Title: The Risk Management For Mitigation Of Hazards In The Construction Projects In Oil and Gas Unit

Module 23/24: Capstone Proposal

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1. Introduction

1.1 Background

The oil and gas industry are at the heart of the world's economic progress, supplying the basic energy materials that form the basic energy feedstock for all, both industrially and domestically. However, it is one of the most hazardous sectors, especially in construction-related infrastructure activities in oil and gas units. There were several catastrophic consequences around the world due to this sector, and several industries have suffered through some very serious tragedies, such as the Deepwater Horizon explosion in 2010, resulting in loss of life, environmental devastation, and hefty fine payments (EPA, 2024). These incidents show the importance of strong risk management practices in excluding hazards. The oil and gas sector represents around 1% of the value of the UK economy (£25bn) and 1 in 160 jobs (Tawdrous, 2024). However, the industry is not without challenges to risk management rooted in complex processes, volatile hydrocarbons, and high-pressure environments (Epstein, 2017). The oil and gas sector is still one of the most hazardous industrial sectors in the UK, despite recent improvements driven by the UK Health and Safety Executive (HSE). During the 2023/24 period, 51 fatal injuries were reported in the sector of construction (including oil and gas infrastructure projects), the sector registering most of the cases (HSE,2023).

Historically, the concept of systematic risk management is being increasingly adopted on a global scale to prevent accidents and minimize operational downtime. For example, in 2022, oil majors such as ExxonMobil (2023) noted that improved safety programs involving predictive analytics and real-time monitoring reduced workplace incidents by 15% (2023). Despite these, progress is impeded by hurdles such as technological integration, regulatory compliance, and workforce training. This study intends to provide an understanding of the significance of risk management strategies in mitigating hazards in oil and gas construction units. It aims to contribute towards the safety and sustainability of an industry that underpins global and UK economic stability by exploring critical challenges and effective strategies.

1.2 Research Problem

The oil and gas units particularly in the construction sector carries high safety risks such as pipeline leak, structural failture and malfunctions in equipments. However, despite these advancements, incidents driven by inadequate hazard

management continue to endanger lives, the environment and operation efficiency. These exacerbate the problem of limited integration of risk management practices that makes an organization vulnerable to accidents and regulatory non compliance (Karim et al., 2023). To fill these gaps, there is need to perform an in depth analysis of safety related issues and approaches to make the industry sustainable and resilient in high stakes operations.

1.3 Research Rationale

The oil and gas sector has to adopt effective risk management strategies because high profile accidents have been shown to be very expensive both economically and environmentally. Yet, while the UK government continues to call for continual improvement in workplace safety standards, practical challenges prevent full adoption (Wong et al., 2015). This study bridges gaps in knowledge by examining existing practices for mitigating hazards, challenges and mitigation strategies to reveal interactions and new knowledge. Knowing these dynamics will help improve alignment between operational practice and regulatory frameworks as well as increase safety.

1.4 Research Aim and Objective

The main aim of the research is to analyse the importance of risk management strategies for the mitigation of hazards in the gas and oil units in construction infrastructure. Following are the research objectives for this study:

- To identify key risk management strategies currently implemented in oil and gas construction projects.
- To assess the effectiveness of identified strategies in mitigating major hazards.
- To find out if improvements can be made to existing risk management frameworks.
- To pinpoint methods and tools that are currently used for identifying risks in oil and gas construction projects and their effectiveness in detecting potential hazards.

Research Question

- What are the most critical risks identified in oil and gas construction projects, and how are these risks currently assessed and prioritized?
- How effective are the existing risk management strategies in mitigating these critical risks in oil and gas construction projects?

- What specific improvements can be made to current risk management frameworks to enhance safety, reduce hazards, and minimize financial and environmental impacts?

1.3 Research Significance

It has important academic and practical applications. This work contributes academically to risk management literature by examining the specific industry needs and challenges in hazard mitigation for oil and gas infrastructure. It allows industry stakeholders, such as project managers, safety officers, and policymakers, to be practically aware of means of improvement of safety in construction units. The hazards identified can reduce workforce safety, protect the environment, and help align operations with compliance standards. This research focuses on actionable insights to help move forward a safer, more sustainable oil and gas industry.

