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Risk Management of Oil and Gas Projects in Saudi Arabia

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Year:2023

Acknowledgements

We would like to express our gratitude to everyone who assisted us in finishing this research, notably the university administration, which used every available resource to complete the scientific research. We also thank our wonderful academics, notably Dr. Walid Soliman, Dr. Fatima Mostafa, and Dr. Nael Zabel, for their assistance and the significant notes that helped to elevate the research to a high-caliber level.

Content Index:

No.	Content	Page number
-	Acknowledgements	1
-	List of content	2
-	Tables and charts	4
-	English/ Arabic Abstract	5
Chapter one		
1.1	Introduction	6
1.2	Problem of the study	6
1.3	The importance of the study	7
1.4	Objectives of the study	7
1.5	Study questions	7
Chapter two		
2.1	Literature Rivew	8
2.2	Risk	9
2.3	Project Management	9
2.4	Risk Management	10
2.5	Risk Management Process	10
2.6	Tools and techniques that support project risk management process	13
2.7	Risk Management Maturity (RMM)	14
Chapter three		
3.1	Previous studies and theoretical framework	16
3.2	Theoretical premises of study	21
Chapter four		
4.1	Methodology and research methods	22
4.2	Study tools	23
4.3	Fields of study	26
Chapter five		
5.1	The validity and reliability of the questionnaire	28
5.2	Statistical analysis	32
Chapter six		
6.1	Study Findings	37

6.2	Recommendations	37
6.3	Summary	38
Reference & Appendix		
-	List of references	39
-	Appendix (A) Interviews	42
-	Appendix (B) Survey Questionnaire	45

Tables & Charts:

No.	Tables	Page number
Table 1	Mature Organizations X Immature Organizations	15
Table 2	Descriptive statistics of the socio-demographics	28
Table 3	Descriptive statistics	29
Table 4	The statistical standard used in the study	31
Table 5	The values of reliability coefficient by Cronbach's alpha	31
Table 6	The mean and standard deviation for the risks scale and scale overall	33
Table 7	The mean and standard deviation for the paragraph scale and scale overall	34

No.	Charts	Page number
Fig 1	The Iron Triangle	9
Fig 2	ISO 31000:2018 RM Process	11
Fig 3	Research Structure.	22

Abstract:

The study covers risk management of oil and gas projects in Saudi Arabia. It used structured interviews with experts, questionnaire survey sent to specialists, and data analysis to obtain results. The study aims to identify significant risks of oil & gas projects in Saudi Arabia which are Supply chain Risk, Cost Risk and Logistic Risk. In regard of risk management maturity level, companies need to improve Risk management principles and methodology, controlling and monitoring process, and circulating Risk management procedures for all project departments at early stages. This ensures increasing awareness about risks and its mitigation strategies, thus ensure projects completion.

Keywords: Risk Management, Oil & Gas projects, Project Risk Management, Risk Management Maturity.

المستخلص:

يهدف البحث لدراسة إدارة مخاطر مشاريع النفط و الغاز في المملكة العربية السعودية. تم إجراء مقابلات مع خبراء في مجال مشاريع النفط و الغاز بالمملكة العربية السعودية ، و إرسال إستبانة لمتخصصين بالمجال أيضاً ، بالإضافة الى عمل تحليل إحصائي للحصول على أجوبة و نتائج الدراسة. يهدف البحث الى تحديد أشد المخاطر تأثيراً على مشاريع النفط و الغاز في المملكة العربية السعودية و تم التوصل الى أعلى ثلاثة مخاطر وهي مخاطر سلاسل الإمداد و مخاطر التكلفة و المخاطر اللوجستية. كما تم البحث عن قياس مستوى نضج إدارة المخاطر في شركات النفط و الغاز و تم استنتاج أن الشركات تحتاج تطوير طرق إدارة المخاطر ، و إجراءات التحكم و المراقبة، و مشاركة إجراءات إدارة المخاطر مع جميع أقسام المشروع ذات العلاقة في مراحل المشروع المتقدمة. ذلك يحقق رفع مستوى الوعي عن المخاطر و إجراءات التعامل معها و بالتالي تضمن إنهاء المشروع بنجاح.

الكلمات الرئيسية: إدارة مخاطر، مشاريع النفط و الغاز، إدارة مخاطر المشروع، نضج إدارة المخاطر.

Chapter one

1.1- Introduction:

The Demand for Oil and Gas keeps rising around the world and energy sector in Saudi Arabia has the biggest focus in terms of supplying the high-quality products in timely manner and competitive costs. As the market demand keeps increasing, the number of Oil and gas Projects will increase also which, in turn, involves so many types of Risk that need to be monitored and managed to ensure safe Project delivery within the planned budget, quality and time. (Zand, E. D. ,2009)

There are some challenges in managing oil and gas Projects in Saudi Arabia due to the complexity of the resources required to build up the projects within specific scope and budget and plan. The more complex is the project, the more risks are expected to be encountered so it becomes crucial at the early stage of the project to develop a risk analysis and strategies to manage the risks during the entire cycle of the project.

Risk is defined as uncertainty of an event that can impact positively or negatively; therefore, management of the potential risk will assure the continuity of the development and project completion as planned.

1.2- Problem of the study:

During the cycle of the projects, Risk management is a critical step that should be assessed and monitored because poor assessment on the risks and late corrective actions taken will lead to failure of the project delivery and overrun on the budget. This research will outline the significant

risks to oil and gas projects of companies in Saudi Arabia, evaluate the strategies applied to deal with those risks for project safe delivery. Furthermore, it will measure the maturity of Risk management implementation in the projects of oil and gas companies at Saudi Arabia.

1.3- The importance of the study:

The target of this study is to identify the effective application of risk management on the project in Saudi oil and gas companies.

