МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН

Казахский национальный исследовательский технический университет имени К.И. Сатпаева

Институт управления проектами им. Е. Туркебаева

УДК 334.752 На правах рукописи

Байбусинова Жанар Бериковна

МАГИСТЕРСКАЯ ДИССЕРТАЦИЯ

На соискание академической степени магистра

Название диссертации	Управление качеством при аутсорсинге в нефтедобывающих компаниях
Направление подготовки	6М051800 – «Управление проектами»

Научный руководитель
MBA, сениор-лектор
_____ Аманов А.Б.
"27" мая 2019 г.

Рецензент
канд.экон.наук, доцент
кафедры «Экономические специальности»
_____ Телагусова Э.О.
"28" мая 2019 г.

Нормоконтроль
канд.техн.наук, ассоц. профессор
_____ Муханова Г.С.
"27" мая 2019 г.

ДОПУЩЕН К ЗАЩИТЕ
Заведующая кафедрой
«Бизнес и менеджмент»
доктор Phd, профессор
_____ Досова С.Н.
"30" 01 2019 г.

Алматы 2019

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН

Казахский национальный исследовательский технический университет имени К.И. Сатпаева

Институт управления проектами им. Е. Туркебаева

Кафедра «Бизнес и менеджмент»

6М051800 – «Управление проектами»

УТВЕРЖДАЮ
Заведующая кафедрой «Бизнес и менеджмент»
доктор Phd, профессор
_____ Досова С.Н.
"30" 01 2019 г.

ЗАДАНИЕ
на выполнение магистерской диссертации

Магистранту *Байбусиновой Ж.Б.*
Тема: Управление качеством при аутсорсинге в нефтедобывающих компаниях
Утверждена приказом Ректора Университета *№1197-м* от *"29" октября 2018г.*
Срок сдачи законченной диссертации *"04" июнь 2019г.*
Исходные данные к магистерской диссертации: *Список изученной литературы. Экспериментальная часть исследования заключается в проведении опросного исследования (анкетирования)*
Перечень подлежащих разработке в магистерской диссертации вопросов:
-определение существующих практик по управлению качеством в нефтедобывающих компаниях;
-изучение мнений ключевых заинтересованных сторон по поводу практик по управлению качеством, а также факторов и проблем, препятствующих обеспечению качества при аутсорсинге;
-исследование факторов качества, критически влияющих на успешное управление качеством при аутсорсинге в нефтедобывающих компаниях;
-формулировка рекомендаций по обеспечению качества в нефтедобывающем сегменте нефтегазовой индустрии.
Перечень графического материала (с точным указанием обязательных чертежей): _____.

Рекомендуемая основная литература:

1. *Mellat-Parast, M., Adams, S. G. and Jones, E. C. (2007) An empirical study of quality management practices in the petroleum industry. Production Planning & Control,Vol. 18, No. 8, December 2007, 693–702*

2. *Mohammad Munir Ahmad Redha Elhuni , (2014),"Critical quality factors for successful TQM implementation in Libyan oil and gas sector", Benchmarking: An International Journal, Vol. 21 Iss 5 pp. 713 - 733*

3. *Khalifa N. Al-khalifaElaine M. Aspinwall, (2000),"The development of total quality management in Qatar", The TQM Magazine, Vol. 12 Iss 3 pp. 194 – 204*

4. *Mahour Mellat Parast Stephanie G. Adams Erick C. Jones, (2011),"Improving operational and business performance in the petroleum industry through quality management", International Journal of Quality & Reliability Management, Vol. 28 Iss 4 pp. 426 - 450*

ГРАФИК

подготовки магистерской диссертации

Наименование разделов, перечень разрабатываемых вопросов	**Сроки представления научному руководителю**	**Примечание**
Обзор литературы	15.03.19	
Методы исследования	10.04.19	
Результаты исследования и выводы	15.05.19	

Подписи

консультантов и нормоконтролера на законченную магистерскую диссертацию с указанием относящихся к ним разделов диссертации

Наименования разделов	**Консультанты, Ф.И.О. (уч. степень, звание)**	**Дата подписания**	**Подпись**
Нормоконтролер	Муханова Г.С., канд.техн.наук, ассоц. профессор	27.05.19	

Научный руководитель _____ Аманов А.Б.

Задание принял к исполнению обучающийся _____ Байбусинова Ж.Б.

Дата "27" мая 2019 г

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МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН
Сәтбаев Университеті
Институт управления проектами имени Э.А.Туркебаева

Отзыв научного руководителя
на магистерскую диссертацию
магистранта Байбусиновой Ж.Б.,
специальности «Управление проектами» - 6М051800

Тема: «Управление качеством при аутсорсинге в нефтедобывающих компаниях».

Целью диссертационного исследования «Управление качеством при аутсорсинге в нефтедобывающих компаниях» является исследование факторов качества, критически влияющих на успешное управление качеством при аутсорсинге в нефтедобывающих компаниях. Магистрантом, Байбусиновой Ж.Б. были решены следующие задачи для достижения вышеуказанной цели:

-определены существующие практики по управлению качеством в нефтедобывающих компаниях;

-изучены мнения ключевых заинтересованных сторон по поводу практик по управлению качеством, а также факторы и проблемы, препятствующие обеспечению качества при аутсорсинге;

-исследованы факторы качества, критически влияющие на успешное управление качеством при аутсорсинге в нефтедобывающих компаниях;

-сформулированы рекомендации по обеспечению качества в нефтедобывающем сегменте нефтегазовой индустрии.

Инструментом исследования для выполнения эксперимeтальной части являлось опросное исследование (исследование, проводимое с помощью анкетирования) среди сотрудников нефтегазовых организаций Казахстана, по совместительству участников проектов, реализуемых в нефтяном секторе. Инструмент был разаработан на основе тщательного изучения литературы и состоял из 62 факторов качества. Надежность инструмента была определена путем подсчета коэффициента Кронбаха в программе SPSS. Результаты опроса (ответы респондентов) были обработаны статистическим методом частотного анализа. Согласно результатам исследования были сформулированы рекомендации по обеспечению качества в нефтедобывающем сегменте путем выявления 18 критических факторов качества, и их последующей категоризации на три степени критичности. Будущие исследования рекомендуется проводить с наиболее высоким числом респондентов. Диссертационное исследование Байбусиновой Ж.Б. на соискание степени магистра по специальности 6М051800 - Управление проектами заслуживает высокой оценки и присуждения степени.

Научный руководитель:
Сениор-лектор кафедры
«Бизнес и Менеджмент» MBA

Аманов А.Б.

«27» мая 2019

МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН
Сәтбаев Университеті
Институт управления проектами имени Э.А.Туркебаева

Рецензия

на магистерскую диссертацию
магистранта Байбусиновой Ж.Б.,
специальности «Управление проектами» - 6М051800

Тема: «Управление качеством при аутсорсинге в нефтедобывающих компаниях».

В диссертационном исследовании «Управление качеством при аутсорсинге в нефтедобывающих компаниях», целью которого является исследование факторов качества, критически влияющих на успешное управление качеством при аутсорсинге в нефтедобывающих компаниях, были решены следующие задачи:

-определены существующие практики по управлению качеством в нефтедобывающих компаниях;

-изучены мнения ключевых заинтересованных сторон по поводу практик по управлению качеством, а также факторы и проблемы, препятствующие обеспечению качества при аутсорсинге;

-исследованы факторы качества, критически влияющие на успешное управление качеством при аутсорсинге в нефтедобывающих компаниях;

-сформулированы рекомендации по обеспечению качества в нефтедобывающем сегменте нефтегазовой индустрии.

Для решения экспериметальной части высокопоставленных задач было проведено опросное исследование (исследование, проводимое с помощью анкетирования) среду сотрудников нефтегазовых организаций Казахстана, по совместительству участников проектов, реализуемых в нефтяном секторе. Надежность инструмента была определена путем подсчета коэффициента Кронбаха в программе SPSS. Результаты опроса (ответы респондентов) были обработаны статистическим методом частотного анализа. Согласно результатам исследования были сформулированы рекомендации по обеспечению качества в нефтедобывающем сегменте путем выявления 18 критических факторов качества, и их последующей категоризации на три степени критичности.

Диссертационное исследование Байбусиновой Ж.Б. на соискание степени магистра по специальности 6М051800 - Управление проектами заслуживает высокой оценки и присуждения степени.

Рецензент:
Доцент кафедры
«Экономические специальности»
КазНПУ имени Абая
Кандидат экономических наук Телагусова Э.О.

«4» июня 2019

ПЕРСОНАЛДЫ БАСҚАРУ БӨЛІМІНІҢ БАСТЫҒЫ
НАЧАЛЬНИК ОТДЕЛА ПО УПРАВЛЕНИЮ ПЕРСОНАЛОМ
ЗАВЕРЯЮ:
Абай атындағы ҚазҰПУ
ПЕРСОНАЛДЫ БАСҚАРУ БӨЛІМІНІҢ БАСТЫҒЫ
НАЧАЛЬНИК ОТДЕЛА ПО УПРАВЛЕНИЮ ПЕРСОНАЛОМ
КазНПУ имени Абая
ПОДПИСЬ

Краткий отчет

Университет:	Satbayev University
Название:	Master's Thesis_на антиплагиат.docx
Автор:	Жанар Байбусынова
Координатор:	Сенымгуль Досова
Дата отчета:	2019-06-05 05:47:03
Коэффициент подобия № 1:	**6,5%**
Коэффициент подобия № 2:	**1,8%**
Длина фразы для коэффициента подобия № 2:	25
Количество слов:	12 745
Число знаков:	84 541
Адреса пропущенные при проверке:	
Количество завершенных проверок:	9

! **К вашему сведению, некоторые слова в этом документе содержат буквы из других алфавитов. Возможно - это попытка скрыть позаимствованный текст. Документ был проверен путем замещения этих букв латинским эквивалентом. Пожалуйста, уделите особое внимание этим частям отчета. Они выделены соответственно.**
Количество выделенных слов 14

>> **Самые длинные фрагменты, определеные, как подобные**

№	Название, имя автора или адрес гиперссылки *(Название базы данных)*	Автор	Количество одинаковых слов
1	URL_ https://www.ijarnd.com/manuscripts/v3i1/V3I1-1147.pdf		59
2	URL_ https://docplayer.net/3777918-Outsourcing-in-the-oil-and-gas-industry.html		41
3	URL_ http://www.tcworld.info/e-magazine/outsourcing/article/ensuring-quality-in-outsourcing/		40
4	URL_ https://asq.org/quality-resources/malcolm-baldrige-national-quality-award		36
5	URL_ https://www.investopedia.com/terms/o/outsourcing.asp		31
6	URL_ https://en.wikipedia.org/wiki/Variation_ratio		27
7	URL_ https://www.investopedia.com/terms/d/descriptive_statistics.asp		22

АННОТАЦИЯ

Целью данного диссертационного исследования является исследование факторов качества, критически влияющих на успешное управление качеством при аутсорсинге в нефтедобывающих компаниях. Для решения экспериментальной части исследования было проведено опросное исследование (исследование, проводимое с помощью анкетирования) среди сотрудников нефтегазовых организаций Казахстана, по совместительству участников проектов, реализуемых в нефтяном секторе. Объектом исследования являются принимавшие участие в анкетировании респонденты. Инструмент исследования состоит из 62 факторов качества, которые представляют собой предмет исследования. Для достижения цели исследования были поставлены и решены следующие задачи:

-определены существующие практики по управлению качеством в нефтедобывающих компаниях;

-изучены мнения ключевых заинтересованных сторон по поводу практик по управлению качеством, а также факторы и проблемы, препятствующие обеспечению качества при аутсорсинге;

-исследованы факторы качества, критически влияющие на успешное управление качеством при аутсорсинге в нефтедобывающих компаниях;

-сформулированы рекомендации по обеспечению качества в нефтедобывающем сегменте нефтегазовой индустрии.

АҢДАТПА

Бұл диссертациялық зерттеудің мақсаты - мұнай өндіруші компанияларда аутсорсинг кезінде сапаны сәтті басқаруға әсер ететін ең маңызды сапа факторларын зерттеу. Зерттеудің эксперименталды бөлігін шешу үшін Қазақстандағы мұнай-газ компанияларының қызметкерлері арасында сауалнама жүргізілді. зерттеу нысаны. Сауалнамаға қатысқан респонденттер зерттеу нысаны болып келеді. Зерттеу құралы, сауалнама, 62 сапа факторынан тұрады және зерттеу мәнін құрайды. Зерттеудің мақсатына жету үшін келесі тапсырмалар қойылды және орындалды:

-мұнайгаз компанияларында сапаны басқарудың қолданыстағы тәжірибелері анықталды;

-негізгі мүдделі тараптардың сапаны басқару тәжірибесі туралы пікірлері, сондай-ақ аутсорсинг барысында сапаны қамтамасыз етуге кедергі келтіретін факторлар анықталды;

-мұнай өндіруші компанияларда аутсорсинг барысында сапаны сәтті басқаруға критикалық түрде әсер ететін сапа факторлары зерттелді;

-мұнайгаз индустриясының өндіру сегментінде сапаны қамтамасыз ету бойынша ұсыныстар жасалды.