2. Literature Review

2.1 Risk Management and Its Importance in Oil and Gas Units of the Construction Sector for Hazards Mitigation

Because of its inherently high-risk nature, the oil and gas construction sector are dependent on the use of risk management to mitigate hazards. There are key hazards (equipment failures, fires, toxic spills) that must be with proactive actions to avoid accidents and cost reductions. The studies, such as Zio (2018), stress that effective risk management frameworks facilitate the identification assessment, and control of possible dangers, protecting both workers and the environment. Like AlNoaimi and Mazzuchi (2021), they argue that if all risk factors are well identified and assessed, project failure can be reduced; this is one of the highly efficient practices in respect to project risk management implementation. Additionally, risk management provides financial benefits beyond a single investment in comprehensive hazard mitigation strategies, allowing for long-term cost savings by averting accidents and penalties (SOG, 2023). This underlines the need to integrate risk management into day-to-day operations, complicating the situation with oil and gas construction projects even more. Early hazard detection and decision-making are improved through the incorporation of advanced technologies, such as predictive analytics and real-time monitoring (R Azmi et al., 2024). Without adequate protection, the industry is open to regular reoccurring exposés of sector-wide impropriety, which erodes reputation and trust with key stakeholders. Therefore, this gap has to be

addressed so that oil and gas operations are sustainable and efficient, reducing the risks in the work environment while maintaining compliance with regulatory mandates. Moreover, there are challenges in incorporating these risk management strategies that need to be addressed.

2.2 Challenges in Incorporating Risk Management in Oil and Gas Units of the Construction Sector

There are several challenges in implementing risk management practices in the oil and gas construction sector, including financial, technical, and cultural barriers. Some of the barriers to the implementation of risk management, according to AlNoaimi and Mazzuchi (2021), include the lack of clear risk definition, lack of support from top management, lack of formal training, and the associated risk management cost. Cultural resistance within project teams remains one of the most dominant barriers faced by practitioners in their efforts to implement risk management strategies. Proactive risk management may not typically be a top priority for organizations that have established practices and norms (Bakere et al., 2024). Employees will assume new governance measures are unnecessary or burdensome and thus reluctant to adopt. Moreover, poor data sharing and communication may cause early identification of hazards to fail, especially in large-scale projects across multiple sites. As shown in Liu et al. (2020), ineffective knowledge management reduces the scalability of risk strategies and causes repeated incidents. The challenges outlined here need to be addressed first through a multiscale stakeholder approach to promote collaboration, streamline processes, and mitigate resistance to safety-first frameworks. However, it is also crucial to identify strategies that can be adopted as risk management approaches in the construction of oil and gas units.

2.3 Strategies for Incorporating Risk Management in Oil and Gas Units of the Construction Sector

The planning of oil and gas construction projects requires that risk management be integrated into the project, thus involving strategic planning and the application of innovative techniques. A demonstrated strategy for improving hazard identification is one that develops a risk management framework that uses technology. According to Tang (2024) and Hussain et al. (2024), real-time monitoring systems can improve the efficiency of responses to emergencies, specifically high-risk events such as pipeline construction and offshore drilling. They lower the delays

caused by possible safety issues. A second effective way to facilitate safety is to instill a safety culture by way of reinforcing training and awareness campaigns. Based on simulation-based training programs that simulate real-life situations, Naqvi et al. (2020) recommend that workers are equipped with skills to manage emergencies well. Aderamo et al. (2024) also stress policies that promote reporting of near misses without fear of reprisal as substantial in promoting safety compliance. Also, coordinated work with regulatory authority and adoption of international best practices help risk mitigation streamlined. Guidelines such as ISO 3100 ensure the uniformity of implementation on the standardization of processes, especially in multinational operations (Dewantara, 2022). Embedding risk management into such a multi-faceted approach helps achieve both short- and long-term safety outcomes by way of doing so deeply within the organizational fabric.

2.4 Literature Gap

While there has been significant advances in the formulation of strategies for handling risks in oil and gas construction, there are still major gaps in the better and effective implementation of these risk management frameworks. From the literature by Zio (2018) and AlNoaimi and Mazzuchi (2021), one can understand more about the right frameworks for accurate risk mitigation but there is lack of knowledge on how to find the most severe risks and how they are prioritiased in a current project. Additionally, there are some difficulties that have been reported like cultural resistance as described by Bakere and colleagues (2024) and lack of clear definitions of risks as highlighted by AlNoaimi and Mazzuchi (2021). More research is required in order to better implement these frameworks and foster collaboration of all stakeholders in the field where risk identification and safety culture is crucial.

2.5 Theoretical Framework

Swiss Cheese Model of Accident Causation is the theoretical framework for this study. According to Larouzee and Le Coze (2020), this model evidence that accidents are due to a series of organisational failures rather than simple human errors. In the model, holes can be conditions of active or latent failures that leave openings for threats to get around protections or safeguards that built into each layer. When these holes are aligned, hazards bypass dedicated safeguards to avert the occurrence of incidents (Larouzee and Le Coze, 2020). This has implications for the risk management within the context of oil and gas construction; that is, strategies targeting the overall system must be strong and have to have multiple layers if

accident prevention and the minimisation of hazards are to be achieved. This model can be applied to the current study as it will facilitate the analyses of how the "defensive layers" of current risk management strategies, methods, and tools align to prevent hazards in oil and gas construction projects. Gaps or weaknesses within these layers are identified with this framework, assisting researchers to suggest improvements to enhance the overall effectiveness of hazard mitigation.