1.4- Objectives of the study:

- 1- Identify significant risks related to projects of Oil and Gas Companies in Saudi Arabia.
- 2- Review risks and perform risk assessment & analysis.
- 3- Measure the maturity of Risk management implementation in the projects of oil and gas companies at Saudi Arabia.
- 4- Provide findings, feedback, and recommendations based on the results of the study.

1.5- Study questions:

1. What are the most significant risks that effects oil and gas projects in Saudi Arabia?
2. How oil and gas companies in Saudi Arabia increase the maturity level?

Chapter Two

2.1- Literature Review:

The International Trade Administration published a Country Commercial Guide of Saudi Arabia in 2022. It states that Saudi Arabia has the second-largest proven oil reserves in the world since it possesses approximately 17 percent of the world's proven petroleum reserves and ranks as one of the largest net exporters of petroleum (ITA,2022). Hence, many companies will form projects of oil and gas in Saudi Arabia, for example, Energy Intelligence published that Saudi Aramco expects to sign contracts for some 90 projects over the next three years (from 2023 through 2025) as it presses ahead with major expansions of its upstream oil and gas capacity.

The success parameters for any project including oil and gas projects are in the proper time completion, within the assigned cost and with properly achieved performance (Zabaal,2007).

Paul Hopkin in his book risk management mentioned that when a company decides to set objectives and deliver stakeholder expectations, there will be risks that can have a negative impact on the ability of the company to fulfil these objectives and achieve its aims (Hopkin,2013).

The company's management maturity has an impact on competitiveness, both for obtaining new contracts and for business continuity (Caiado et al,2016). additionally, it has been found that those companies that follow risk management add around 20% to 30% more shareholders value (Kumar,2021). Oil and gas projects are large, complex, and risky, because they involve a considerable number of stakeholders, are technologically difficult and must adhere to tight budget and time. As a result of ineffective project risk management practices, many of these projects are not delivered on time and/or within budget (Elhoush and Kulatunga,2017). Risk management has been widely studied and applied in oil and gas pipeline projects, but the reality

is that the impacts still occur. This is due to the ineffectiveness of existing risk management application (Nova, et al.,2019).

The remaining part of this chapter will provide definitions of related terms, and explanations.

2.2- Risk:

According to the Institute of risk management, risk definition is the combination of probability of an event and its consequence that range from positive to negative. It's inevitable to define risk in organizational context which is anything that can impact the fulfilment of the organization's objectives (Thompson and Hopkin,2021).

2.3- Project Management:

Project Management Institute defines project management as the use of specific knowledge, skills, tools, and techniques to deliver something of value to people. It involves activities such as project planning, project execution and project monitoring according to 'The Iron Triangle' (cost, quality, and time). (Suda, et al.,2015).

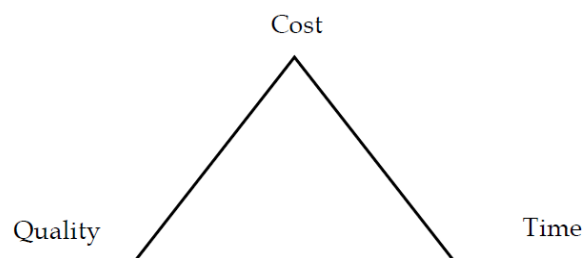


Fig 1: The Iron Triangle

2.4- Risk Management

Risk Management is not a new idea or concept. There were forms of Risk Management at all times and for all kinds of scenarios that had to be managed by man. Risk Management implies that actions are taken to anticipate, minimize or mitigate risks from imminent or future events, with the goal to master and control them (Kalia and Muller,2007).

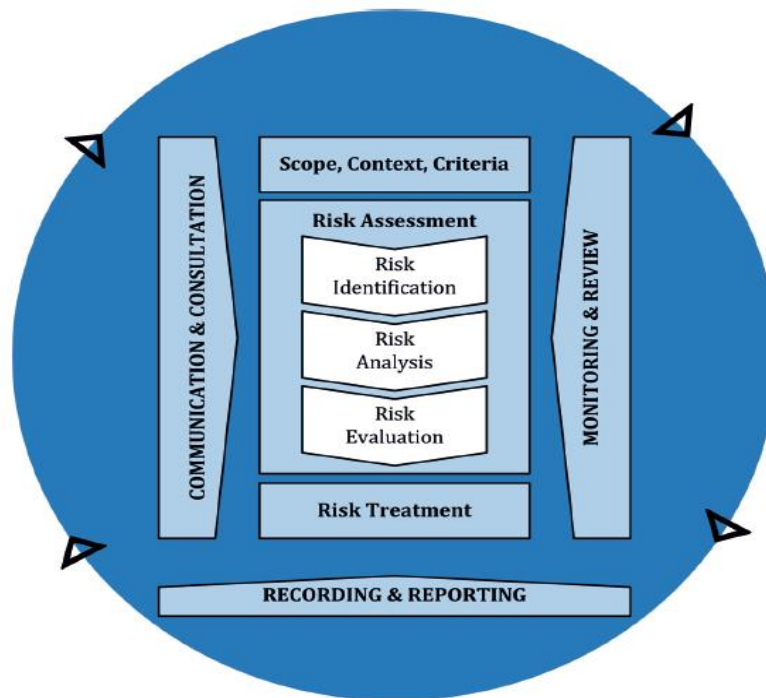
Risk management focuses on identifying, evaluating, and managing risks to minimize the impact on the project. There are no projects without risks because there is an infinite number of events that can have a negative effect on the project. (Doval,2019).

2.5- Risk Management Process:

"The first step in the risk management process is to acknowledge the reality of risk. Denial is a common tactic that substitutes deliberate ignorance for thoughtful planning." - Charles Tremper

To perform the risk management process, ISO 31000:2018 guideline will be used where it can be applied to any organization at any level, including project level (Saptarini and Nainggolan,2022).