ABSTRACT

The overall aim of this research is to investigate quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies. A questionnaire was used as a survey instrument to conduct the empirical study. Employees of oil and gas organizations served as research subjects, i.e. respondents to the questionnaire. Survey instrument contains 62 quality factors there were to be investigated to uncover the most critical ones. Specifically, within the context of the upstream oil and gas sector, the following research objectives have been met to reach the overall aim of this research:

1. *Identify* existing quality management practices in the upstream petroleum industry.
2. *Explore* key stakeholder views and practices related to quality management of outsourced services, including drivers and barriers to ensuring quality in outsourcing.
3. *Investigate* quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies.
4. *Produce* recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry.

CONTENTS

INTRODUCTION

This work addresses the various practices the upstream petroleum companies have put in place to ensure the quality of product and service delivery from their outsourcing partner. The overall aim of this research is to investigate quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies. Three major segments constitute the oil and gas industry: upstream, midstream and downstream. Since the focus of the current study is put on the upstream segment, a clear definition of the latter is required. The upstream oil and gas segment finds and produces crude oil and natural gas and can also be referred to as the exploration and production (E&P) sector.

Specifically, within the context of the upstream oil and gas sector, the objectives of this research are to:

1. *Identify* existing quality management practices in the upstream petroleum industry.
2. *Explore* key stakeholder views and practices related to quality management of outsourced services, including drivers and barriers to ensuring quality in outsourcing.
3. *Investigate* quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies.
4. *Produce* recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry.

Two main research means will be employed to facilitate this study: a thorough review of relevant literature and the gathering and analysis of empirical data. The section entitled Research Methods details both the research strategy and the data collection techniques to be used to collect the empirical data. If the first and the second objectives set out earlier are to be met through doing a careful and thorough literature review, the last two objectives, the third and fourth, will be satisfied through conducting empirical research. Literature review chapter sets out the current trends in outsourcing within the context of upstream petroleum industry and identifies the existing quality management systems implemented in oil and gas companies. The findings from Literature review chapter will provide the theoretical framework against which, later in the study, the research findings will be compared and contrasted.

The research findings will add to the body of knowledge in quality management in the petroleum industry. The empirical study findings will help uncover any critical quality factors that should be addressed in the first place to ensure quality whilst outsourcing. A questionnaire will serve as a research instrument. Kazakhstani oil and gas companies will serve as research sites whereas their employees will serve as research subjects, those who will take the questionnaire.

2 Literature review

2.1 Introduction to the literature review

This section presents the review of literature related to studies on quality management systems implemented in the petroleum companies operating in the upstream sector. The study within this review of literature focuses on objectives 1 and 2 as set out in the introductory chapter and repeated herein below (the third objective will be met through examining case studies, while the final objective – objective 4 – is derived as a result of the findings from objectives 1, 2 and 3):

1. *Identify existing quality management practices in the upstream petroleum industry.*
2. *Explore key stakeholder views and practices related to quality management of outsourced services, including drivers and barriers to ensuring quality in outsourcing.*
3. Investigate quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies.
4. Produce recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry.

Provided the above areas of literature are investigated, a significant contribution will be made to this research. The existing quality management practices in the upstream petroleum industry will be identified. Key stakeholder views and practices related to quality management of outsourced services, including drivers and barriers to ensuring quality in outsourcing will be explored. In effect, the value of studying the aforementioned literature areas will be to provide a meaningful discussion and analysis of quality management when outsourcing, in a structured way, to facilitate a critical understanding of quality practices and issues surrounding them.

At the end of this section it is believed that a critical understanding of key issues will be shown, that the reader will be better educated in these areas and that there will come into view a clear focus and justification for the current in-depth research in the field of quality management in upstream petroleum industry. To address the issues outlined above and reach the research objectives set out earlier, an investigation of what is meant by the term *outsourcing* in the context of petroleum industry should be made in the first place. Further, the existing quality management systems implemented in oil and gas companies will be explored to help uncover drivers and barriers to ensuring quality in outsourcing. Finally, provided the objectives are tackled through in-depth literature review, emerging issues will be highlighted in the Literature Review conclusion so as to provide the justification for empirical research aiming to investigate quality factors that are essential for

successful quality management of outsourced services in upstream petroleum companies.

2.2 Defining outsourcing within the context of upstream petroleum industry

As was pointed out earlier, a good starting point is to investigate what is meant by the term *outsourcing* in the context of petroleum industry, specifically, within the context of the upstream oil and gas segment. Further, having defined the term, the current trends in outsourcing oil and gas services should be made clear to the reader at the end of this sub-section.

There has been made a clear point by Tholons Inc. (2007:1) when, in a foreword to their report for Outsourcing in the oil and gas industry, they bring out the main challenges the then oil and gas industry was facing:

' Today's oil and gas industry continues to struggle in finding a complicated balance between rising global demand, diminishing global resources, and in maintaining manageable distribution and operating costs. While mergers and consolidation continue, oil and gas management are determining other approaches to recover their base lines. One particular measure is to include business process outsourcing (BPO) in their operational mix.'

The challenges delineated above date back more than a decade and have gone even further today. Since then, petroleum industry has undergone a marked change. A major drop in oil price, starting in mid-2014 and settling at $38.23 a barrel in 2016 amplified those challenges the petroleum industry was already facing. Since that drastic drop, the price for a barrel of oil has not exceeded $58. Not only did the steep drop in oil prices affected the petroleum industry, but it also harmed the world's economy. The economies of oil producing countries, where Kazakhstan belongs, that are highly oil dependent suffered the most. Flynn (2018, cited in Heath, 2018), a senior market analyst at Chicago-based Price Futures Group, expressed his concern about that oil crisis and its major implications saying 'It was a major crash signaling a slowdown in the global economy.'

Now when we revisit the aforementioned quote (*op. cit.*), along with the challenges there appear ways to cope with the latter. In tackling the challenges and seeking to recover their base lines, oil and gas management actively 'included *business process outsourcing* (BPO) in their operational mix.' Today when oil price stays low and is likely to remain low for the foreseeable future, outsourcing remains 'the answer for companies that want to stay on top as the industry continues to grow and adapt to changing views' (Velocity Global, 2017). However, some companies

started to consider adopting ‘In-Sourcing model’. There has been referred a case in Harthy et al. (2017) when one of the major oil and gas operator in the Middle East decided jointly with its shareholders to move from the concept of ‘Out sourcing’ to ‘In sourcing’ where the company itself has owned rigs including their own employees to execute the drilling operations. Harthy et al. (2017) believe that such shift is necessary as:

‘the declining oil price has a profound effect on the growth of this sector and any inflexible outsourcing contracts, which are the norm currently, will have a profound effect on performance. In this situation turning from outsourcing to insourcing plays an important role, especially when combined with internal knowledge; know how, skills and expertise.’

The differing aforementioned views indicate that there have been conflicting reports on whether *Outsourcing* is believed to remain in disruptive times as beneficial as it was back in pre-crisis period. Now that ‘In sourcing’ is defined, we should arrive at defining ‘Outsourcing’. Fortunately, there is a clear and agreed definition for outsourcing. Alexandra Twin, an editor and writer for CNN’s financial web site, in an article on Outsourcing at Investopedia (2019), defined outsourcing in the following simplistic terms: ‘Outsourcing is the business practice of hiring a party outside a company to perform services and create goods that traditionally were performed in-house by the company's own employees and staff.’ Yet there is a term that should be introduced to be differentiated from *outsourcing* that is *offshoring*. Unfortunately, the definition for outsourcing provided above, although having the benefit of concision, suffers from a lack of clarity as *offshoring* also fits that description. Offshoring is in many ways comparable to outsourcing but there are some important things to consider in differentiating between the two. Offshoring refers to obtaining services or products from another country. Jeffrey Glen in an article for Business dictionary (2013) best illustrates that difference writing ‘while much offshoring involves *outsourcing services* to another company, it can also refer to simply *re-location* certain aspects of a business to another country.’ One can readily appreciate the distinction between outsourcing and offshoring from the quote as ‘re-location certain aspects of a business to another country’ does not count as outsourcing.

Commonly, businesses outsource their non-core functions as it enables them to focus on the core aspects of the business, which are the essential, defining activities of an organization, and take advantage of cost savings from the outsourced functions. Nonetheless, upstream petroleum companies where ‘operational processes are traditionally more complicated and more costly in terms of managing a variety of business functions, tend to hand parts of their core work, such as engineering services apart from finance and accounting, to outside service providers’

(*op. cit.*). Now that outsourcing is defined, the categorization of services that upstream petroleum companies outsource should be introduced where specific service processes make up appropriate business functions. Furthermore, a clear distinction should be made by introducing which processes and functions oil and gas operators consider as core to their business and which non-core yet critical.

The report titled 'Outsourcing in the oil and gas industry' prepared by Tholons Inc. (*op. cit.*), an internationally recognized organization offering global outsourcing advisory services, best illustrates what is considered higher-value services and what is referred to as lower value services for the petroleum companies operating in the upstream sector. The excerpt from the table appearing in the report (*ibid.*) that lists business functions with the corresponding service processes that are likely to be outsourced by oil and gas companies is provided in the Table 2.2. The original table can be found in Appendix A to the present study.

Table 2.2 - A listing of business functions that are likely to be outsourced by oil and gas companies.

Business Function	Service Process
Higher Value Services	
Engineering and Design	• Property evaluation & acquisition • Divestitures • Drilling prospects and engineering reserve reports • Field study exploration • Waterflood feasibility and field performance issues • Process, mechanical, electrical, structural, civil and control engineering services
Lower Value Services	
Human Resources	• Payroll and tax related • Compensation and benefits • Health and pension administration • Administration and claims processing related to employee insurance, retirement, education and other employee related benefits • Training and related services
Back office and shared services	• Document management • Remote document process and storage • Document automation and related services • Web-based document management

Source: Excerpt from Tholons Inc.'s report (2007:7)

As seen in the Table 2.2 and Appendix A, Engineering and Design, Information technology outsourcing (ITO) and Finance and Accounting are referred to as higher value services whereas Human Resources and Back office and shared services

correspond to lower value services. Such a classification of outsourced services designed specifically for upstream oil and gas companies and offered by Tholons Inc. (*ibid*.) help group the service processes into more general categories, business functions. The current research will study at greater length the outsourcing of Engineering and Design *business function* that in turn encompasses six *business* (service) *processes*, namely (1) Property evaluation & acquisition, (2) Divestitures, (3) Drilling prospects and engineering reserve reports, (4) Field study exploration, (5) Waterflood feasibility and field performance issues and (6) Process, mechanical, electrical, structural, civil and control engineering services. According to Tholons Inc.'s classification, Engineering and Design *business function* outsourcing is regarded as a higher value service. Higher-value services imply core activities whereas lower-value services correspond to non-core activities. Now that outsourcing is defined within the context of upstream petroleum companies, we can revisit the research aim that states:

The overall aim of this research is to investigate quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies.

As the focus is put on *quality* management of outsourced services, the rest of the current research builds on the main theme stated in the research aim. Quality has proven to be the most significant factor not only whilst outsourcing, but most importantly, whilst choosing an outsourcing partner. Rouget (2009) acknowledges the ever-increasing role of quality:

'Business process outsourcing in petroleum industry has become a leading business model of our time. While the increasing pressure to cut cost is still among the primary drivers for this trend, today quality has become a major issue when it comes to choosing an outsourcing partner.'

The fact that quality overtook cost as the prevailing criterion whilst choosing an outsourcing partner is confirmed in numerous other studies. Telus Int. (2019), an experienced customer service outsourcing and digital IT services provider, holds firmly to the view that:

'Cost advantage is no longer the most important benefit in outsourcing partnerships as companies consider more valuable the potential for improved performance, better service and innovation offered by the potential outsourcing destination.'

The aforementioned views support the need for investigating quality issues in outsourcing. Further, the existing quality management systems implemented in oil and gas companies will be explored to help uncover drivers and barriers to ensuring quality in outsourcing. The next section presents the review of the quality

management systems currently implemented in oil and gas companies both local and foreign. As the quality management systems are identified, they will be investigated to help unearth drivers and barriers to ensuring quality in outsourcing in the following sections.

2.3 Identifying the existing quality management systems implemented in oil and gas companies

Most studies available to date on quality management systems in upstream oil and gas companies refer to the oil producers in the Middle East, namely Qatar, Iran and Libya. Although there has been extensive research regarding the development of total quality management TQM, quality management practices, improving operational and business performance in the petroleum industry of the Middle East through quality management, ensuring quality in outsourcing has received less attention. Nonetheless, the studies have provided an insight into the nature and extent of the quality issues. The results of the studies will be examined at length in the following sections when referring to drivers and barriers to ensuring quality.

Mellat-Parast et al. (2007) stressed the need for research and empirical work on TQM in developing countries, particularly in the Middle East. Implementation of TQM in developing oil-dependent economies progressed at a much slower rate, whereas Japan followed by the US, Europe and the South East Asian countries adopted TQM much earlier. The lack of research prompted Mellat-Parast et al. (*ibid.*) to target the following research questions: what are the implications of quality management in the Middle East? How is quality management being implemented in the Middle East? Do quality management practices affect operational and/or business performance? The overall research aim in turn was to empirically study quality management practices in the petroleum industry in Iran, the representative country in the Middle East.