3. Methodology

3.1 Research Philosophy: Positivism

The philosophy which will be adopted for this study is positivism, taking into consideration measurable and observable realities in oil and gas construction project's risk management strategies. Park et al. (2020) contends that positivism ensures that findings are based on the empirical evidence, free from the researcher bias. It is in tandem with the study's objective of objectively analyzing the effectiveness of these strategies. Building on existing approaches and quantifiable data, the work aspires to deliver reliable conclusions and practical recommendations for optimizing risk management frameworks.

3.2 Research Approach: Deductive

It will use a deductive research approach where the problems are derived from literature lead to theoretical constructs and hypothesis. Using empirical data, these hypotheses will be systematically tested in such a way that a systematic and logical process will emerge from validating theoretical propositions. This approach ensures that empirical risk management knowledge based on hypothesis testing and statistical analysis (Borgstede and Scholz, 2021) resembles positivist stance's emphasis on reliability. It contributes to the study's objective of evaluating and strengthening existing strategies.

3.3 Research Method: Quantitative

A quantitative method will be used in this study. It includes numerical data collection and analysis using objectivity and statistical validation (Ahmad et al., 2019). Data on risk management practices will be collected through surveys and structured questionnaires, and will be evaluated through statistical method. This method will conduct a robust analysis of implementation and impact to answer the research questions thoroughly and inform actionable risk management strategies in oil and gas project.

3.4 Data Collection Tool

Primary data collection for the study will be done through an online survey, which will consist of closed-ended questions hosted on Google Forms. Online surveys, have several advantages over other surveys including their accessibility, cost-effectiveness, and the potential to convene participants from different geographical locations (Ball, 2019). This will be particularly useful considering the busy schedule of the construction sector employees. Data privacy and security are guaranteed by using Google Forms, and due to this form's intuitive interface, there is also a higher response rate and participant engagement.

3.5 Sample Size and Sampling Technique

For this study, the sample size will be 100 employees and managers of the construction sector. For quantitative surveys, 100 is generally the minimum number of participants (Fox, 2023). Researcher will recruite participants using a purposive sampling technique. This sampling technique is justified because it allows participants to be sampled who are most likely to give meaningful, informed responses about the study's area of interest (Campbell et al., 2020). The researcher will be using LinkedIn to use it as a recruitment platform, enabling them to source participants from a very wide pool drawn from the construction community. Structured online surveys will manage the target sample size of 100 participants which will facilitate the data collection across a wide geographic area. Participants will be screened for relevant experience in construction risk management to minimize the bias and make certain that representation is achieved, and to obtain informed insights. The use of this methodology is appropriate as the sample size is robust but focus on targeted selection by which reliable and meaningful data of the risk management strategy can be obtained.

3.6 Data Analysis

The researcher will be using the Statistical Package for Social Science (SPSS) for the data analysis. It is a powerful and widely known software for quantitative data analysis. This tool will allow the descriptive and inferential statistical analysis, such as regression and correlation, to explore relationships and patterns of collected data (Rahman and Muktadir, 2021). This choice comes from the fact that SPSS takes large datasets and provides effective results efficiently. Mreover, the expected data includes responses on the current risk management practices, their perceived effectiveness, and areas for improvement.

3.7 Ethical Considerations

The ethical implications considered in this study revolve around the confidentiality of participant data, informed consent and possible discomfort to disclose sensitive risk management practices In circumstances like these, the researcher will make sure participants know fully the purpose and procedures of the study before going ahead and participating in it. They will be given consent forms highlighting what their rights such as anonymity and right to withdraw at any time. Questions will be phrased in such a way to avoid pressuring participants to reveal confidential or sensitive information. Data will be limited in access and anonymized and stored securely before analysis. The recruitment process will also clarify the voluntary nature of participation with no coercion or undue influence. These measures ensure that everyone is being kept within the ethicalparameters and minimize risk to participants.

4. Conclusion

This research proposes the need for risk management strategies to alleviate the hazards of oil and gas unit construction projects. The study contributes to bridging significant knowledge and practice gaps in the high-risk industry by focusing on the learning of how to identify challenges, evaluate their impact, and propose actionable strategies. Being a positivist philosophy, a deductive approach and quantitative methodology guarantee that the findings are reliable and empirical. The research aims to add to the knowledge, practice, and tools that facilitate improving safety, operational efficiency and conformance to regulations in oil and gas infrastructure projects, thus aiding industry sustainability and workforce well-being.

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Appendix

Gantt Chart