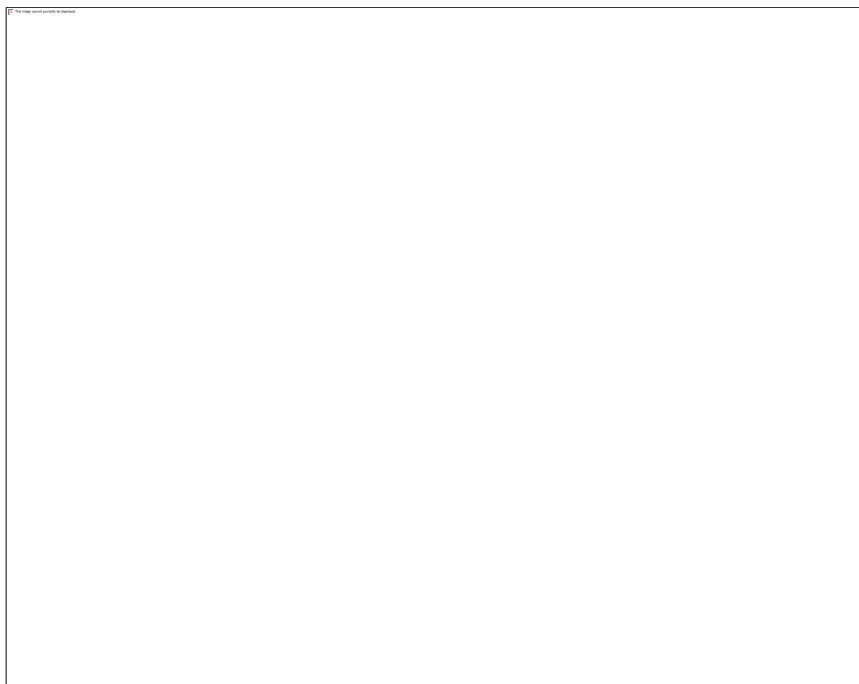


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**BINDURA UNIVERSITY OF SCIENCE EDUCATION
FACULTY OF AGRICULTURAL AND ENVIRONMENTAL
SCIENCES**

DEPARTMENT OF ENVIRONMENTAL SCIENCE

**TITLE: AN INVESTIGATION ON THE IMPACT OF RISK MANAGEMENT ON
ENVIRONMENTAL QUALITY, HEALTH, AND THE SAFETY STATUS OF
EMPLOYEES AND PUBLIC IN THE OIL AND GAS INDUSTRY: A CASE STUDY
OF NATIONAL OIL INFRASTRUCTURE COMPANY, MUTARE.**



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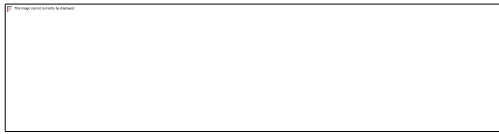
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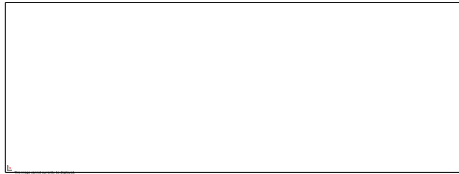
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DATA COLLECTION PERMISSION LETTER

DEDICATION

I dedicate this dissertation to my family, who constantly supported, encouraged and guided me through this path. To my parents, who instilled in me the importance of education and tenacity; to my friends, who supported me during difficult times; and to my mentors, whose knowledge and direction have impacted my academic aspirations, your conviction in my ability has motivated me to achieve new heights, for which I am eternally thankful.

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I want to offer a heartfelt appreciation all the people who helped me throughout. Firstly, i give thanks to my supervisor, Dr.Dzvene, for his essential advice, insight, and support. Your knowledge and constructive input helped shape this work.

I am also deeply grateful to my colleagues and friends for their constant support and encouragement during this project. The conversations and shared experiences made the ride more pleasurable. I am deeply indebted to my family for their unwavering support and faith in my abilities. Your kindness and encouragement have served as the cornerstone for my life. Thank you for being a part of this important chapter in my life.

ABSTRACT

This research looks at the influence of risk management on environmental quality, safety, and health in gas and oil business, specifically at Zimbabwe's National Oil Infrastructure Company (NOIC). Understanding the relationship between risk management methods and their consequences for environmental and public health is vital, given the oil and gas sector's importance to the national economy. This study tries to accomplish various goals. The first is to identify the current risk management policies and practices employed at NOIC; secondly, to examine the correlation between these risk management methods and environmental quality, particularly concerning air and water pollution, habitat disruption, and waste management; thirdly, to analyse the effectiveness of various risk management strategies utilized within the industry; and finally, to evaluate the impact of these methods on safeguarding employee health. The study tries to accomplish various goals. The first is to identify the current risk management policies and practices employed at NOIC; secondly, to examine the correlation between these risk management methods and environmental quality, particularly concerning air and water pollution, habitat disruption, and waste management; thirdly, to analyse the effectiveness of various risk management strategies utilized within the industry; and finally, to evaluate the impact of these methods on safeguarding employee health.