The following definitions of the process steps are interpreted based on ISO 31000:2018:



Figurer 2: ISO 31000:2018 RM Process

2.5.1- Communication and consultation.

It's a continuous step during all process to gather and share information among stakeholders and project team about risks and risk management strategies. It leads to better decision-making, and risk management outcomes. In other words, ensure all those responsible are well informed and updated during the process.

2.5.2- Scope, Context, and Criteria.

- Define the scope of the risk management process, and the objective of the project.
- Establish the external and internal context by understanding the organization environment.
- Develop risk criteria.

2.5.3- Risk Assessment:

Risk assessment consists of the following next 3 steps which are: Identify risks, analyse risks, and evaluate risks.

2.5.3.1- Risk Identification:

It's the process of finding, recognizing, and describing risks which can affect the achievement of the project. In addition, It involves identifying risk sources, and risks impact. The most common risk identification techniques used in the oil and gas projects are a questionnaire survey, literature review, brainstorming, Delphi method and focused group interview (Rawat, Gupta, Rao,2022).

2.5.3.2- Risk Analysis:

ISO 31000 states that "risk analysis involves consideration of the causes and sources of risk, their positive and negative consequences and the likelihood that those consequences can occur. A key factor is risk likelihood and impact levels, which are risk exposure.

2.5.3.3- Risk Evaluation:

It's a process of comparing the results of risk analysis with risk criteria (mentioned in step 2) to decide the action required regarding the risks whether it is acceptable or unacceptable. The decisions involve: avoidance, transfer, mitigation, acceptance. For opportunities, decisions involve exploiting, sharing, enhancing and acceptance too.

2.5.4- Risk Treatment:

It's a process of risk modification. It requires selecting and implementing treatment options to address risks, evaluates their effectiveness, and assess the level of residual risk.

2.5.5- Monitoring and Review:

The process of supervising & reviewing the quality of risk management plan, implementation, and its outcomes to determine its suitability and effectiveness.

2.5.6- Recording and Reporting:

Records and reports are the database used for improvement purposes regarding the process itself, methods, tools, and techniques. It's a reference for future projects.

2.6- Tools and techniques that support project risk management process:

Referring to Kassem (2022) risk management process requires tools and techniques to be applied, and for this purpose, the most adopted techniques are in the following list:

1. Brainstorming
2. Change Analysis (ChA)
3. Checklist
4. Interviews
5. Delphi Method
6. Expert Judgement
7. Cause and Consequence Analysis
8. Fuzzy Logic
9. The Event Causal Factor Charting (ECFCh)

10. The Expect Monetary Value (EMV)
11. Failure Mode—Effects Analysis (FMEA)
12. Hazard—Operability (HAZOP)
13. The Fault Tree Analysis (FTA)
14. Hazard Review (HR)
15. Pareto Analysis (PA)
16. Risk Breakdown Matrix (RBM)
17. Monte Carlo Method
18. The Risk Breakdown Structure
19. Probability and Impact Matrix
20. Relative Importance Index (RII)
21. Risk Index
22. The Strengths—Weaknesses—Opportunities—Threats.

2.7- Risk Management Maturity (RMM)

Maturity of organization is related to different aspects explained by Caiado et al. (2016) in the following table:

Table 1. Mature Organizations X Immature Organizations

Description	Mature organizations	Immature organizations
Objectives	The process is explicitly defined, managed, measured, controlled and effective.	Achieve their results thanks to the heroic efforts of individuals using approaches that they create more or less spontaneously.
Planning	Do things in a systematic way.	In many cases, the quality is not required, and the time and costs can be much greater than the planned.
Achievement of targets	Achieve their quality goals, deadlines, and costs in a consistent and efficient manner.	Create goals, but too often lose them by wide margins of error.
Processes	Have systematized processes and documented methods to do their work.	Do not think in terms of processes and their methods vary depending on the circumstances and the people doing the work.
Results	Data are systematically collected and used to analyze, control, predict and plan for their performance.	Their results are unpredictable and inconsistent.

Elhoush and Kulatunga (2017) explained that some risks are managed and mitigated by companies as they occur without effective and official risk management. Risk management maturity requires knowledge, awareness, and comprehension of risks to ensure effective implementation of risk management to mitigate risks.

Chapter Three

3.1- Previous studies and theoretical framework:

Kadam and Raut (2021) studied the critical risk factors that influence price, time and quality of oil and gas (Engineering, Procurement, and Construction) projects in India. The research emphasized the importance of risk management, and after applying risk assessment, it delivered 15 risk factors that found to be critically occurring during the phases of EPC projects.

AlNoaimi and Mazzuchi (2021) studied the application of risk management strategies in an oil and gas company in the Kingdom of Bahrain. The search, using quantitative and qualitative methods, identified major risks and measures applied by the company to manage them. Based on results it recommended to have certified training for staff at all levels to enhance the knowledge and skills about risks issues, employing highly skilled staff to mitigate risks. Also, the company should divide risks based on their sources into controllable and non- controllable to plan risk management easily.

Suda, et al. (2015). studied risks and risk management for oil and gas industry based on literature review for previous studies. Project Risk evaluation reaches to the level where it could be more reliable due to the methods that have been used to avoid the anticipated risks that might affect the project execution, Such as, FMEA and HAZOP and FTA. Implementation of these methods become a challenge to the oil and gas sector as there is a lack of awareness in the interfaces between the Project execution plan and Risk management plan.