Quite similar research was carried out in another Middle East country, Qatar. The purposes of the study conducted by Al-khalifa et al. (2000) were to assess: the awareness, the understanding, the progress of, and reasons for the implementation of ISO 9000 and TQM; the obstacles encountered in TQM implementation; and the knowledge and/or practices of TQM related activities.

Mellat-Parast et al. (2009) later expanded on their research by investigating empirically the effects of quality management practices on operational and business performance. The most recent paper on quality management in the petroleum industry was published in 2012. The purpose of the paper by Ahmad et al. (2012) was to investigate quality factors that were absolutely essential for successful implementation of total quality management (TQM) in Libyan oil and gas companies (LOGCs).

All aforementioned studies employed a questionnaire as an instrument for data collection. The techniques used in developing the questionnaires along with the data

analysis methods will be set out in the successive section to uncover any drivers and barriers to ensuring quality.

The Lists of Kazakhstani oil and gas service companies with API Spec Q1® Registered Management System and with ISO 9001 Registered Management System are represented in Table 2.3.1 and Table 2.3.2 accordingly.

Table 2.3.1 - The List of Kazakhstani oil and gas service companies with API Spec Q1® Registered Management System.

Company	City	State	Country	Certification(s)	Status
"Zhigermunayservic e" LLP	Atyrau		Kazakhstan	Q1-1917	Active
JSC "Aktyubinsk Petroleum Machinery Plant"	Aktobe	Aktyubinsk Region	Kazakhstan	Q1-2599	Active
JSC Kaskor-Mashzavod	Aktau	Mangystau	Kazakhstan	Q1-3493	Active
KIOS LLP	Aksai	Burlinsky Region	Kazakhstan	Q1-0209	Active
KSP Steel LLP	Pavlodar		Kazakhstan	Q1-0744	Active
Schlumberger Logelco Inc./SLB BDT Kazakhstan-Aksay Facility	Aksay	West Kazakhstan Oblast, Burlinsky Region	Kazakhstan	Q1-2625	Active
Schlumberger Logelco Inc./SLB BDT Kazakhstan-Aktau Facility	Aktau	Mangistau Oblast	Kazakhstan	Q1-1189	Active
SFEROVA KZ LLP	Burlin Region, Aksai, West Kazakhst an Oblast		Kazakhstan	Q1-3409	Active
TMK-Kaztrubprom	Uralsk	West Kazakhstan	Kazakhstan	Q1-0946	Active
Uralsk Industrial Business & Trade Company LLC	Uralsk	West Kazakhstan Region	Kazakhstan	Q1-2083	Active
Ust-Kamenogorsk Industrial Valve Plant, JSC	Vostochn o-Kazakhst anskaya	Oblast	Kazakhstan	Q1-3621	Active

Source: retrieved from https://mycerts.api.org/Search/CompositeSearch

Table 2 - The List of Kazakhstani oil and gas service companies with ISO 9001 Registered Management System.

Company	City	State	Country	Certification(s)	Status
"Zhigermunayservice" LLP	Atyrau		Kazakhstan	ISO-2043	Active
JSC "Aktyubinsk Petroleum Machinery Plant"	Aktobe	Aktyubinsk Region	Kazakhstan	ISO-2735	Active
JSC Kaskor-Mashzavod	Aktau	Mangystau	Kazakhstan	ISO-3598	Active
KIOS LLP	Aksai	Burlinsky Region	Kazakhstan	ISO-0491	Active
KSP Steel LLP	Pavlodar		Kazakhstan	ISO-0970	Active
SFEROVA KZ LLP	Burlin Region, Aksai, West Kazakhstan Oblast		Kazakhstan	ISO-3340	Active
Uralsk Industrial Business & Trade Company LLC	Uralsk	West Kazakhstan Region	Kazakhstan	ISO-2181	Active

Source: retrieved from https://mycerts.api.org/Search/CompositeSearch

3 Research methods

3.1 Introduction to research methods

This research study has a number of inter-related objectives set within the context of the upstream oil and gas segment. They are as follows:

1. *Identify* existing quality management practices in the upstream petroleum industry.
2. *Explore* key stakeholder views and practices related to quality management of outsourced services, including drivers and barriers to ensuring quality in outsourcing.
3. *Investigate* quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies.
4. *Produce* recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry.

As was discussed earlier, the first two objectives were to be met through carrying out thorough literature review whereas the last two are to be met through empirical study. This section will detail the Research Methods to be used, which are related to implementing the empirical research (research strategy, data collection techniques and framework for data analysis). Accordingly, a valuable aspect to this research work relates to Objective 3 that is empirical in nature: *Investigate* quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies. The need for such empirical research has emerged from the literature reviewed. Most studies available to date on quality management in the context of the petroleum industry were carried out predominantly in the Middle East countries, namely Qatar, Iran and Libya. Those countries are very rich in petroleum reserves. According to BP's 2012 Statistical Review of World Energy, ten countries in the Middle East account for only 3.4% of the area but contain 48% of world's known oil reserves and 38% of natural gas reserves. So far, very little research has been done on quality management issues in the petroleum industry of Kazakhstan, though it is a major oil producer and has the second–largest oil reserves and the second–largest oil production after Russia among the former Soviet republics. According to the aforementioned studies, there is a concern about the lack of empirical research in the field of quality management in oil and gas industry. The opportunity, therefore, to *investigate* quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies in Kazakhstan ought to contribute significantly not only to the study of quality management in general, but to a richer understanding of quality management issues in particular. Further, the final Objective 4 that is to *produce* recommendations on ensuring quality when outsourcing in the upstream segment of

the oil and gas industry will be met (detailed in Section 4 Research findings). By comparing theory with practice – i.e. comparing the Literature Review findings with the 'real world', Research findings (detailed in Section 4) – the researcher will gain a fuller understanding of the issues surrounding the successful quality management of outsourced services in upstream petroleum companies so will contribute to adding to the body of knowledge in quality management in the petroleum industry. This section – Research Methods – will provide the details of the research strategy adopted to address the research issues set out earlier, along with the techniques to use when gathering data, including site and sample selection, and lastly, the framework for data analysis to be used. Further, the potential limitations and problems associated with the selected research strategy and its implementation will be addressed at the end of this Research Methods chapter.

3.2 Research strategy

The section that sets out the Research strategy to be employed in one's research study, according to Biggam (2008:82), is often deemed the most difficult one. Most inexperienced researchers often fail to recognize what is meant by a research strategy, lack ample explanation of why they are using a particular research strategy and thereby they end up selecting a strategy that is wholly inappropriate for their research (*ibid.*). Therefore, this section not only introduces the research strategy to be used in the current study but also aims at supporting the chosen strategy with the definition, explanation and appropriateness for this research. In the first place, 'What is a research strategy?' question should be answered. Biggam (2008:82) defines *a research strategy* in simple terms:

'Quite simply, it is where you describe how you intend implementing your own research study, i.e. the strategy that you intend adopting to complete your empirical study.'

The current research involves carrying out empirical study to meet the objective 3 set out earlier that is to investigate quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies. As Literature review findings revealed that, there is a need for empirical data, practical research work will be carried out to tackle that deficiency. It follows from the Biggam's definition that one needs to work out their overall approach to implementing their research, i.e. their research strategy. Furthermore, the chosen research strategy will further aid in proving the research under consideration valid and reliable. Valid research is the one that is based on tried and tested research strategy. The question of reliability (and validity) will be further addressed in the current study at length. So, whatever research strategy is chosen, its appropriateness

to the research should be successfully argued. Provided the chosen research strategy is appropriate to one's research, then they are heading towards the goal of achieving valid research.

The empirical research in this study is concerned with collecting quantitative data ('investigate quality factors that are essential …') through the vehicle of questionnaires with numerically rated items. Real petroleum companies will serve as research sites whereas their employees as research subjects. A total of 62 numerically rated items/quality factors will be investigated with intent to uncover the critical ones. Correspondingly, the views of different stakeholders (research subjects) on a number of inter-related items (62) that converge into 13 core quality constructs such as (1) top management support, (2) strategic quality planning, (3) quality information availability, (4) quality information usage, (5) employee training, (6) employee involvement, (7) product/process design, (8) supplier quality, (9) customer orientation, (10) quality citizenship, (11) benchmarking, (12) internal quality results, (13) external quality results will be collected in a form of numerically ranked questions and analyzed to identify critical quality factors within the upstream petroleum segment.

There is a long list of research strategies, including case studies, surveys, ethnography, and action research, to mention but a few, from which the researcher can select the one that best suits their study instead of 'reinventing the wheel'. In order to meet the condition of academic credibility, a tried and tested research strategy should be adopted. A *case study*, 'a study of characteristics of an individual unit – a child, a class, a school or a community' – fails to address the researcher's aim of conducting the empirical research at several research sites (a selected sample of oil and gas companies). Similarly, *action research* that 'requires the researcher to be involved in the research not just as a (research) observer but as a participant', also does not meet this research objectives and cannot be adopted as a research strategy.

The research strategy that will be used to implement the empirical research in the current study is a survey. What is a survey approach and why is it suitable for this research? Biggam (2008:83) describes a survey thus:

'A survey is a representative selection from the population of a particular type, for instance, a survey of 30 universities from the population of universities in the UK or a survey of 200 retail companies in Europe.'

Check & Schutt define Survey research as "the collection of information from a sample of individuals through their responses to questions" (2012:160). The Objective 3 of the current research, *Investigate* quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies, will be met, as indicated earlier, through conducting empirical research into quality management practices. Empirical research will be quantitative in nature

(discussed later in 3.3.1 Site and sample selection) and employ a questionnaire as a survey instrument. Since dozens of companies represent the petroleum industry of Kazakhstan, a sample of XX companies will be selected from the population of oil and gas companies in Kazakhstan. Kraemer (1991:13) recognized three specific characteristics of a survey research. According to Kraemer (1991:13), the following features are specific to a survey research:

- *survey research is used to quantitatively describe specific aspects of a given population;*
- *the data required for survey research are collected from people and are, therefore, subjective;*
- *survey research uses a selected portion of the population from which the findings can later be generalized back to the population.*

Now, whether all aforementioned characteristics of a survey research fit the research strategy adopted in this study should be verified. Regarding the first characteristic, the research method adopted in this study is quantitative in nature since the primary focus of this research will be on collecting quantitative data through using questionnaires with numerically rated items (discussed at length in the next Section 3.3.1 Site and sample selection). The data required for survey research will be gathered from employees of petroleum companies that serve as Research subjects; hence, this research meets the second requirement. Only a selected sample of companies that is representative of the entire population of oil and gas companies in Kazakhstan will be surveyed. The survey research findings will later be generalized back to the population. Correspondingly, this research meets Kraemer's third and final condition – *survey research uses a selected portion of the population from which the findings can later be generalized back to the population*.

A survey research strategy as any other strategy is not devoid of criticism and there are limitations in adopting this approach that need attention. Surveys frequently are published in the popular press: '50% of people use email every day'; etc. As Biggam (2008:80) notes, these surveys, normally, lack the details about the research methods adopted, the sampling technique, the context in which the questions were asked, or the actual questionnaire used, etc. Therefore, these surveys are often deficient in the trustworthiness of the results, lacking academic credibility. As such, when implementing a survey, researchers should adopt 'a much more methodical and transparent approach, one that meets the high standards set by the academic community.'

Now that the research strategy adopted in this study is introduced and justified, to remove any accusation of lacking academic credibility in designing and applying survey strategy for this study, the researcher has done the following:

- *detailed the research methods adopted;*
- *presented the sampling technique used;*
- *set out the means of data collection;*
- *set out the framework for data analysis;*
- *provided the actual questionnaire used.*

All of the above are detailed and discussed at greater length in the following sub-sections of this Research methods chapter.

3.3 Data collection

3.3.1 Site and sample selection

The survey selected as a research strategy in the present study is generally considered a quantitative in nature. However, Biggam (2008:87) asserts that:

'It is not the research strategy – case study, survey, experimental, action research, etc. – that determines whether or not your empirical study is quantitative or qualitative in nature: that is dependent on a combination of your research strategy, your individual research objectives and your data collection technique(s).'

As such, a combination of the research strategy (1), research objectives (2) and data collection technique(s) (3) should be considered before coming to a conclusion whether the research is quantitative or qualitative in nature. Regarding the (1) and (3) clauses in the above sentence, the study appears to be quantitative since a closed questionnaire survey will be employed that tend to yield answers that are easily quantifiable (six people said this, four said that, etc.). Whereas individual research objectives (2) such as *'Explore key stakeholder views and practices related to quality management of outsourced services'* imply qualitative study demanding in-depth exploratory research answers that were delivered earlier through literature review. Hence, the current research is deemed both quantitative and qualitative in nature, though the empirical aspect of this project is wholly quantitative. Babbie (2010) states that researchers adopting a quantitative approach 'focus on gathering numerical data through polls, questionnaires, and surveys, and generalizing it across groups of people or to explain a particular phenomenon.' The statement correlates with the empirical aspect of this project: to perform statistical analysis of numerical data collected through a survey questionnaire using computational techniques such as SPSS (Statistical Package for the Social Sciences) so that quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies will be uncovered. It is then hoped that such an approach, incorporating both quantitative and qualitative methods, will assist in tackling the

issues arisen from the section on 'Issues and Review of Related Literature' by providing a 'thick description' of the quality management matters encountered in the Survey. Nevertheless, the primary focus of this research strategy is the collecting of quantitative data.