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LIST OF ACRONYMS AND ABBREVIATIONS

SPSS.....	Statistical Package for Social Sciences
NOIC.....	National Oil Infrastructure Company
EMA.....	Environmental Management Agency
MDGs.....	Millennium Development Goals
ISO.....	International Organisation for Standards
NDS1.....	National Development Strategy 1

CHAPTER 1

1. INTRODUCTION

This chapter contains the background to the study, problem statement, general objectives, specific objective, hypothesis, justification, study area description and limitations to the study.

1.1 BACKGROUND TO THE STUDY

In the oil and gas sector, risk management research has important ramifications for public and worker safety, health, and environmental quality. The exploration of global practices and principles begins far from Zimbabwe, touching on contemporary studies and models adopted in various regions before culminating in the context of Zimbabwe.

In studies from various regions, it has been observed that rigorous risk management practices contribute significantly to reducing environmental hazards. For instance, research conducted in Norway highlighted that implementing robust environmental risk assessments is crucial for maintaining compliance with safety regulations and minimizing ecological disturbances (Kristensen et al., 2021). Following this, a study in Canada established correlations between proactive risk management and improvements in workplace safety within the oil and gas sectors, suggesting that such frameworks not only protect employees but also enhance community trust (Nguyen & Gorman, 2022). In the United States, Barrett et al. (2022) identified that industries employing integrated risk management practices experienced fewer incidents of environmental contamination, reinforcing the connection between comprehensive risk management and environmental health.

In the Southeast Asia, in Malaysia, research has focused on risk management frameworks and their correlation with operational excellence in the gas and oil industry. A study emphasized on impact of enterprise risk management in shaping operational success, indicating that the adoption of sound risk management practices is critical for addressing varied operational challenges (Tasmin et al., 2020). Additionally, the commitment to safety within the Malaysian oil and gas industry highlights the role of management in fostering a culture of safety and proactive risk mitigation (Nguyen et al., 2024). Such principles, if adopted, could enhance safety outcomes in similar high-risk industries.

Another research conducted in Indonesia by Hasiholan et al. discusses the essential role of local governments as participating interest (PI) holders in managing environmental impacts in upstream oil and gas operations (Hasiholan et al., 2023). This study emphasizes the legal and regulatory frameworks necessary for effective health, safety, and environmental compliance, suggesting that similar frameworks could be beneficial in other contexts (Hasiholan et al., 2023).

Moving to the Middle East, in Yemen, researchers identified various risks affecting construction projects related to oil and gas. The study highlighted political instability and project cost estimation as critical factors impacting operations, which underscores the necessity of integrating comprehensive risk assessment and management practices to mitigate these geopolitical risks (Rawat et al., 2022). These findings resonate with the significance of risk awareness and proactive communication strategies in high-risk environments, reinforcing that safety and disaster avoidance are directly correlated with effective risk management frameworks (Nordin et al., 2021).

In the West, literature on occupational health and safety management illustrates a systematic approach to evaluating safety metrics. For example, the focus on health implications, such as mercury exposure among oil and gas workers, emphasizes the relevance of stringent risk management to safeguard worker health (Palathoti et al., 2022). This is further augmented by research in Nigeria that assessed health and safety costs associated with employee welfare, linking it back to overall profitability in the oil and gas industry, which creates a compelling case for investing in risk management strategies (Promise et al., 2024).

Moving on to Africa, and more especially to Ghana, it is observed that the condition of safety and occupational health management frameworks has a big impact on reducing workplace accidents in the oil and gas industry (Liu et al., 2020). The importance of cultivating a healthy safety culture that promotes adherence to safety protocols cannot be overstated (Akano et al., 2024). This sets the stage for Zimbabwe's own oil and gas sector, which, while not as prominent, stands to benefit significantly from these international best practices.

A study conducted in Nigeria examined risks associated with oil spills and their detrimental environmental effects. This research underscored the necessity of robust risk management frameworks to safeguard local health and safety, stressing the community's involvement in decision-making processes (Obi et al., 2023).

In South Africa, similar concerns regarding risk management have emerged within the oil and gas sector, with a focus on regulatory compliance and environmental protection measures. Recent findings suggest a direct correlation between effective risk management practices and improved public health outcomes in the vicinity of operational sites (Smith & Nkosi, 2023).