In fact, Finalizing the Project plan and sequence of activities without linking the anticipated risks that might occur to each activity will lead to negative impact on both cost and schedule. Project stakeholders should finalize the anticipated risks in the risk profile and keep it updated and monitored. Training project team members on the methods developed to evaluate the risks in daily activities with frequent coaching sessions will make the team members responsible about their safe achievement of subjective tasks and sharing their thoughts and proposals on the best practice ways to complete certain job.

Rawat, et al. (2021) focused on identifying risks that causes delay in oil and gas projects and suggested mitigation strategies to develop the city gas distribution (CGD) sector in India. This research used systematic and comprehensive review of literature. In addition, using weighted average ranking method the study identified the top ten risks which impact the oil and gas projects causing cost overrun and project delay. Risks are” (project cost, improper project management, change in economic parameters, currency exchange rate, government regulations and laws, contractor and subcontractors’ issues, lack of skilled labor, delay in approvals, health and safety issues and force majeure)”. This study recommended risk management implementation to avoid CGD project delay.

Bin Seddeeq, et al. (2019) investigated the causes of time and cost overrun in oil and gas construction projects in Saudi Arabia. The study identified 38 causes using literature review and assessments. According to the findings, the search recommended selecting appropriate consultants, and assigning qualified managers to plan projects properly. The study indicated that further studies should be conducted on this field.

Egboga and Worlu (2020) examined the relationship between project risk avoidance and project execution concerning the four components (budget, quality, schedule and scope) among oil and gas companies in Nigeria. The study used questionnaires to collect data from experts in oil and gas companies and analysed the results. The search found that its necessary to implement risk avoidance strategies in oil and gas companies and they should invest more in process and technologies that increase the risk avoidance and improve projects quality.

Aboelkheir (2022) identified political and strategical risks, and risk management applied in oil and gas industry operations to mitigate risks in Yemen. The search made assessment according to probability impact matrix to identify risks and measure their social, economic, and environmental impacts in relation with political uncertainty. The study suggested that companies' ability to monitor and report on newly designed initiatives, and continuous assessment on environmental performance of managers can lead to Successful implementation of risk management at every stage of operation.

Zand (2009) conducted a case study to highlight important risk factors in oil and gas projects in the Middle East. The search also observed how risks and risk management influence the project by comparing two projects in Qatar and Iran which faced technical risks. As a result of effective risk management strategy, the Qatari project finished ahead of time and within the cost. In the contrary, the lack of effective risk management led the Iranian project to face delay and cost overrun. It also suggested to investigate other aspects of oil and gas projects in the future.

Kassem, et al. (2019) studied risk factors in projects in oil and gas processing facilities in Yemen as a case study for developing countries. The search stated the importance to rank the risk factors after conducting an analysis on the impact and likelihood. The internal risks have the greatest effect on the oil and gas projects then the following: “changes during construction project, government instability, incorrect project cost estimation, government delay in decision making, incorrect project schedule estimation, and political situation and war in the country”.

Kassem (2022) divided 51 risk factors into internal and external factors and examined these factors and their negative impact on oil and gas construction projects in Yemen. The searcher developed a model to evaluate the relation between cause-and-effect factors on project success. The study recommended to clearly outline the responsibilities and tasks for all related roles of the project: stakeholder, client, contractor, consultant, and government. Additionally, the study stated the importance of using risk mitigation techniques, and that risk management application is essential for project delivery.

Dyah and Nainggolan (2022) covered the risk assessment on selected oil & gas projects in mature field in east Kalimantan, Indonesia. Data collection was performed by using questionnaire for specialists involved in the project. After all data were analysed and implemented risk management, one of the study recommendations is that to develop risk register, it needs to involve the operation team risk management specialist.

Richard and Pascal (2022) studied major risks faced by Oil and Gas Businesses in Tanzania. The search conducted questionnaire and interviews with experts of the field and analysed them to obtain results and findings. The study found that most oil and gas project in Tanzania reduce operations as a response for unexpected regulatory changes and price fluctuation risks. one of the highlighted information in the study that oil & gas projects strive to use risk identification techniques that doesn't consume time and cost such as questionnaires, Delphi techniques, interviews.

Caiado et al. (2016) provided a set of guidelines of risk management maturity analysis and offered a model matrix to evaluate companies' maturity in applying risk management on projects. The study presented literature review and sent survey to experts to gather information about risk management maturity models. Based on the results, the RMM/PMI model was the best-known model among the other 14 models described in the research.

Elhoush and Kulatunga (2017) studied the effectiveness of project risk management within oil and gas industry in Libya. The method used to collect data is study case and semi- structured interviews. Although there is no structured written risk management framework or procedure within the Libyan oil industry, there is a positive relationship between performing risk management and project performance.

3.2- Theoretical premises of study:

Applying risk management affects the delivery of oil & gas projects in Saudi Arabia and determines their Success or failure. The most important step of the risk management process is to identify risks, to ensure applying the needed mitigating techniques and increase the risk management maturity level of the company.

Chapter Four

4.1- Methodology and research methods:

This chapter presents the methodology used to achieve the objectives of this study. The descriptive method used in this research covers two parts which are: 1) identify risks affecting projects of Oil and Gas Companies in Saudi Arabia and 2) Measure the maturity of Risk management implementation in the projects of oil and gas companies at Saudi Arabia. It also describes the process and tools used to gather data and acquire answers.