Simple random sampling was used to select both the petroleum companies (research site) and the respondents (sample population) from each company. Simple random sampling compared to random sampling results in even less bias since it allows for every member of the population to have an equal chance of being selected (Biggam, 2008:88). The fact that the subjects under study have been chosen at random helps reduce bias and make claims that the results of the current survey will be representative of a larger population, the broader oil and gas community. This research has as its focus the aim of achieving a quantitative insight into quality management related issues in petroleum companies. The review of relevant literature established that quality management practices influence significantly operational and business performance in the petroleum industry and quality related issues are an area of increasing interest in the oil and gas community. Moreover, with regard to sampling, those studies indicated the sampling techniques they implemented as the research limitations. The similar study, «Critical quality factors for successful TQM implementation in Libyan oil and gas sector», by Ahmad et al. (2012:713) as the means of data gathering also used a questionnaire and surveyed only quality managers and engineers as their sample population. In outlining the need for future research, Ahmad et al. (2012:713) suggested gathering information 'from various stakeholders such as employees, customers, suppliers and even competitors.' Hence, the current study will not limit the respondents' number to quality-related ones, but instead will expand the number of sample population to be surveyed encompassing all employees from different departments and all stakeholders of the ongoing projects in those performing oil and gas organizations as shown in Table 3.3.1.

How will this data be collected? The survey data will rely on sole data collection technique: questionnaire. The main source of data will be gathered from the research subjects, i.e. respondents to the questionnaire, which serves as a research instrument (detailed in section 3.3.2 Data collection techniques). Questionnaires are an applicable means of collecting quantitative data, and commonly used in surveys. Indeed, Hewitt et al. (2017) acknowledge that 'the questionnaire survey is a very well-known and widely-used research technique for quickly and efficiently gathering and analyzing data from a population under study.' The survey instrument consists of two parts, where the first part contains questions designed to collect the demographic information, the results of which are presented in the Table 3.3.1 and discussed in Chapter 4 on Survey Findings. The questionnaire format used along with the questions that appear in it are detailed in the following sections 3.3.2 Data collection techniques and 3.4 Framework for data analysis. Furthermore, Appendix B contains the actual questionnaire employed in this study.

The use of a questionnaire as a survey instrument is appropriate to this research because it allows the opportunity for collecting numerical data from the respondents on how they perceive each of quality factors, as to their level of importance to the successful quality management of outsourced services. The numerically rated items/quality factors will also allow for implementing statistical analysis of quantitative data and to study the effects of quality management practices on overall business performance.

As indicated earlier, the sampling technique used in this study is simple random sampling. The reason behind choosing simple random sampling was in a lower amount of bias it results in compared to other sampling means. The fact that random sampling allows for making claims that the results of the current survey will be representative of a larger population was also the case when deciding upon the sampling technique to select. However, when conducting research on a specific population, the researcher also needs to justify the sample size chosen to make sure that their sample of that population is representative. Sample size is an issue in quantitative research. Normally, the larger the sample size, then the more representative the results produced. To claim that the findings are representative of a larger population, the researcher needs to justify the sample size selected employing statistical techniques. One such statistical tool is offered by the Internet site http://www.surveysystem.com. The Internet site has produced a calculator to help one determine their sample size with different degrees of confidence. The calculator allows for determining the confidence interval and confidence level with unknown population and for known sample size. Out of numerous ways of administering questionnaires, including face-to-face, by phone, and on paper, online method (a survey administration app 'Google Forms') was selected for two main reasons. First, the online questionnaires are best when results should remain anonymous. Secondly, their advantage is the ability to export data to a spreadsheet for further analysis. The link to the questionnaire with a covering letter was e-mailed to individuals who were employed in companies representing Kazakhstani oil and gas sector. Hence, it is barely possible to determine a response rate due to administering the online questionnaires. Overall, 30 out of XX questionnaires were returned sufficiently completed. The online calculator available at the following link https://www.surveysystem.com/sscalc.htm was used to find confidence interval for this survey results. The entry data required to find confidence interval are as follows:

- *confidence level;*
- *sample size;*
- *population;*
- *percentage.*

The 95% *confidence level* was used in the study that means that we can be 95% certain. Most researchers use the 95% confidence level. The *sample size* equals the number of responses received that is 30. Since the population is very large and

unknown (there are dozens of oil and gas companies operating in Kazakhstan with thousands of employees), the *Population* box was left blank. Regarding the last remaining box *Percentage*, it was taken to be 50%. The worst-case percentage (50%) should be used when a general level of accuracy for a known sample size needs to be determined. First, the data were entered in the calculator to find the confidence interval. The confidence interval for the *sample size* of 30 and *percentage* of 50, according to the result, is 17.89. The figure below 3.3.1 is an excerpt from the above-mentioned web site that demonstrates the data entered and the answer for confidence interval.

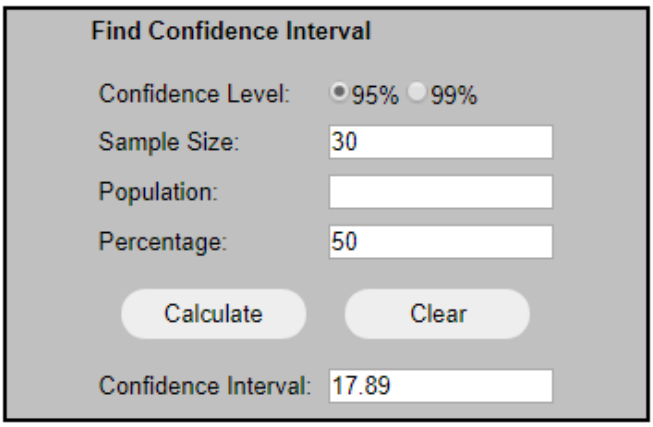

Figure 5.1 - Calculating the confidence interval. Source: compiled by author

The confidence interval of 17.89 then was entered back in the calculator to find the sample size and prove the consistency of results. The figure 5.2 is an excerpt from the site that shows the sample size needed for the known confidence interval.

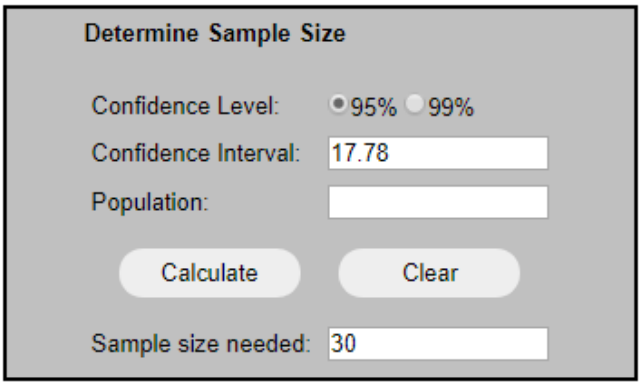

Figure 5.2 - Calculating the sample size. Source: compiled by author

The confidence interval (also called margin of error) found for the sample size of 30 (the number of respondents) is quite large due to the small sample size. Apparently, the narrower the confidence interval the more accurate the estimates. Hence, it is highly recommended that the future research be conducted with a larger sample size.

Table 3.3.1 - Survey demographic information.

	Number of respondents	Percentage of respondents (%)
Business category:		
Upstream segment	15	50.00
Midstream segment	1	3.33
Downstream segment	0	0.00
Oil Service Company	7	23.33
Oil Equipment Manufacturer	2	6.66
Consultancy	2	6.66
Others	3	10.00
Length of working experience in the industry:		
Less than a year	4	13.33
1 to 5 years	11	36.66
More than 5 years	15	50.00
Size (number of employees):		
Less than 50	10	33.33
Less than 250	8	26.66
Less than 500	3	10.00
More than 500	9	30.00
Job title:		
Top manager	6	20.00
Middle manager	8	26.66
Quality department member	5	16.66
Other	11	36.66
Role in the ongoing (or closed) project(s):		
Project sponsor	2	6.66
Project manager	11	6.66
Quality management team member	6	20.00
Other	11	36.66
Quality Management System:		
ISO 9001	19	63.33
API Spec Q1	3	10.00
API Spec Q2	2	6.66
Other	6	20.00
Respondent's age:		
Under 25	2	6.66
25÷35	20	66.66
35÷45	5	16.66
45÷55	2	6.66
55 or older	1	3.33
Respondent's gender:		
Male	19	63.33
Female	11	36.66

Source: compiled by author

3.3.2 Data collection techniques

This section details the means by which empirical data are to be collected in the current study. Deciding upon which data collection technique(s) to use is just as important as selecting an appropriate research strategy. This research is concerned with gathering quantitative data. As such, the use of case studies, although useful in gathering qualitative data, would not satisfy the researcher's desire for quantitative input, perceptual data from different stakeholders on quality management practices in the petroleum industry. Moreover, qualitative studies (e.g. interview, case study) are detailed and time-consuming undertakings. The current study aims at producing results that would be representative of a larger population and, hence, qualitative studies linked to in-depth exploratory studies, where the research site is constrained to single source or just a few sources, would not be applicable in terms of generalizability. The results of a case study, for instance, would be of interest only to those coping with similar issues raised in the study and would lack generalizability. Any sound findings that would result in recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry would be significantly weakened by the lack of quantitative data from the survey. As indicated earlier, quantitative data will be based on individual perceptions of different stakeholders on quality management practices in the petroleum industry. Hence, although the current research falls under the heading of 'quantitative' study, the fact that quantitative information is based on perceptual data provided by the respondents to the questionnaire allows for 'quality' responses and to some extent falls under the heading of 'qualitative' study.

Quantitative data will be obtained primarily through the vehicle of closed questionnaires. The survey questionnaire will consist of a number of closed-ended questions, namely 13 constructs composed of 62 quality factors presented as statements. The respondents will be requested to rate each statement on a five-point Likert scale, where the lowest rank 1 corresponds to 'very low' (non-critical factor) and the highest rank 5 corresponds to 'very high' (critical factor). The survey instrument solicits information from the participants about their perceptions of quality management practices aiming at obtaining quantitative data that will be further exported to SPSS and processed to uncover the critical quality factors (detailed in section 3.4 Framework for data analysis). The 13 quality constructs and 62 quality factors that make up those 13 constructs and appear in the questionnaires have been selected after thorough review of corresponding literature. The survey instrument was developed back in 1999 (Rao et al.) and repeatedly used later as the instrument in similar studies related to quality management practices in the petroleum industry (Mellat-Parrast et al., 2007; 2009).

The constructs/quality factors selected for developing a questionnaire are based on The Malcolm Baldrige National Quality Award (MBNQA) criteria. The American Society for Quality defines MBNQA as follows:

'The Malcolm Baldrige National Quality Award (MBNQA) is an award established by the U.S. Congress in 1987 to raise awareness of quality management and recognize U.S. companies that have implemented successful quality management systems.'

Although MBNQA is best known as the US national quality award, many practitioners, researchers and academics along with Quality gurus as Juran (1994) have long recognized MBNQA as 'a helpful model for getting into world class quality'. Mellat-Parrast et al. (2007:694) contend that MBNQA 'has been primarily used as a framework for business improvement rather than as an award for quality.'

The Baldrige model consists of seven criteria, as follows:

1. Leadership
2. Strategic planning
3. Measurement, analysis and knowledge management
4. Customer and market focus
5. Human resource focus
6. Process management
7. Business results

The generalizability of MBNQA and its relationship to many quality management constructs proves that 'the Baldrige model is a useful framework for studying quality management practices' (*ibid.*). Rao et al. (1999) further expanded the original Baldrige model constructs by adding six more constructs through undertaking a comprehensive empirical study. The extended model consisting of 13 constructs that 'allows capturing all aspects of quality management' as well as the original Baldrige model have served as a survey instrument in many studies related to quality management practices. Mellat-Parrast et al. (2007) have employed the survey instrument developed by Rao et al. (1999) in their study 'An empirical study of quality management practices in the petroleum industry.' Later the same instrument was applied by Mellat-Parrast et al. (2009) in undertaking their consecutive study titled 'Improving operational and business performance in the petroleum industry through quality management.' Both studies have proven successful in terms of the consistency of their results with previous studies on quality management.

