعلومات المتعلقة ببحثه العلمي لذا يرجى تسهيل مهمته وإبداء المساعدة في هذا المجال.

أعطيت له هذه الإفادة بناءً علي طلبه لاستخدامها فيما يخوله القانون و تعتبر رسمية بعد التوقيع و الختم.

وشاكرين حسن تعاونكم معنا مسبقاً .

والسلام عليكم ورحمة الله وبركاته ،،،

د. عبدالباسط قدور
المستشار الثقافي

Printed On: 14/05/2014 Printed By: AA274

61-62 Ennismore Gardens, London, SW7 1NH T: +44(0)20 3006 9891 F: +44(0)20 7584 6961 W: culturalaffairs.libyanembassy.org

APPENDIX G: SAMPLE OF RESEARCH DATA

Respondent	*Ownership*	*Experience*	*Asset*	*Partner use*	*Partner benefit*	*Exploration*	*Drilling*	*Production*	*Reserves*	*Technology*	*HSE*	*Internal outcomes*	*External outcomes*
1	1	29	29.00	20.00	15.00	2	2	3	2	3	4	21.00	14.00
2	1	27	22.00	27.00	14.00	2	3	3	1	2	4	17.00	12.00
3	1	17	29.00	25.00	12.00	2	3	3	2	3	5	17.00	13.00
4	1	26	32.00	31.00	18.00	2	4	4	3	3	4	19.00	16.00
5	1	37	30.00	33.00	18.00	3	2	4	4	4	4	22.00	21.00
6	1	32	24.00	32.00	12.00	3	1	2	3	4	4	17.00	17.00
7	1	12	24.00	28.00	14.00	1	1	2	2	2	3	17.00	15.00
8	1	10	20.00	23.00	16.00	1	2	3	2	2	3	15.00	13.00
9	1	19	31.00	33.00	19.00	2	2	2	2	2	4	13.00	14.00
10	1	15	26.00	30.00	12.00	2	1	3	2	3	3	17.00	15.00
11	1	24	26.00	26.00	13.00	1	1	3	2	3	3	14.00	16.00
12	1	29	30.00	26.00	12.00	1	2	2	1	2	3	11.00	10.00
13	1	9	23.00	33.00	16.00	1	3	3	1	3	3	19.00	11.00
14	1	10	27.00	17.00	9.00	1	3	3	1	3	4	13.00	11.00
15	1	18	27.00	33.00	16.00	4	2	4	3	4	4	22.00	18.00
16	1	31	29.00	33.00	18.00	3	3	4	3	4	4	16.00	17.00
17	1	14	29.00	34.00	12.00	2	2	3	1	2	4	14.00	12.00
18	1	31	21.00	30.00	10.00	3	1	3	2	3	4	17.00	15.00
19	1	20	27.00	24.00	10.00	1	1	3	3	3	3	15.00	18.00
20	1	13	31.00	26.00	17.00	2	2	2	2	3	3	16.00	13.00
21	1	23	29.00	28.00	11.00	1	2	3	2	2	4	15.00	13.00
22	1	25	28.00	28.00	10.00	2	1	4	3	4	4	19.00	16.00
23	1	12	25.00	26.00	10.00	1	1	3	2	4	3	18.00	15.00
24	1	8	23.00	35.00	15.00	1	4	2	2	4	3	11.00	13.00
25	1	22	22.00	33.00	15.00	1	4	4	3	5	4	17.00	17.00
26	1	30	30.00	29.00	17.00	4	3	5	5	4	5	20.00	22.00
27	1	26	30.00	32.00	18.00	3	2	5	5	4	5	22.00	23.00
28	1	16	30.00	31.00	16.00	3	2	4	4	3	4	22.00	20.00
29	1	10	32.00	33.00	18.00	2	3	5	5	5	5	20.00	24.00
30	1	33	33.00	32.00	17.00	2	4	5	4	3	4	23.00	22.00