The main sources of input in this research are literature review and previous studies, interviews with experts of the field in Saudi Arabia, and survey questionnaire sent to employees in Saudi companies. The process described in the following figure:

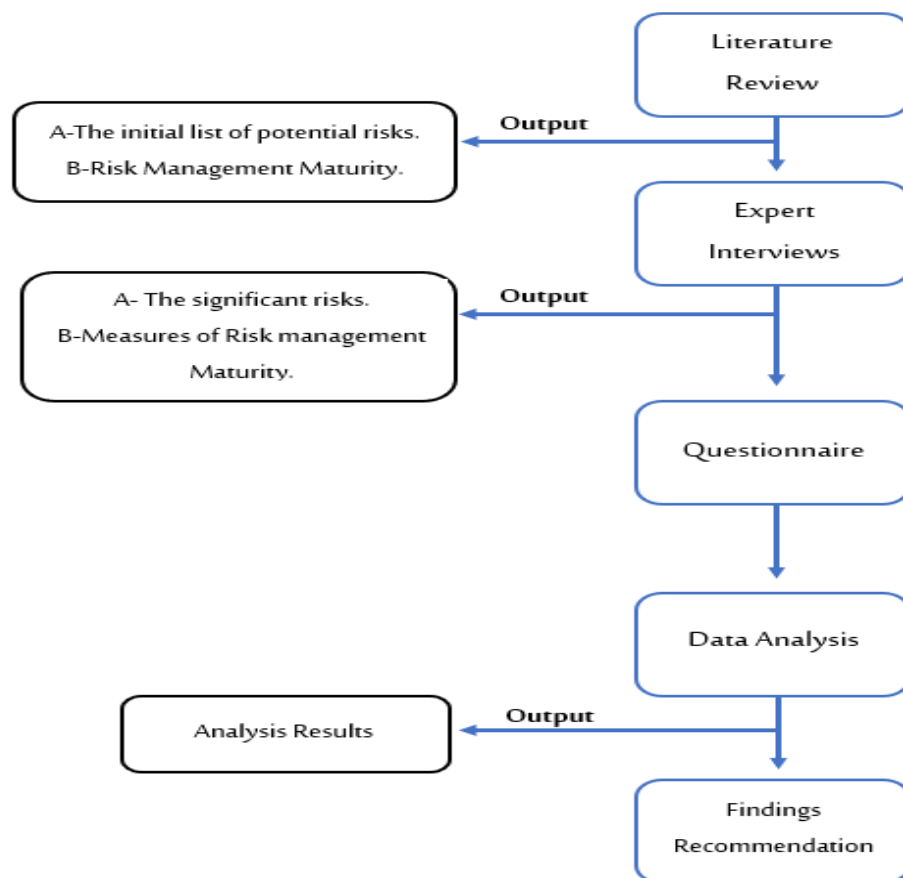


Figure 3: Research Structure.

4.2- Study tools:

4.2.1: Literature Review.

Data collected by reviewing previous studies to create the initial list of potential risks affecting oil & gas projects, and study whether they are applicable in Saudi Arabia. Information was gathered and presented regarding the level of risk management maturity of oil & gas companies to mitigate risks and successfully deliver projects.

4.2.2: Interviews

To support findings of previous studies, semi-structured interviews were conducted with experts of the field working in Saudi companies. Questions were formed about the accuracy of literature review findings in project in Saudi Arabia. With the collaboration of experts in project management, risk management, and Engineers, the risk identification process was filtered to be limited by 11 risks that affect oil & gas projects in Saudi Arabia.

4.2.2.1 The main risks impacting oil & gas projects in Saudi Arabia:

- 1) Supply chain Risk.
- 2) Logistics Risks
- 3) Cost Risks
- 4) Political Risks
- 5) Supply chain Risk.
- 6) Labor Risks: Lack of skilled employees.

7) Improper Project Management.

8) Economic Risks.

9) Compliance Risk.

10) Operational Risks.

11) Technical Risks

In addition, the search outlined the aspects of measuring the maturity of risk management implementation in the projects of oil and gas, and how Companies effectively manage risk of oil and gas projects in Saudi Arabia based in the expert's knowledge and day-to-day experience in the target companies.

1) Management circulates the expectation and procedure for risk identification in regular basis to all departments.

2) Management has a training program for risk management tools application.

3) Management has a uniform procedure for all departments for risk management processes.

4) Lesson learnt from previous projects are documented and well explained regularly to avoid such risks for ongoing projects.

5) Risk management planning is evaluated regularly and adjusted to meet the latest update of Project status.

6) All actions in Risk management plan are listed based on systematic ways and not feelings.

7) All Risks Identification processes are systematic with documented methods.

- 8) All findings during risk management assessment are recorded and discussed and timely actioned.
- 9) Management has considered maturity models to measure the implementation level of RM process.
- 10) Risk Response Plan is recorded and updated regularly in Risk profile with target completion date.
- 11) Awareness sessions for risks control and reporting are held for all employees.

4.2.3. The Survey Questionnaire:

Questionnaire survey was created to collect data from employees in oil & gas companies in Saudi Arabia only. After referring to Doctors in Risk management department the content was reviewed and approved, The survey was formed and sent by the Google Drive site (<https://drive.google.com>).

The questionnaire includes 3 parts:

Part 1: it includes six questions about the respondents, and companies' background.

Part 2: This part contains the (11) main risks which has impact on oil & gas projects in Saudi Arabia. The respondents were asked to determine the likelihood and impact levels by choosing the suitable degree from their point of view. The answers developed using likelihood/impact matrix: 1) very high. 2) high. 3) moderate. 4) low. 5) very low.

Part 3: This part contains (11) statements to measure the maturity of risk management implementation in the projects of oil and gas, and to examine how Companies effectively

manage risk of oil and gas projects in Saudi Arabia. The respondents were asked to choose what best indicate their level of agreement with these statements from the following choices: 1) strongly disagree. 2) disagree. 3) neutral. 4) agree. 5) strongly agree.

4.2.4. Analysis:

All gathered data were assessed and analyzed using qualitative and quantitative methods by SPSS version 25. Based on the results of the analysis, the study will provide the findings and recommendations.