In Zimbabwe, the local industry could harness insights from global frameworks to formulate a robust risk management strategy tailored to local contexts, considering the unique environmental and socio-economic factors at play. As the country navigates its emerging oil and gas sector, the implementation of effective risk management practices could yield improvements in environmental quality and reclaim public trust by enhancing health and safety standards (Promise et al., 2024).

In summary, an international perspective on risk management reveals interconnected themes that underscore its critical importance across various jurisdictions. The insights gathered not only inform practices in Zimbabwe but also highlight the essential role of communication, employee involvement, and continuous improvement in fostering a culture of safety in high-risk environments.

1.2 PROBLEM STATEMENT

The oil and gas industry operations are often associated with environmental degradation, health and safety issues affecting the quality of life for local populations and well-being of workers. Despite the implementation of various risk management strategies aimed at mitigating these, there remains a persistent concern regarding the effectiveness of such measures in safeguarding environmental quality and ensuring well-being of both employees and surrounding communities.

The company is facing environmental protection challenges such as fuel spills during loading and offloading. The company records at least one spillage incident every month according to the company accident register as of July 2024. The company is failing to attain the ISO14001 certification, also poor class of licenses from EMA ranging between red and amber, leading to high waste disposal licensing fees costing USD\$2000 from EMA and failure to attain the ISO14001.

The workers are facing healthy risks problems such as respiratory illness, minor skin damages to the loaders and laboratory workers due to contact with fuels, unpleasant smells, as recorded

by the NOIC as of 31 July 2024. Oil and gas industry is also associated with environmental problems such as air pollution from the generator emissions and fuel gases, water pollution from effluent waste and land pollution from solid waste disposal, also property damages from fuel tankers and vehicle accidents and fires, so an investigation to see if risk management is crucial to solve such. During the period, January to July 2024, the company recorded approximately 10 cases of property damages, and approximately 2 cases of fire caused by tanker fault in the depot.

This study investigates the impact of risk management on environmental quality, employee health and safety, and public well-being at National oil Infrastructure Company in Mutare. This problem statement highlights the research gap and sets the stage for the investigation, which will explore the effectiveness of risk management practices and identify areas of improvement.

1.3 GENERAL OBJECTIVE

1. To investigate the impact of risk management on the safety, health, and environmental quality in the gas and oil industry.

1.4 SPECIFIC OBJECTIVES

1. To identify the current risk management practices, and policies at National Oil Infrastructure Company, Mutare.
2. To examine the relationship between risk management methods and environmental quality, focusing on air and water pollution, habitat disruption and waste management.
3. To analyse the risk management methods used in the oil and gas industry to evaluate their effectiveness.
4. To evaluate the effectiveness of methods used for safeguarding employee health, environmental quality and the surrounding communities through injury and illness statistics.

1.5 HYPOTHESIS

H0: There is no significant relationship between the effectiveness of risk management practices and environmental quality, safety, and workers healthy status in the gas and oil industry.

H1: There is a significant relationship between effectiveness of risk management practices and environmental quality, safety, and healthy status in the gas and oil sector.

1.6 JUSTIFICATION

The investigation of how risk management affects the environment, worker health and safety, and public safety in the oil and gas sector is crucial for a number of reasons. The oil and gas sector is linked to habitat degradation, water and air pollution, and oil spills. To help protect the environment, measures that reduce environmental degradation and encourage sustainable practices must be developed. This requires an understanding of how successful risk management techniques are. Additionally, this study will assist in determining practical ways to shield community people from hazardous material exposure and employees from accidents and health problems. Additionally, this will assist in highlighting the advantages of all stakeholder involvement. The global economy greatly benefits from the oil and gas sector. However, significant monetary losses, legal ramifications, and harm to one's reputation can result from safety incidents and environmental disasters. Such hazards can be reduced, economic stability can be guaranteed, and natural resources can be preserved with effective risk management. It is crucial to do this study since these economic ramifications can be resolved with the aid of efficient risk management.

This investigation will also provide insights into how well companies adhere to regulations that were put in place by the government and other regulatory board like EMA to safeguard the environment, and the workers safety, thus helping National Oil infrastructure company in attaining the ISO 14001 certification. This investigation aims to highlight the importance of transparency and communication in risk management, fostering better relationships between companies and their stakeholders. This investigation is justified not only by the pressing need to protect the environment and public health but also by its potential to enhance the operational integrity of the oil and gas industry, contributing to a more sustainable and responsible energy future. Additionally, this study will contribute to the corpus of knowledge already available on risk management in the oil and gas sector. This project will also help in providing empirical data and insights that can be used by academics, industry professionals, and policy makers to inform future practices and regulations.