The current study aims at exploring quality factors for successful quality management when outsourcing in upstream petroleum companies. For the purposes

of the current research, quality management practices within the context of project management will be investigated as *outsourcing* implies contracting services to an outside service provider. Another point to stress is that this research is industry-specific (*petroleum industry*), and furthermore sector-specific (*upstream sector also known as E&P sector*). The current trends in outsourcing in the petroleum industry along with the definition of *outsourcing* in the context of oil and gas industry and the industry segments were set out earlier in Literature review chapter. Both studies conducted by Mellat-Parrast et al. (2007; 2009) investigated quality management practices in Iran as it is the representative country in the Middle East because of the major role it plays in the petroleum industry in the world. *Project managers/consultants* from different companies that have *projects* in the *petroleum industry*, namely, *upstream sector*, in Iran due to their expertise served as Research subjects in the questionnaire survey conducted by Mellat-Parrast et al. (*ibid.*). Another academic paper concerned with 'Identifying critical quality factors for successful TQM implementation in Libyan oil and gas sector' by Ahmad et al. (2012) used perceptual data provided by quality managers and engineers only and emphasized the need for gathering information from various stakeholders such as employees, customers, suppliers and even competitors. Therefore, the current study surveyed not only quality-related managers as in Ahmad et al. (2012) or project managers and consultants as in Mellat-Parrast et al. (2007; 2009) but broadened the list of research subjects encompassing everyone involved in projects as shown in Table 3.3.1. The list of the respondents also can be found in the first part of the questionnaire (Appendix B) under two different heading: *your job title* and *your role in the ongoing (or closed) project(s)*. The first part of the questionnaire contains demographic questions, the results of which are summarized in the Table 3.3.1. *'Your job title'* question presents the respondent with four different options as (1) top manager, (2) middle manager, (3) quality department member and as the fourth offers the 'Other (please specify)' option. *'Your role in the ongoing (or closed) project(s)'* offers project-related roles such as (1) project sponsor, (2) project manager, (3) quality management team member and the final (4) 'Other stakeholder (please specify)' option. It is worth noting that both questions consider, in the first place, surveying top managers and quality-related employees and allow for any other stakeholder to take the questionnaire by including the 'Other stakeholder (please specify)' option. Accordingly, the current survey took into account the suggestions made in previous studies and indicated earlier regarding the need for gathering information from various stakeholders and not limiting the respondents to top/project managers and quality-related employees and team members. Surveying different stakeholders will allow for obtaining different perspectives of similar quality management issues and correspond to acquiring a clear picture. Appendix B contains the actual questionnaire sample used in the current study that

in turn consists of two parts, where the Part 1 is intended to collect demographic information whereas Part 2 contains all 62 quality factors presented as statements.

As can be seen in the Appendix B, the questionnaire is presented in a matrix format. A matrix is a question type that lists a set of questions for which the answer categories are all the same, as in our example, where each question has the same answer choices, a 5-point Likert scale. Hence, rather than posing each question and its response options individually, the matrix format that suits well the survey instrument was preferred. Using a matrix format is a nice way of streamlining answer choices. Not only will this save the author some space in their survey but it will also help respondents progress through the survey more easily. However, as was indicated earlier, out of numerous ways of administering questionnaires, online method (a survey administration app 'Google Forms') was preferred over the others for two main reasons. First, the online questionnaires are best when results should remain anonymous. Secondly, their advantage is the ability to export data to a spreadsheet for further analysis. The link to the questionnaire along with the paper matrix format with a covering letter was e-mailed to individuals who were employed in companies representing Kazakhstani oil and gas sector. Both paper and online formats of questionnaire are best choices when results should remain anonymous.

3.4 Framework for data analysis

The 13 constructs identified by Rao et al. (1999) were considered to serve as a framework for quality management to reflect the main objectives of this research. The development of this survey instrument was discussed earlier in Section 3.3.2. The 62 quality-related questions appearing in the questionnaire as statements are placed under those 13 constructs/headings to ease the analysis of the quantitative data for the researcher and help the respondents focus as they take the questionnaire survey. Table 3.4 reveals the breakdown of questions under each theme. As shown in the Table 3.4, a different number of questions constitute different themes. For example, the theme/construct №9 Customer orientation (co) contains the highest number of questions – 8 – nearly three times as many as the themes with the least amount of questions – 4 – №3 Quality information availability (qia) and №4 Quality information usage (qiu) accordingly. This uneven distribution of questions under each heading is to be justified later in the Research findings section through performing reliability analysis. Cronbach's coefficient alpha for the 13 constructs considered in the study will be identified. The coefficient measures the internal consistency (reliability) of the instrument. Cronbach's coefficient value of 0.7 and above would be an acceptable value for survey research. Along with the overall alpha for all 62 quality factors, Cronbach's coefficient value for each construct will be determined. Provided each construct has a value of 0.7 or above, the instrument will prove reliable. Thus, items/questions assigned to each construct/theme will

prove to measure the same factor. The constructs are detailed below (Table 3.5). The abbreviation in parentheses next to each construct is provided to denote the variables in the data analysis (research findings) section.

Table 3.4 - Questionnaire survey: breakdown of themes and questions.

Theme	**Number of questions**
1.Top management support (tms)	7
2.Strategic quality planning (sqp)	4
3.Quality information availability (qia)	3
4.Quality information usage (qiu)	3
5.Employee training (et)	4
6.Employee involvement (ei)	5
7.Product/process design (pd)	5
8.Supplier quality (sq)	6
9.Customer orientation (co)	8
10.Quality citizenship (qc)	4
11.Benchmarking (b)	4
12.Internal quality results (iqr)	5
13.External quality results (eqr)	4

Source: compiled by author

An important part of this research is to describe, analyze and synthesize (compare survey findings against Literature review findings) the survey data. Figure 3.4 represents the approach adopted for quantitative data analysis process in this study. As shown in the Figure 3.4, the steps involved in quantitative data analysis process, presented in the form of a flowchart, are not iterative in nature, but rather sequential. Workflow is as follows:

- *collect data through the questionnaire survey;*
- *prove the instrument reliable through carrying out reliability analysis;*
- *describe data;*
- *perform frequency analysis using statistical tools;*
- *interpret the results;*
- *compare survey findings against literature review findings.*

Once data are collected, a reliability test will be performed on a data set using SPSS software. Provided the instrument is proved reliable, the data gathered through the questionnaire will be described. Since the questionnaire contains questions that aim at collecting demographic information apart from the questions intended to measure each quality factor, first the *demographics* will be described. Further, data analysis process will be initiated using descriptive statistics, namely *frequency analysis*. Frequency analysis is broken down into measures of central tendency and measures of variability (spread). Both measures will be estimated as part of statistical analysis and set out in Survey findings chapter.

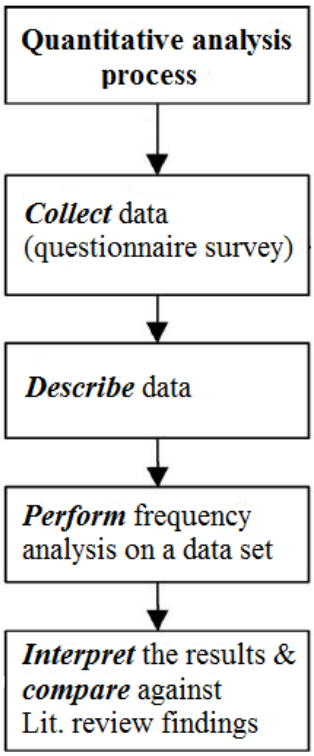

Figure 3.4 - Quantitative data analysis process for the questionnaire survey responses. Source: compiled by author

The first level of investigation, estimating measures of central tendency (frequency distribution and mode), will aid at identifying modal categories for all quality factors, thus uncovering the preliminary list of critical quality factors. Whereas the second level of investigation that includes estimating measures of dispersion (range, variation ratio and index of diversity) will help generating the final list of critical quality factors by supporting or contradicting the findings from the previous level of data analysis. Unfortunately, small sample size (N=30) prevents the researcher from performing more complex analysis on the data set, such as factor analysis. It is highly recommended that the future research be conducted with a larger sample size. Two levels of data analysis will help ensure the objective 3 of the current research – *investigate quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies* – is satisfied. Hence, the follow-up objective 4 – *produce recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry* – must be met as well.

The themes/constructs reflect the overall aim and objectives in this research and they are inter-related. Table 3.5, as indicated earlier, summarizes each construct's operational definitions.

Table 3.5 - Summary of construct's operational definitions. Source: Mellat-Parast, 2007.

Construct	Definition
Top management support (tms)	addresses the critical role of management in driving company-wide quality management efforts
Strategic quality planning (sqp)	incorporates the integration of quality and customer satisfaction issues into strategic and operational plans, which allow firms to set clear priorities, establish clear target goals, and allocate resources for the most important things.
Quality information availability (qia)	refers to the availability of quality information for effective and efficient quality management practices
Quality information usage (qiu)	indicates how much quality information is used by managers when making decisions
Employee training (et)	explains the level of continuous and intensive training as an essential part of quality management
Employee involvement (ei)	relates to the involvement of employees in problem solving, and decision making at all levels in the organisation
Product/process design (pd)	indicates the implementation of product/process management techniques that reduce process variation and affect internal quality performance
Supplier quality (sq)	acknowledges the importance of suppliers in achieving higher levels of quality in an organisation
Customer orientation (co)	refers to the extent the company evaluates the feedback from its customers in improving quality
Quality citizenship (qc)	stresses the practice of company responsibility and its social role in society, such as improvement of education, safety, and health care in the community
Benchmarking (b)	is defined as the search for industry best practices that lead to superior performance
Internal quality results (iqr)	determines how much quality management practices have affected internal quality measures, such as defect rates, reprocessing rate, production lead time, and productivity
External quality results (eqr)	refers to the improvement of external performance of the firm, which is measured by competitive market position, profitability and customer satisfaction

4. Survey Findings

This chapter reveals the findings from the survey described in Chapter 3 Research Methods. The survey instrument used was a questionnaire that included questions that address specific study objectives and collect demographic information. The demographic data gathered is presented in Table 3.3.1 and was intended to identify fundamental issues, such as business category, length of working experience in the industry, job title, role in the ongoing (or closed) project(s), respondent's age and gender, and whether the company has quality management system registered to ISO 9001, API Spec Q1 or API Spec Q2. The research subjects include all employees of an organization, i.e. all stakeholders involved in projects, since suggestions of previous studies on expanding research subjects and not limiting them to quality-related managers was taken into account. The breakdown of research subjects according to their job titles and project roles are presented in Table 3.3.1. The gathering of empirical data for this research is based on a questionnaire survey, to allow an analysis of quantitative data in a set context, within the upstream segment of the oil and gas industry. Next, description of gathered data is presented followed by the analysis and interpretation of collected quantitative information. Data analysis process followed the steps detailed in *Framework for data analysis* chapter and presented next. The survey instrument can be found in Appendix B. Once data description and analysis are set out, a summary of the research findings will be presented at the end of this Survey Findings Chapter. However, a more detailed summary of drawn conclusions that meets the objective 4 of the current study – *produce recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry* – will be provided in the final Conclusion chapter.

4.1 Demographics

As indicated earlier, the questionnaire was administered to oil and gas companies in the online format (a survey administration app 'Google Forms'). The first part of the instrument contained questions designed to collect the demographic information, the results of which are presented in the Table 3.3.1 and discussed next. In the sample, 63% of the participants were male whereas 37% were female. The respondents representing 25÷35 age group constitute almost 67%. A half of the respondents have been in the oil and gas industry for at least five years. The second part of the instrument includes 62 quality factors presented as statements, which are aimed at investigating how the research subjects perceive the criticality of quality factors to the success of quality management in oil and gas companies. The questionnaire employed in this study uses a five-point Likert scale (where the lowest rank '1' corresponds to 'very low' (non-critical factor) and the highest rank '5' corresponds to 'very high' (critical factor) to yield quantitative data for analysis.

4.2 Reliability analysis

Instrument reliability is an important factor to consider in a study as it helps ensuring quality of measurements and of the data gathered for a study. Reliability is defined as the extent to which an instrument yields consistent results. The most common measure of reliability is the *internal consistency* that in turn is measured by Cronbach's alpha, α (or coefficient alpha), developed by Lee Cronbach in 1951. Internal consistency reliability refers to the degree to which test items measure the same construct. Following the data collection, the responses were coded to enable them to be computer processed. The software package used for the analysis was SPSS (Statistical Package for the Social Sciences). Table 4.2.2 contains Cronbach's alpha for the 13 constructs considered in the study and shows the number of items (questions) attributed to each construct (variable). All constructs have a coefficient value of greater than 0.7, which is considered acceptable for a survey research (Nunally and Bernstein 1994, Streiner 2003). Accordingly, the test items (questions) measured the same construct to which they were assigned. Further, the overall Cronbach's alpha for all 62 items (total number of quality factors appearing in the questionnaire), was generated and yielded a coefficient value of 0.977 that indicates a high level of internal consistency for the survey instrument (Table 4.2.1). The instrument used for measuring success of quality management using critical quality factors (CQFs) was considered reliable.

Table 4.2.1 - Reliability of the survey.

Reliability statistics		
Cronbach's alpha	Cronbach's alpha based on standardized items	N of elements
,977	,978	62

Source: compiled by author in SPSS

Table 4.2.2 - Reliability of the constructs. Source: compiled by author in SPSS

Construct (Variable)	**Number of items**	**Cronbach's alpha**
Top management support (tms)	7	0.901
Strategic quality planning (sqp)	4	0.833
Quality information availability (qia)	3	0.707
Quality information usage (qiu)	3	0.824
Employee training (et)	4	0.840
Employee involvement (ei)	5	0.880
Product/process design (pd)	5	0.887
Supplier quality (sq)	6	0.827
Customer orientation (co)	8	0.910
Quality citizenship (qc)	4	0.797
Benchmarking (b)	4	0.814
Internal quality results (iqr)	5	0.907
External quality results (eqr)	4	0.913

4.3 Descriptive statistics (Frequency analysis)

Data analysis in this study draws its main conclusions using *descriptive statistics*. Descriptive statistics are brief descriptive coefficients that summarize a given data set that represent the entire or a sample of a population. Accordingly, they are very little dependent on the sample size. Given the relatively low number of responses (N=30) received for this survey, it is proved rationale to use frequency analysis. This small sample size prevents the researcher from performing more complex analysis on the data set, such as factor analysis. It is highly recommended that the future research be conducted with a larger sample size. Earlier conducted studies that have repeatedly been referred to throughout this research also preferred frequency analysis to the other statistical tools for their data processing. The summaries drawn from descriptive statistics represent the initial description of the data set and allow for a particular investigation in greater depth. Therefore, the Objective 3 of the current research - *investigate quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies* – can be satisfied by relying solely on descriptive statistics. Frequency analysis is broken down into measures of central tendency and measures of variability (spread). Both measures will be estimated as part of statistical analysis and addressed next.