4.3- Fields of study:

4.3.1- The research domain:

The research covers Risk Management of Oil & gas projects in companies (both public & private sectors) in Saudi Arabia, especially the eastern region.

4.3.2- The human sphere:

The study addressed experts who have experience on projects of oil and gas done by companies in Saudi Arabia. Some of the positions are mentioned below:

- Director of oil & gas company
- Project Managers
- Risk Managers
- Risk Specialists
- Engineers

4.3.3- The time zone:

The research was started on the 10th of jun,2023, and submitted on the 26th of Aug,2023.

Chapter Five

5.1- The validity and reliability of the questionnaire:

5.1.1- Sample Characteristics:

The study sample consisted of (43) of experts and specialists in the field of oil and gas projects, project management and risk management in oil and gas companies in the Kingdom of Saudi Arabia, who were randomly selected from the study population; Table (2) shows the descriptive statistics of the personal variables:

Table (2)
Descriptive statistics of the socio-demographics

Variable	Categorical	Frequency	Percentage
Your personal experience in oil & gas projects (years):	less than 1	0	0.0
	from 1 to 5	26	60.5
	from 6 to 10	6	14.0
	from 11 to 15	4	9.3
	from 16 to 20	3	7.0
	more than 20	4	9.3
Company ownership:	public sector	13	30.2
	private sector	30	69.8
Your personal experience in Risks & Risk management (years):	less than 1	10	23.3
	from 1 to 5	15	34.9
	from 6 to 10	9	20.9
	from 11 to 15	4	9.3
	from 16 to 20	2	4.7
	more than 20	3	7.0

As per Table (2) result, following results are noted.

1. Reached highest percentage of the experience in oil and gas projects (60.5%) for the experience level (from 1 to 5 years), while it reached the lowest percentage (7.0%) for the experience level (from 16 to 20).
2. The reached number of company ownership in the private sector (30) by percentage (69.8%), while the number of company ownership in public sector (13) by percentage (30.2%).
3. The highest percentage of the experience in risks & risk management (34.9%) for the experience level (from 1 to 5 years), while the lowest percentage (4.7%) for the experience level (from 16 to 20).

Table (3)

4. Descriptive statistics

Categorical	Frequency	Percentage	Categorical	Frequency	Percentage
Procurement	1	2.3	Supply chain leader	1	2.3
Filed engineer	1	2.3	Production engineer	1	2.3
Engineer	3	7.0	Risk specialist	2	4.7
Finance of performance consultant	1	2.3	Mechanical engineer	2	4.7
Petroleum engineer	1	2.3	Subcontracts	1	2.3

CED	1	2.3	Operations engineer	1	2.3
Project manager	1	2.3	PMS	1	2.3
Health and safety engineer	1	2.3	Manager	4	9.3
Senior planning engineer	1	2.3	Head of market risk	1	2.3
Project engineer	4	9.3	Area manager	1	2.3
Retired consultant engineer	1	2.3	Internal auditor	1	2.3
Mechanical production engineer	1	2.3	Investigation and research manger	1	2.3
Filed service manager	2	4.7	Customer service	1	2.3
Senior risk manager	1	2.3	Anti fraud senior officer	1	2.3
ERM senior analyst	1	2.3	Financial crime	1	2.3
			Director	1	2.3

5.1.2-The statistical standard used in the study:

In order to explain the means of the estimates of the study sample members on each paragraph of the questionnaire as well as on each of its fields; the tripartite statistical criterion was used (Kilani and Sherifin, 2014) as shown in Table (4).

Table (4)

The used statistical standard to interpret the means of the estimates of the study sample members on each of the tool paragraphs and on its fields.

Mean	Degree of agree
From 1.00 - less than 2.33	Low
From 2.34 - less than 3.67	Moderate
From 3.68 to 5.00	High

The length of each grade was calculated through highest value-lowest value number of grades=5-13=1.33

5.1.3- Reliability:

To ensure the reliability of the study tool, the Cronbach alpha equation was applied to the original study sample, to find out the stability of the internal consistency of each scale of the study, table (5) shows the following:

Table (5)

The values of reliability coefficient by Cronbach's alpha

Scale	Cronbach's alpha
risks those affect oil & gas projects	0.90
increase the maturity level	0.86

From the previous table, we find that the value of the reliability coefficient of risk scale reached (0.90), while the reliability coefficient of increase the maturity level reached (0.86), these values are high enough to conduct the study.

5.2- Statistical analysis:

5.2.1- The results:

This chapter includes a presentation of the results of the study aimed at knowing risk management of oil and gas projects in Saudi Arabia, according to the answers to research questions.

5.2.1.1- Data preparation:

After the data collection was completed, we encoded the data and then entered it into SPSS Version 25 , and then performed the statistical processes needed to reach the results.

The first question: What are the most significant risks that affect oil & gas projects in Saudi Arabia?

To answer this question, we have extracted the means and standard deviation of the most significant risks that affect oil and gas projects scale; the tables (6) explain this.