4.3 Descriptive statistics (Frequency analysis)

4.3.1 Measures of central tendency

Measures of central tendency that include the mean, median, and mode, are found from frequency analysis. *Frequency analysis*, a descriptive statistical method that shows the number of occurrences of each response chosen by the respondents, has been selected the most appropriate for data analysis. Either Excel or SPSS Statistics can perform frequency analysis and aid one in analyzing the results and drawing conclusions. First, frequency distribution of responses for all quality factors have been produced using Excel. The output graphs (bar charts) are presented in Figures 4.3.1, 4.3.2, 4.3.3. According to the scale used in the questionnaire (five-point Likert scale), there are only five possible response ranges (bins) for each quality factor, namely ‘1’-non-critical, ‘2’-of minor importance, ‘3’-of medium importance, ‘4’-important, ‘5’-critical. However, when selecting the range (bin width), taking into account very low number of responses ranked ‘1’-non-critical and ‘2’-of minor importance, the answers at rank 1 & 2 were merged to form one possible range – ‘1÷2-non-critical’ as shown in the Table 4.3.1. As such, four possible response ranges (bins) for each quality factor have emerged and further used in quantifying response frequencies. Table 4.3.1. represents an excerpt from Excel and shows frequency distribution for first five quality factors.

Table 4.3.1 - Frequency of responses for QF1-QF5 quality factors.

Range (Bin width)	Legend to the scale	Frequency of responses (N=30)				
		QF1	QF2	QF3	QF4	QF5
1 ÷ 2	Non-critical	1	2	0	1	0
3	Medium importance	9	6	13	8	6
4	Important	9	14	9	7	10
5	Critical	11	8	8	14	14
	Total (N=30)	30	30	30	30	30

Source: compiled by author in Excel.

Now that frequency distributions for all quality factors have been calculated both numerically (Table 4.3.1) and graphically (Figures 4.3.1, 4.3.2, 4.3.3), the next step of frequency analysis is to estimate central tendency for the corresponding frequency distributions. Out of three main measures of central tendency, the mode, a data point with the highest frequency, appears to be the most reliable as nearly all of the quality factors' response distributions are unimodal in nature as illustrated in bar charts (Figures 4.3.1, 4.3.2, 4.3.3). That is, each distribution that is unimodal has one clear peak as shown in bar charts that corresponds to the most frequent number in a data set. The mode provides a summary of how respondents perceive the criticality of each of the QF (quality factor) to the success of quality management practices in their organizations. The summaries drawn from frequency analysis are presented in the Table 4.3.2. in the form of modal categories. According to the analysis, out of 62 quality factors, 15 were identified as *critical*, 42 factors were merged under the heading '*important*', 5 factors were returned as '*of medium importance*' by the majority of the respondents, and no factor was perceived as *'non-critical'*.

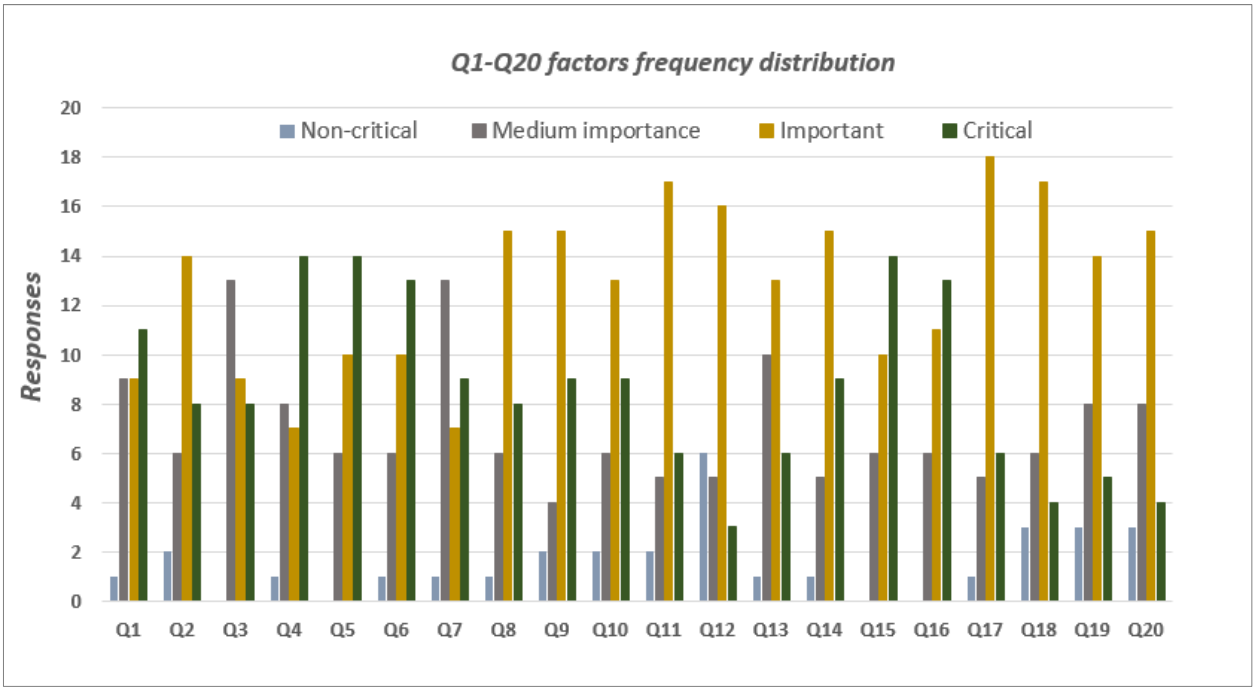

Figure 4.3.1 - Frequency distribution of responses for QF1-QF20 quality factors

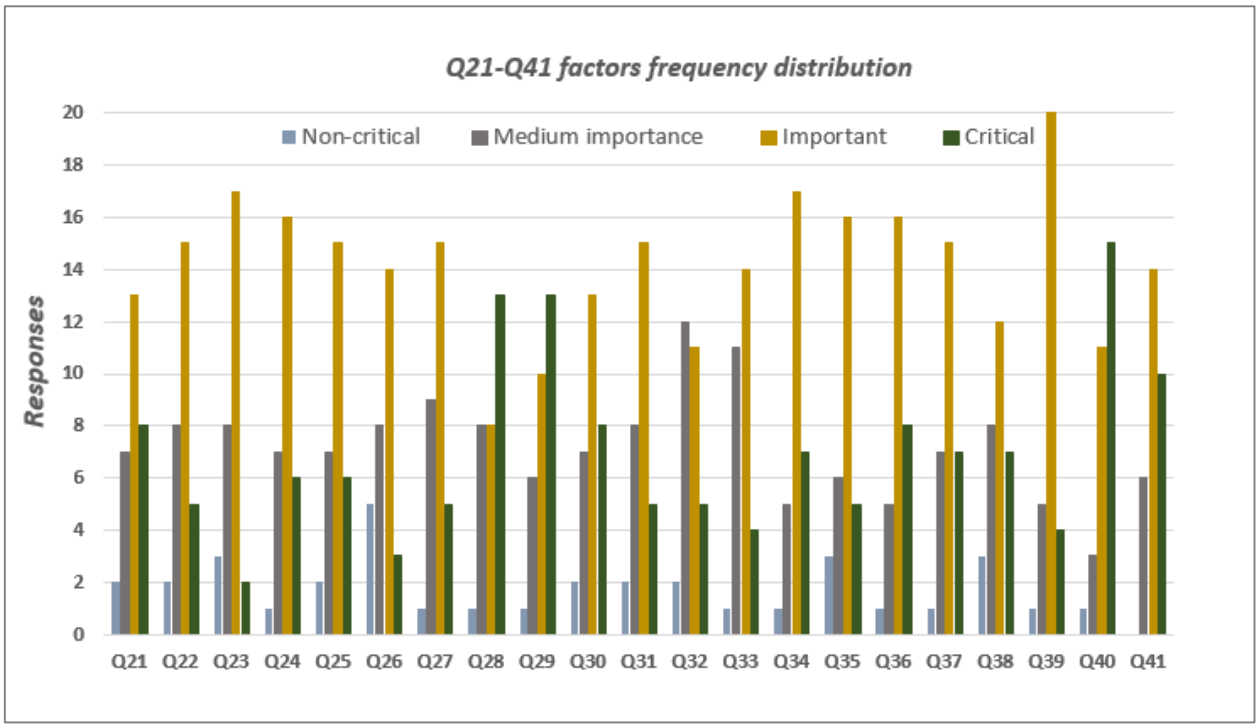

Figure 4.3.2 - Frequency distribution of responses for QF21-QF41 quality factors. Source: compiled by author in Excel.

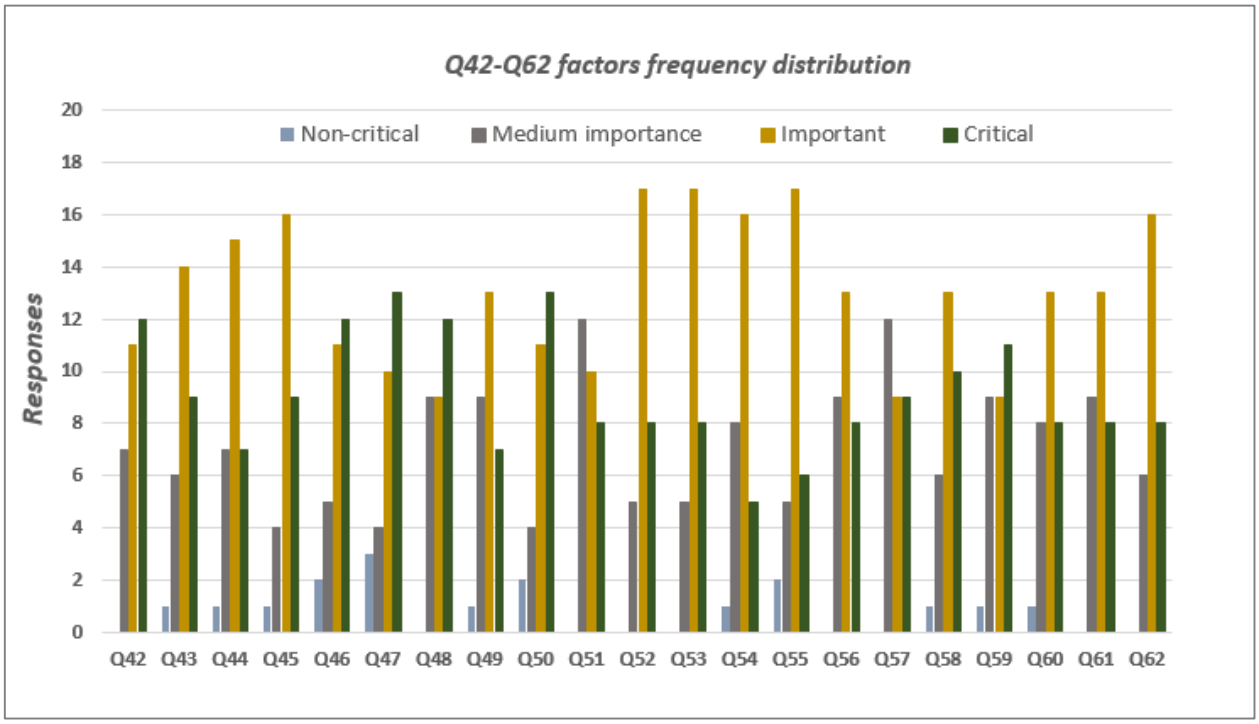

Figure 4.3.2 - Frequency distribution of responses for QF42-QF62 quality factors. Source: compiled by author in Excel.

Table 4.3.2 - Quality factors classified into three modal categories.

No. QF	Quality factor
Modal category: critical	
QF1	1.Extent to which the top company executive assumes responsibility for quality performance
QF4	2.Extent to which the top management has objectives for quality performance
QF5	3.Extent to which quality goals are made specific within the company
QF6	4.Importance attached to quality by the top management in relation to cost and schedule objectives
QF15	5.Extent to which quality data are used by top management in decision-making
QF16	6.Extent to which quality data are used by middle management in planning and controlling
QF28	7.Clarity of product/service specifications
QF29	8.Clarity of product/service procedures
QF40	9.Extent to which executives demonstrate with their actions that customer satisfaction is important
QF42	10.Extent to which information from customers is used in designing company's products and services
QF46	11.Extent to which public health issues are considered as a company/division responsibility
QF47	12.Extent to which public safety issues are considered as a company/division responsibility
QF48	13.Extent to which environmental issues are considered as a company/division responsibility
QF50	14.Extent to which your company/division studies the best practices of other companies to get ideas about how to do things better
QF59	15.Extent to which customer complaints have been reduced by quality management
Modal category: important	
QF2	16.Acceptance of responsibility for quality by major department heads within the company
QF8	17.Extent to which quality management is considered in the company/division strategic plan
QF9	18.Extent to which customer satisfaction is considered in the company/division strategic plan
QF10	19.Extent to which the top management supports long-term quality improvement process
QF11	20.Extent to which quality goals and policy are understood within the company/division
QF12	21.Availability of quality data (error rates, quality costs, defect rates, scrap, rework, returns, etc.)
QF13	22.Extent to which necessary quality data are available on time
QF14	23.Extent to which quality data are available to managers and supervisors
QF17	24.Extent to which quality data are used by hourly workers in their operations
QF18	25.Extent to which quality-related training is given to hourly employees throughout the company/ division
QF19	26.Extent to which training in the basic statistical techniques (such as histograms, cause and effect diagrams, control charts, etc.) is provided in the company/division as a whole
QF20	27.Availability of resources for employee training in the company/division

QF21	28.Extent to which training in specific work skills (technical and vocational) is given to employees throughout the company
QF22	29.Extent to which employee involvement programmes are implemented in the company/ division
QF23	30.Extent to which hourly/non-supervisory employees participate in quality decisions
QF24	31.Extent to which employees are held responsible for the output of their process
QF25	32.Extent to which quality awareness building among employees is ongoing
QF26	33.Extent to which the company/division measures employee morale
QF27	34.Extent to which new product/service design is reviewed before the product/service is produced
QF30	35.Extent to which implementation/producibility is considered in the product/service design process
QF31	36.Extent to which process design minimizes the chances of employee errors
QF33	37.Degree to which your company relies on a few dependable suppliers
QF34	38.Extent to which your company provides technical assistance to your suppliers
QF35	39.Extent to which the supplier is involved in your product development process
QF36	40.Extent to which you build long-term relationships with your suppliers
QF37	41.Clarity of specifications provided to your suppliers
QF38	42.Extent to which your company/division is totally committed to creating satisfied customers
QF39	43.Extent to which your company's goals exceed customers' expectations
QF41	44.Extent to which employees know which attributes of the products or services your company's customers value
QF43	45.Extent to which top management frequently contact customers
QF44	46.Extent to which customers' complaints are resolved
QF45	47.Extent to which employees are encouraged to satisfy customers
QF49	48.Extent to which the organization extends its quality commitment to the external community
QF52	49. Extent to which your company/division compares the current quality levels for products and services features with those of world leaders
QF53	50.Extent to which your company compares the current process quality levels with those of competitors
QF54	51.Extent to which scrap levels have been reduced by quality management
QF55	52.Extent to which rework levels have been reduced by quality management
QF56	53.Extent to which productivity of your company has been increased by quality management
QF58	54.Extent to which costs of your company have been reduced by quality management
QF60	55.Extent to which the competitive position of your company/division has been enhanced by quality management
QF61	56.Extent to which quality management has contributed to keeping your company/division in business
QF62	57.Extent to which profits of your company/division have been increased by quality management.
Modal category: medium importance	
QF3	58.Degree of participation by top management in the quality improvement process
QF7	59.Amount of review of quality issues in the top management meetings
QF32	60.Extent to which suppliers are selected based on quality rather than price

QF51	61.Extent to which your company/division compares the current quality levels for products and services features with those of competitors
QF57	62.Extent to which profits of your company/division have been increased by QM

Source: compiled by author

4.3 Descriptive statistics (Frequency analysis)

4.3.2 Measures of dispersion (spread/variability)

Measures of variability, or the measures of spread, aid in analyzing how spread-out the distribution is for a set of data. Measures of variability include the standard deviation, variance, range, and the kurtosis and skewness. However, most popular measures of dispersion used for *frequency analysis* are Standard Deviation, Variance and Range. For the purposes of the present study, Range and Variance for the given data set (30 responses for each of 62 QFs) will be calculated. Measures of central tendency (frequency distribution and mode) helped classify the quality factors (Table 4.3.2) into three modal categories (critical, important and of medium importance) and are considered as the first level of investigation that aided in producing interim survey results. Now that the first level of investigation into 62 quality factors is completed, the further data analysis can be initiated. This include calculating range and variance (variation ratio) for the dataset. Accordingly, the results of the second level of investigation into quality factors will aid in drawing final conclusions, i.e. survey findings, by either supporting or contradicting the interim results.

Range analysis

First, *range* analysis will be performed on a given dataset, to sort the quality factors with regard to their range values. The *range* is the most obvious measure of dispersion and is the difference between the lowest and highest values in a dataset. According to the scale used in the questionnaire (five-point scale), there are only five possible range values for each quality factor. A range value of '0' occurs when all respondents give a quality factor the same rating resulting in identical maximum and minimum rating values. Estimated range values for critical quality factors are presented in Table 4.3.2.2

Variation ratio

The range analysis, though helpful, has not sufficed to arrive at a consensus over the final list of critical quality factors. Accordingly, variation ratio, another measure of variability, will be generated for all quality factors to achieve the necessary agreement of a majority of participants over the critical quality factors. The following equation is used to calculate VR:

Variation ratio: $VR = 1 - f_m / N$

,where f_m is the frequency (number of cases) of the mode, and N is the total number of cases.

Just as with the *range*, the larger the *variation ratio*, the more differentiated or dispersed the data are; and the smaller the variation ratio, the more concentrated and similar the data are. The conditions adopted in similar study by Ahmad et al. (2012:719) will be applied for the present study. Those conditions enable categorizing quality factors in terms of their VR values into three, where VR = 0 means unanimity (all respondents rated the quality factor as critical), VR $\leq$ 0.5 means majority consensus (more than 50 per cent of respondents rated the quality factor as critical) and VR $\geq$ 0.5 means no majority consensus in rating a quality factor as critical. Hence, variation ratio will help separate the quality factors that received consensus by majority of the respondents from other quality factors with no majority agreement amongst the respondents as to the criticality attributed to a quality factor. Estimated *variation ratio* values for critical quality factors are also presented in Table 4.3.2.2 alongside *range* values so as to enable cross-checking the criticality of each quality factor against both measures of variability.

Index of diversity

Since variation ratio does not take into account the full distribution of responses, another measure of dispersion, *index of diversity* will be generated to complement the former two (*range*; *variation ratio*) and arrive at conclusions regarding the criticality of quality factors. Index of diversity, a measure that shows how diverse a particular category of a variable is, will aid in identifying the degree of concentration of responses in a few large categories. According to Ahmad et al. (2012:719), '*DI* can be considered as a surrogate measure of agreement amongst respondents concerning the response distribution for each of the quality factor'.

In mathematical terms:

Index of diversity = $1 - (P_1^2 + P_2^2 + \ldots + P_k^2)$

, where P_k is the proportion of responses in category k and k is the number of categories.

Just as with the *variation ratio*, a framework for *index of diversity* data interpretation will be drawn from the same study by Ahmad et al. (2012:719). They suggest that *diversity index (DI)* value close to '0' implies near unanimity, *DI* value near '0.5' indicates equal clustering around two large categories, and *DI* value around '0.75' signifies high level of disagreement. Table 4.3.2.2 contains *index of diversity* values calculated for the 18 quality factors returned by respondents as critical.

Now that all measures of spread are computed, an updated list of critical quality factors is to be generated that will either follow the previous list (Table 4.3.2) based on measures of central tendency or differ from it. Next, the results of range, variation ratio and index of diversity will be measured against each other and against the measures of central tendency with the aim of classifying and ordering the CQFs.

The second level of investigation reveals that the response distributions of 62 quality factors include only three possible types of *ranges* with the corresponding numerical values of '2', '3' and '4'. Table 4.3.2.1 contains estimated range values. 14 quality factors have a range value of '2' and are represented by all three categories (critical, important and of minor importance). Range analysis for 37 quality factors also dispersed into three categories yielded a value of '3'. Finally, 11 quality factors share a range value of '4' and are represented only by two modal categories (critical, important). Now it is still difficult to draw conclusions relating the critical quality factors, since the *range* estimates alone can tell little about the general agreement on the criticality of a quality factor. *Variation ratio* and *Index of diversity* estimates are also listed in the table 4.3.2.2 and should be measured against *range* results to complement the new list of CQFs. Table 4.3.2.2 shows that there is an agreement between the index of diversity values and the variation ratio results. The fact that diversity index did not exceed a value of '0.75' indicates a reasonably good level of agreement amongst the respondents concerning the criticality of these quality factors. The variation ratio estimates resulted in the following classification: 5 quality factors with VR values less than '0.5' are assumed to have majority consensus amongst the respondents whereas 13 quality factors with VR values greater than '0.5' signify no majority consensus in rating a quality factor as critical (Table 4.3.2.2). Therefore, to satisfy the objectives of the current study, there is a need to look for all aforementioned measures of spread and central tendency to find out whether they correlate or not and whether they produce consistent results. Accordingly, the estimates from frequency analysis will serve as a basis in an attempt to sort and order 18 CQFs as to their level of criticality (Table 4.3.2.2). The findings, hence, represent the fundamentals to produce recommendations on what quality factors to address in the first place. The classification of CQFs into three levels of criticality is discussed next at greater depth.

Table 4.3.2.1 - Classification of quality factors according to their range values.

Range value	**No. of factors**	**Quality factors**	**Category**
2	14	Q3, Q5, Q15, Q16, Q41, Q42, Q48, Q51, Q52, Q53, Q56, Q57, Q61, Q62	Critical, important, of minor importance
3	37	Q1, Q2, Q4, Q6, Q7, Q8, Q9, Q10, Q13, Q14, Q17, Q19, Q20, Q23, Q24, Q27, Q28, Q29, Q30, Q31, Q32, Q33, Q34, Q36, Q37, Q38, Q39, Q40, Q43, Q44, Q45, Q50 Q54, Q55, Q58, Q59, Q60	Critical, important, of minor importance
4	11	Q11, Q12, Q18, Q21, Q22, Q25, Q26, Q35, Q46, Q47, Q49	Critical, important

Source: compiled by author

The results of classifying and ordering CQFs into three levels of criticality is presented in Table 4.3.2.2. The former list of 15 quality factors uncovered using measures of central tendency was subjected to a significant change after estimating measures of spread. The changes to the register resulted in the following updates:

- *the number of CQFs is extended from 15 to 18;*
- *only 7 from 15 original CQFs appear on the updated list;*
- *9 factors returned as 'important' turn into critical;*
- *2 factors returned as 'of medium importance' turn into critical.*

The process of classifying and ordering CQFs into three levels of criticality involved the following stages:

- *all 62 quality factors were sorted in line with their range values;*
- *range 4 quality factors were ignored due to high variability;*
- *factors returned as 'important' and 'of medium importance' were removed from Range 3 quality factors' list;*
- *remaining Range 2 and Range 3 quality factors were reordered in accordance with their VR and DI values.*

A three-level hierarchical structure for critical quality factors has been established following the aforementioned stages:

- *Level 1 critical quality factors;*
- *Level 2 critical quality factors;*
- *Level 3 critical quality factors.*

Table 4.3.2.2 – The final register of categorized critical quality factors.

Sq.	**Quality factor**		**Variation ratio**	**Index of diversity**	**Classification into levels**
	Range 2	**Range 3**			
1	QF39		0.333	0.508	1
2	QF17		0.400	0.571	1
3	QF52		0.433	0.580	1
4	QF53		0.433	0.580	1
5	QF62		0.466	0.604	1
6	QF5		0.533	0.631	2
7	QF15		0.533	0.631	2
8	QF41		0.533	0.631	2
9	QF16		0.566	0.637	2
10	QF56		0.566	0.651	2
11	QF61		0.566	0.651	2
12	QF53		0.566	0.651	2
13	QF42		0.600	0.651	2
14	QF48		0.600	0.660	2
15	QF51		0.600	0.660	2
16	QF57		0.600	0.660	2
17		QF1	0.633	0.684	3
18		QF59	0.633	0.684	3

Source: compiled by author

The criteria used to stratify the CQFs are as follows:

Level 1 critical quality factors

Level 1 critical quality factors are considered to be of the highest priority. They are essential to successful quality management as perceived by nearly all respondents since they have the lowest variability, *Range* values of '2' and *Variation ratio* values of less than '0.5' indicating high agreement concerning their criticality amongst the respondents. These 5 CQFs in level 1 are as follows:

1. QF39: Extent to which your company's goals exceed customers' expectations;
2. QF17: Extent to which quality data are used by hourly workers in their operations;
3. QF52: Extent to which your company/division compares the current quality levels for products and services features with those of world leaders;
4. QF53: Extent to which your company compares the current process quality levels with those of competitors;
5. QF62: Extent to which profits of your company/division have been increased by quality management.

Level 2 critical quality factors

These are quality factors that have a range value of '2' and variation ratio values of '0.5' and greater but less than '0.6'. They are deemed essential as perceived by majority of the respondents whereas some participants consider them less important. These CQFs are recommended to be addressed right after addressing Level 1 critical quality factors.