Table (6)

The mean and standard deviation for the risks scale and scale overall

Id	Risks	Mean	St. deviation	Degree of risk	Order
5	Cost Risk. [Impact]	3.907	.971	High	1
1	Supply chain Risk. [Impact]	3.860	.833	High	2
13	Improper Project Management [Impact]	3.860	.861	High	2
11	Labor Risk: Lack of skilled employees. [Impact]	3.814	.932	High	4
21	Technical risk. [Impact]	3.814	.732	High	4
4	Cost Risk. [Likelihood]	3.767	.922	High	6
19	Operational risk. [Impact]	3.767	.868	High	6
3	Logistics Risk. [Impact]	3.721	.882	High	8
9	Environmental Risk [Impact]	3.721	1.054	High	8
7	Political Risk [Impact]	3.698	.964	High	10
15	Economic Risk. [Impact]	3.628	.926	Moderate	11
17	Compliance risk. [Impact]	3.605	.821	Moderate	12
10	Labor Risk: Lack of skilled employees. [Likelihood]	3.581	1.006	Moderate	13
14	Economic Risk. [Likelihood]	3.558	.959	Moderate	14
12	Improper Project Management [Likelihood]	3.488	1.009	Moderate	15
2	Logistics Risk. [Likelihood]	3.442	.959	Moderate	16
18	Operational risk. [Likelihood]	3.372	.952	Moderate	17
16	Compliance risk. [Likelihood]	3.302	.860	Moderate	18
8	Environmental Risk [Likelihood]	3.256	1.049	Moderate	19
20	Technical risk. [Likelihood]	3.256	1.026	Moderate	19
6	Political Risk [Likelihood]	3.163	1.153	Moderate	21
	Scale overall	3.599	.478	Moderate	

We see in table (6) the mean for the most significant risks that affect oil & gas projects in Saudi Arabia ranked between (3.163- 3.907) by high and moderate agree, Where risk number (5) which

states “Cost Risk. [Impact]” in the first rank, and risk number (1, 13) which states “Supply chain Risk. [Impact]” and “Improper Project Management [Impact]” came in second rank with mean (3.860), and risk number (11, 21) which states “Labor Risk: Lack of skilled employees. [Impact].” “Technical risk. [Impact]” came in third rank with mean (3.814), while the risk number (6) which states “Political Risk [Likelihood]” came in final rank, while reaching mean for scale overall (3.599) with moderate degree of risk.

The second question: How do oil and gas companies in Saudi Arabia increase the maturity level?

To answer this question, the means and standard deviations of the exudation level increase scale in oil and gas companies were calculated.; the table (7) explains this.

Table (7)

The mean and standard deviation for the paragraph scale and scale overall

Id	Paragraph	Mean	St. deviation	Degree of agree	Order
4	Lessons learned from previous projects are documented and well explained regularly to avoid such risks for ongoing projects.	4.047	.872	High	1
5	Risk management planning is evaluated regularly and adjusted to meet the latest update of Project status.	3.837	1.022	High	2
11	Awareness sessions for risk control and reporting are held for all employees.	3.814	.824	High	3

10	Risk Response Plan is recorded and updated regularly in Risk profile with target completion date.	3.767	.996	High	4
2	Management has a training program for risk management tools application.	3.674	.969	Moderate	5
7	All Risks Identification processes are systematic with documented methods.	3.674	.892	Moderate	5
1	Management circulates the expectation and procedure for risk identification on a regular basis to all departments.	3.651	.948	Moderate	7
3	Management has a uniform procedure for all departments for risk management processes.	3.651	1.021	Moderate	7
8	All findings during risk management assessment are recorded and discussed and timely actioned.	3.651	1.044	Moderate	7
9	Management has considered maturity models to measure the implementation level of the RM process.	3.628	.900	Moderate	10
6	All actions in a Risk management plan are listed based on systematic ways and not feelings.	3.512	1.121	Moderate	11
	Scale overall	3.719	.682	High	

We see from the previous table that the means of the responses of the respondents on the methods followed by companies to increase the level of oil and gas maturity ranked between (3.512- 4.047) by high and moderate agree, Where method number (4) which states "Lesson learned from previous projects are documented and well explained regularly to avoid such risks for ongoing projects" in the first rank, and method number (5) which states "Risk management

planning is evaluated regularly and adjusted to meet the latest update of Project status” came in second rank with mean (3.837), and method number (11) which states “Awareness sessions for risks control and reporting are held for all employees.” came in third rank with mean (3.814), and method number (10) which states “Risk Response Plan is recorded and updated regularly in Risk profile with target completion date.” came in fourth rank with mean (3.814), while the method number (6) which states “All actions in Risk management plan are listed based on systematic ways and not feelings” came in final rank, while reaching mean for scale overall (3.719) with high degree of agree.

Chapter Six

6.1- Study Findings

Many types of risks were found based on the results gathered in the interview and questionnaire and the most common ones are Supply chain Risk, Cost Risk and Logistic Risk. The degree of the risk for these 3 common types is high which means Risk management exercise should be applied to control and minimize the consequences. Project management should pay attention to controlling the cost and engaging Risk management team to avoid any anticipated risks as the impact and likelihood of Cost Risk are high as per the result of the questionnaire. Lack of communication within a project team is leading to repeat the risks faced in previous projects. Most of the project team believe that the main reason why Projects are facing typical issues is ignorance of Risk management principles and methodology. In addition to that, the controlling and monitoring process is not taken seriously in most organizations which in turn leads to sudden issues and Risks. Risk management procedures for all project departments should be created at an early stage of the project to increase the awareness of anticipated risks in the project cycle and ensure knowledge of reporting risks and mitigation are educated.

6.2- Recommendations for minimal Risks in Projects:

- Awareness of Risk management principle and tools.
- Improving the communication between the project team and organization to avoid typical risks.
- Measuring the maturity level of the organization and follow the proper model to strengthen the level.

- Considering a budget for tolerating risks in the project to control the budget project efficiently.
- Dedicated Professional Risk management specialists should be part of the Project management to implement the Risk management tools.
- Consulting professional Risk management companies in case of uncontrolled risks are experienced to avoid major impact on the project.