These eleven quality factors are:

1. QF5: Extent to which quality goals are made specific within the company;
2. QF15: Extent to which quality data are used by top management in decision-making;
3. QF4: Extent to which employees know which attributes of the products or services your company's customers value;
4. QF16: Extent to which quality data are used by middle management in planning and controlling;
5. QF56: Extent to which productivity of your company has been increased by quality management;
6. QF61: Extent to which quality management has contributed to keeping your company/division in business;
7. QF53: Extent to which your company compares the current process quality levels with those of competitors;

8. QF42: Extent to which information from customers is used in designing company's products and services;
9. QF48: Extent to which environmental issues are considered as a company/division responsibility;
10. QF51: Extent to which your company/division compares the current quality levels for products and services features with those of competitors;
11. QF57: Extent to which your company's manufacturing throughput time has been reduced by quality management.

Level 3 critical quality factors

These quality factors have a *range* value of '3' and *variation ratio* values of greater than '0.6' implying high variability. Low majority consensus (low level of agreement) amongst the respondents concerning the criticality of these factors inferred from measures of spread took them down to Level 3. These CQFs are recommended to be addressed right after addressing Level 1 and Level 2 critical quality factors. They have the lowest influence in terms of criticality on successful quality management. These two critical quality factors are as follows:

1. QF1: Extent to which the top company executive assumes responsibility for quality performance;
2. QF59: Extent to which customer complaints have been reduced by quality management.

CONCLUSION

The overall aim of this research was to investigate quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies. The specific research objectives were, within the upstream oil and gas segment, to:

1. *Identify* existing quality management practices in the upstream petroleum industry.
2. *Explore* key stakeholder views and practices related to quality management of outsourced services, including drivers and barriers to ensuring quality in outsourcing.
3. *Investigate* quality factors that are essential for successful quality management of outsourced services in upstream petroleum companies.
4. *Produce* recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry.

The first two objectives were met through carrying out thorough literature review whereas the last two were met through conducting empirical study. Research methods chapter contains information regarding what research strategy, data collection techniques and framework for data analysis were used whereas Survey findings chapter sets out the main conclusions and recommendations drawn from quantitative data analysis. Now that the main objectives of the current study were satisfied, the objective 4 – *Produce recommendations on ensuring quality when outsourcing in the upstream segment of the oil and gas industry* – , though partly was addressed in Chapter 4, should be revisited to arrive at the final recommendations. Amongst 18 critical quality factors returned as 'critical' by the respondents, those concerning managing quality whilst outsourcing should be addressed in the first place to reach the overall aim of this research, that is to investigate quality factors that are essential for successful quality management of *outsourced services* in upstream petroleum companies.

Discussion of research findings

The final register (Table 5) of 18 critical quality factors was revisited to discuss the criticality of the factors with regard to managing quality whilst outsourcing. The results of this investigation suggest that addressing these 18 CQFs in the first place aids in ensuring quality whilst outsourcing in Kazakhstani oil and gas sector. Amongst the critical quality factors, factor №39 - *Extent to which your company's goals exceed customers' expectations* - was perceived by the respondents as the most critical. Exceeding customer's expectations is known as *Gold plating* and is not recommended as a best practice by PMBOK. *Gold plating* refers to 'giving

Table 5 - The final register of critical quality factors.

Sq.	No. of QF	*Level 1 critical quality factors*
1	QF39	Extent to which your company's goals exceed customers' expectations
2	QF17	Extent to which quality data are used by hourly workers in their operations
3	QF52	Extent to which your company/division compares the current quality levels for products and services features with those of world leaders
4	QF53	Extent to which your company compares the current process quality levels with those of competitors
5	QF62	Extent to which profits of your company/division have been increased by quality management
Sq.	**No. of QF**	***Level 2 critical quality factors***
1	QF5	Extent to which quality goals are made specific within the company
2	QF15	Extent to which quality data are used by top management in decision-making
3	QF4	Extent to which employees know which attributes of the products or services your company's customers value
4	QF16	Extent to which quality data are used by middle management in planning and controlling
5	QF56	Extent to which productivity of your company has been increased by quality management
6	QF61	Extent to which quality management has contributed to keeping your company/division in business
7	QF53	Extent to which your company compares the current process quality levels with those of competitors
8	QF42	Extent to which information from customers is used in designing company's products and services
9	QF48	Extent to which environmental issues are considered as a company/division responsibility
10	QF51	Extent to which your company/division compares the current quality levels for products and services features with those of competitors
11	QF57	Extent to which your company's manufacturing throughput time has been reduced by quality management
Sq.	**No. of QF**	***Level 3 critical quality factors***
1	QF1	Extent to which the top company executive assumes responsibility for quality performance
2	QF59	Extent to which customer complaints have been reduced by quality management

Source: compiled by author

the customer extras (extra functionality, high quality components, extra scope or better performance)' (Mulcahy, 2018:324). Apparently, most oil and gas organizations might have a policy that promotes gold plating (for example, 'Meet and exceed customers' expectations.') due to the highly competitive nature of the petroleum industry. The competitiveness is reflected in other critical quality factors, including QF53 - *Extent to which your company compares the current process quality levels with those of competitors* -, and QF51 - *Extent to which your company/division compares the current quality levels for products and services features with those of competitors*. Conversely, these two factors, known as

benchmarking, are recommended as a best practice by PMBOK. Benchmarking is a common technique used in quality management processes. Another quality factors perceived by the respondents as critical, including QF4 - *Extent to which employees know which attributes of the products or services your company's customers value* -, QF42 -*Extent to which information from customers is used in designing company's products and services*-, and QF59 - *Extent to which customer complaints have been reduced by quality management*- emphasize the need for obtaining input from customers whilst managing quality.

The discussion of the findings reveals that nearly all 18 critical quality factors support the best practices of quality management recommended by PMBOK (2017) and those found in literature. Accordingly, the survey findings increase the generalizability of the study. The high level of generalizability is strengthened by the fact that tried and tested research strategy (a survey) was used along with the reliable data collection technique (a questionnaire). Furthermore, research subjects that took the questionnaire survey come from organizations representing different segments of the petroleum industry (upstream, midstream, downstream). As such, survey findings may be *generalizable* to other sections of the petroleum industry, and is not limited to the upstream sector. However, there is a limitation in the study that is attributed to the small sample size (N=30). This sample size prevents the researcher from performing more complex analysis on the data set. It is highly recommended that the future research be conducted with a larger sample size.

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Appendix A: A listing of business functions that are likely to be outsourced by oil and gas companies (from Tholons Inc.'s report (2007:7)).

Business Function	Service Process
Higher Value Services	
Engineering and Design	• Property evaluation & acquisition • Divestitures • Drilling prospects and engineering reserve reports • Field study exploration • Waterflood feasibility and field performance issues • Process, mechanical, electrical, structural, civil and control engineering services
ITO	• Application/Software deployment and management • Hardware deployment and management • IT consulting services • IT/IS training • Network and workstation management • System integration • System infrastructure provision • System related support and management
Finance and Accounting	• Accounts receivable/payable • Revenue accounting • Tax related services • Finance and treasury • Land record & property related • Financial reporting • Due diligence & auditing • Electronic document imaging
Lower Value Services	
Human Resources	• Payroll and tax related • Compensation and benefits • Health and pension administration • Administration and claims processing related to employee insurance, retirement, education and other employee related benefits • Training and related services
Back office and shared services	• Document management • Remote document process and storage • Document automation and related services • Web-based document management

Appendix B: Survey Questionnaire

Data collection technique: Questionnaire survey

Questionnaire Survey Part 1: Survey demographic information

Part 1: Survey demographic information
Please check the appropriate box or, where relevant, specify your answer:
About yourself,
Which category below includes your age? ☐ Under 25 ☐ 45 ÷ 55 ☐ 25 ÷ 35 ☐ 55 or older ☐ 35 ÷ 45
What is your gender? ☐ Male ☐ Female
Length of working experience in the industry: ☐ Less than a year ☐ From 1 to 5 years ☐ More than 5 years
Your job title: ☐ Top manager ☐ Middle manager ☐ Quality department member ☐ Other (please specify)_____
Your role in the ongoing (or closed) project(s): ☐ Project sponsor ☐ Project manager ☐ Quality management team member ☐ Other stakeholder (please specify)_____
About your organization,
Size (number of employees)? ☐ Less than 50 ☐ Less than 250 ☐ Less than 500 ☐ More than 500
Business category: ☐ Upstream segment ☐ Midstream segment ☐ Downstream segment ☐ Consultancy ☐ Service ☐ Oil equipment manufacturer ☐ Other (please specify)_____
Please indicate if your organization has the following Registered Quality Management System: ☐ ISO 9001 ☐ API Spec Q1 ☐ API Spec Q2 ☐ Other (please specify)_____

Questionnaire Survey Part 2: Actual 62 quality factors/statements

Part 2 Legend to the scale:						
1- **Very low** Non-critical: factors you feel aren't absolutely essential for successful quality management whilst outsourcing						
2- **Low** Minor importance: factors you feel are of 2- importance. These factors will not affect the success or failure of quality management process						
3- **Medium** Medium importance: factors you feel are of medium importance. These factors will not seriously affect the success or failure of quality management process						
4- **High** Important: factors you feel are important but not absolutely essential for successful quality management whilst outsourcing						
5-Very high Critical: factors you feel are absolutely essential for successful quality management whilst outsourcing						
Please check (✓) in the right-hand column the appropriate scale against each statement		**Scale**				
		1	**2**	**3**	**4**	**5**
№	***Top management support***					
1	Extent to which the top company executive assumes responsibility for quality performance					
2	Acceptance of responsibility for quality by major department heads within the company					
3	Degree of participation by top management in the quality improvement process					
4	Extent to which the top management has objectives for quality performance					
5	Extent to which quality goals are made specific within the company					
6	Importance attached to quality by the top management in relation to cost and schedule objectives					
7	Amount of review of quality issues in the top management meetings					
Strategic quality planning						
8	Extent to which quality management is considered in the company/division strategic plan					
9	Extent to which customer satisfaction is considered in the company/division strategic plan					
10	Extent to which the top management supports long-term quality improvement process					

11	Extent to which quality goals and policy are understood within the company/division					
Quality information availability						
12	Availability of quality data (error rates, quality costs, defect rates, scrap, rework, returns, etc.)					
13	Extent to which necessary quality data are available on time					
14	Extent to which quality data are available to managers and supervisors					
Quality information usage						
15	Extent to which quality data are used by top management in decision-making					
16	Extent to which quality data are used by middle management in planning and controlling					
17	Extent to which quality data are used by hourly workers in their operations					
Employee training						
18	Extent to which quality-related training is given to hourly employees throughout the company/ division					
19	Extent to which training in the basic statistical techniques (such as histograms, cause and effect diagrams, control charts, etc.) is provided in the company/division as a whole					
20	Availability of resources for employee training in the company/division					
21	Extent to which training in specific work skills (technical and vocational) is given to employees throughout the company					
Employee involvement						
22	Extent to which employee involvement programmes are implemented in the company/ division					
23	Extent to which hourly/non-supervisory employees participate in quality decisions					
24	Extent to which employees are held responsible for the output of their process					
25	Extent to which quality awareness building among employees is ongoing					
26	Extent to which the company/division measures employee morale					
Product/process design						
27	Extent to which new product/service design is reviewed before the product/service is produced					
28	Clarity of product/service specifications					
29	Clarity of product/service procedures					
30	Extent to which implementation/producibility is considered in the product/service design process					
31	Extent to which process design minimizes the chances of employee errors					
Supplier quality						
32	Extent to which suppliers are selected based on quality rather than price					
33	Degree to which your company relies on a few dependable suppliers					

34	Extent to which your company provides technical assistance to your suppliers					
35	Extent to which the supplier is involved in your product development process					
36	Extent to which you build long-term relationships with your suppliers					
37	Clarity of specifications provided to your suppliers					
Customer orientation						
38	Extent to which your company/division is totally committed to creating satisfied customers					
39	Extent to which your company's goals exceed customers' expectations					
40	Extent to which executives demonstrate with their actions that customer satisfaction is important					
41	Extent to which employees know which attributes of the products or services your company's customers value					
42	Extent to which information from customers is used in designing company's products and services					
43	Extent to which top management frequently contact customers					
44	Extent to which customers' complaints are resolved					
45	Extent to which employees are encouraged to satisfy customers					
Quality citizenship						
46	Extent to which public health issues are considered as a company/division responsibility					
47	Extent to which public safety issues are considered as a company/division responsibility					
48	Extent to which environmental issues are considered as a company/division responsibility					
49	Extent to which the organization extends its quality commitment to the external community					
Benchmarking						
50	Extent to which your company/division studies the best practices of other companies to get ideas about how to do things better					
51	Extent to which your company/division compares the current quality levels for products and services features with those of competitors					
52	Extent to which your company/division compares the current quality levels for products and services features with those of world leaders					
53	Extent to which your company compares the current process quality levels with those of competitors					
Internal quality results						
54	Extent to which scrap levels have been reduced by quality management					
55	Extent to which rework levels have been reduced by quality management					

56	Extent to which productivity of your company has been increased by quality management					
57	Extent to which your company's manufacturing throughput time has been reduced by quality management					
58	Extent to which costs of your company have been reduced by quality management					
External quality results						
59	Extent to which customer complaints have been reduced by quality management					
60	Extent to which the competitive position of your company/division has been enhanced by quality management					
61	Extent to which quality management has contributed to keeping your company/division in business					
62	Extent to which profits of your company/division have been increased by quality management					