6.3- Summary:

This report is focusing on the Risk management implementation in oil and Gas companies in Saudi Arabia. Questionnaires and interviews were done to support the findings and recommendation for accurate results based on stakeholders of various projects. As shown in the research, types of Risk are a lot and many people participating in the questionnaire and interview are commenting about poor implementation of Risk management tools which means the maturity level of risk implementation could be approximately ranking between low to moderate for most of the organization. Furthermore, SPSS version 25 was used to support the study and show the degree of Risk in order based on the mean and Standard deviation. Organizations need to increase the level of awareness for employees on the recommended methods to deal with such Risks that are possibly occurred based on the Job nature. Measuring the maturity level of Risk implementation is a very important activity which is missed by many organizations. Improving the maturity level of Risk implementation and developing procedures on best practice for using Risk management methods will help to minimize such Risks that could be faced in project cycle. Involving expert companies in Risk management as a consultant will make Risk management process smoother.

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Appendix (A)

Interview:

The main points discussed with the experts and the answers contributed effectively on the study setting the foundation of oil & gas projects in Saudi Arabia, the risks they encounter causing delays.

1- Risk specialist has been asked about the top 3 risks commonly faced in oil and Gas industry

Answer:

1. Supply chain Risks
2. Logistics Risks
3. Cost Risks

2-Planner and Risk manager and Project manager were asked about how the supply chain affects the project

Answer :

The project schedule is developed based on the material delivery dates and any change to the arrival date will lead to schedule impact in terms of sequence of the project activities. Also, Supply chain plays an important role in giving Engineering the data from suppliers to design the drawings so lack of inputs will lead to poor design and quality issues.

3-Project manager received a query about why oil and Gas companies still face the typical issues in project executing with the evolution of Risk Management

Answer:

Poor implementation of Risk management tools due to ignorance of the Risk management principles and the way to apply them in the projects. Secondly, there might be some application of risk management tools on the project at an early stage but monitoring and controlling are not taken as serious activities that need to be implemented in project life cycle to ensure timely action is taken.

4- Project Engineer and Project Control Engineer are answered the query of how usually the risks are mitigated in oil and gas industry as following:

Answer:

Mitigating the risks starts with realizing the risks and then preparing RCA and corrective actions and studying the impact on both cost and schedule of the project. Finally , Getting concurrence from all subject matter experts on the way proposed to move forward and implement the risk management plan.

5-Cost Engineer answers the question of what is cost Risk and what are the main causes as follows.

Answer:

There are a lot of factors that can be categorized under Cost risks where this type of Risks can be defined as overrunning the budget for a project before project completion and main causes of cost risks are incorrect forecasting of the budget and wrong estimation for the project need.

6-Project manager and Risk manager are asked about how the delay of Engineering deliverables increases the other Risks in oil and Gas Project.

Answer:

The schedule of the project is created in sequence wise where the plan of Engineering deliverables and arriving material are considered to forecast the finish dates of all activities and any delay from Engineering will increase the probability of cost Risk due to delay in project completion.

Appendix (B)

Survey Questionnaire:

Part (1) General information.

1- Name (optional):

2- Job position:

3- Company name (optional):

4- Company ownership:

☐ public sector

☐ private sector

☐ Other, specify:

5- Your personal experience in oil & gas projects (years):

☐ less than 1

☐ from 1 to 5

☐ from 6 to 10

☐ from 11 to 15

☐ from 16 to 20

☐ more than 20

6- Your personal experience in Risks & Risk management (years):

☐ less than 1

☐ from 1 to 5

☐ from 6 to 10

☐ from 11 to 15

☐ from 16 to 20

☐ more than 20

Disclaimer:

All optional information is considered private, and will not be published without your consent.

They are merely for the researcher's own reference.

Part (2) Identification of Risks of oil & gas projects in Saudi Arabia:

(The objective of this questionnaire is to determine the most significant risk faced in oil & gas projects in companies in Saudi Arabia.)

Please score the following options of Risks from 1 to 5:

1. Supply chain Risks.

1. Likelihood (1-5)

2. Impact (1-5)

2. Logistics Risks.

1. Likelihood (1-5)

2. Impact (1-5)

3. Cost Risks.

1. Likelihood (1-5)

2. Impact (1-5)

4. Political Risks.

1. Likelihood (1-5)

2. Impact (1-5)

5. Environmental Risks.

1. Likelihood (1-5)

2. Impact (1-5)

6. Lack of skilled employee (Labor risk)

1. Likelihood (1-5)

2. Impact (1-5)

7. Improper project management.

1. Likelihood (1-5)

2. Impact (1-5)

8. Economic Risks.

1. Likelihood (1-5)

2. Impact (1-5)

9. Compliance risk.

1. Likelihood (1-5)

2. Impact (1-5)

10. Operational risk.

1. Likelihood (1-5)
2. Impact (1-5)

11. Technical risk.

1. Likelihood (1-5)
2. Impact (1-5)

Part (3) (Maturity of Risk management implementation in the projects of oil and gas companies):

(The objective of this questionnaire is to examine how Companies manage risk of oil and gas projects in Saudi Arabia, and how they apply risk management effectively during Project life cycle)

Please choose from the following scale which ranged from 1 to 5, which means that:

1 = strongly disagree,

2= disagree,

3= Neutral,

4 = agree

5 = strongly agree.

- 1\ Management circulates the expectation and procedure for risk identification in regular basis to all departments
- 2\ Management has a training program for risk management tools application
- 3\ Management has a uniform procedure for all departments for risk management processes
- 4\ Lesson learn from previous projects are documented and well explained regularly to avoid such risks for ongoing projects
- 5\ Risk management planning is evaluated regularly and adjusted to meet the latest update of Project status
- 6\ All actions in Risk management plan are listed based on systematic ways and not feelings
- 7\ All Risks Identification processes are systematic with documented methods
- 8\ All findings during risk management assessment are recorded and discussed and timely actioned
- 9\ Management has considered maturity models to measure the implementation level of RM process
- 10\ Risk Response Plan is recorded and updated regularly in Risk profile with target completion date
- 11\ Awareness sessions for risks control and reporting are held for all employees

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