The research significantly advances National Development Strategy 1 (NDS1), education 5.0, the Millennium Development Goals (MDGs), and Vision 2030. The five main missions of

Education 5.0 in Zimbabwe are teaching, research, community service, innovation, and industrialisation. The following are the ways in which this study supports these pillars:

The investigation is rooted in original research, addressing real-world challenges in the oil and gas sector. The study promotes societal well-being, demonstrating a commitment to the community wellbeing by focusing on health, safety, and environmental quality. The findings offer practical, risk-based solutions that can improve operational practices in the energy sector, supporting the industrialization agenda.

Zimbabwe's economy is expected to reach upper-middle income status by 2030 according to Vision 2030. The study contributes through, sustainable Industrial growth, Improved public health and environmental stewardship and enhanced environmental and health safety standards. The study supports safer and more sustainable industrial operations by recommending effective risk management practices. . The research can also inform evidence-based policies within the energy and environmental sectors directly contributing to human capital development, a key pillar of vision 2030.

The study reflects core MDG objectives, particularly Goal 7 which focuses on ensuring environmental sustainability. The oil and gas industry's environmental quality is the subject of the investigation. The study advances public health by concentrating on health and safety standards, which helps achieve Goal 6: fight diseases and enhance health. Goal 8 is to develop a global partnership for development, knowledge-sharing and best practices in risk management contribute to international cooperation.

NDS1 (2021–2025) is a medium-term economic blueprint that focuses on inclusive growth, environmental sustainability, and infrastructure development. This study contributes to environmental protection by assessing and proposing ways to mitigate environmental risks in oil and gas operations. The study also helps in improving governance in the energy sector by enhancing risk management supporting transparency and accountability. The study emphasizes the welfare of employees and surrounding communities, which is a key part of human capital development under NDS1.

In conclusion, this research is justified not only by the pressing need to protect the environment and public well-being but also by its potential to enhance the operational integrity of the oil and gas industry, contributing to a more sustainable and responsible energy future.

1.7 STUDY AREA DESCRIPTION

The National Oil Infrastructure Company (NOIC) Feruka Depot is located in Mutare, Zimbabwe. Mutare is situated in the eastern part of the country, near the border with Mozambique. The depot is specifically located at Feruka, which serves as a strategic site for NOIC's operations. Mutare receives significant rainfall, with an average annual rainfall of around 800-1,000 mm. The climate is quite mild, with average temperatures ranging from 18°C to 25°C. The area is surrounded by lush vegetation, including miombo woodlands and grasslands.

Mutare is a significant urban centre in eastern Zimbabwe, with a diverse population. The city's economy is driven by industries like manufacturing, agriculture, and services. Traditional and modern gender roles coexist, with women increasingly participating in various sectors. The National Oil Infrastructure Company (NOIC) is responsible for transporting and distributing petroleum products in Zimbabwe. The company was founded in 2011, after the unbundling of NOCZIM into Petro trade and NOIC.

The company headquarters is in Harare, Zimbabwe. Products include diesel, petrol, jet A1, ethanol, and illuminating paraffin. The company has 5 depots strategically located in Bulawayo, Mutare, Beitbridge, Msasa, and Mabvuku. NOIC offers blending services for clients and pipeline transportation through its subsidiary, PetroZim Line. PetroZim Line, a wholly-owned subsidiary of NOIC, operates the pipeline from Feruka to Msasa, transporting refined fuel for distribution to oil company depots and end-user markets.

1.8. STUDY AREA MAP



Figure 1.1 Map showing NOIC Feruka Depot, Mutare by google maps

1.9 LIMITATIONS THE STUDY

A case study of the National Oil Infrastructure Company may be used to examine how risk management affects environmental quality, health, and safety in the oil and gas sector. However, there are a number of potential restrictions to consider: The availability and dependability of data comes first. Data access may be restricted; for example, private information may not be accessible to the general public. The analysis may be impacted by variations in the quality of the data, such as the dependability of environmental and safety records.

The second limitation is that access to reliable and comprehensive data may be restricted. The study might rely on secondary data, which could be out dated or incomplete, leading to potential biases in the analysis

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

The oil and gas sector is essential to the world's energy supply, but it also presents serious dangers to worker safety, public health, and environmental quality, (Che R and Zaim, 2023). A. Ahsan W, Idris O, et al. (2023) stated that effective risk management techniques are essential for reducing these negative effects. This review of the literature summarises the results of several investigations into the connection between risk management procedures and the outcomes for the environment, worker safety, and health in the oil and gas industry. Finding the research gap between this study and previous ones is made easier by the literature review (Paul A., Mathew N. O., et al, 2024). The researcher will use well-known experts, authors, lecturers, and contributors to illustrate the connection between risk management and the environment, worker safety, and health.

2.2 RISK MANAGEMENT FRAMEWORKS

In the oil and gas sector, risk management usually include risk identification, assessment, and mitigation. According to Siri and Bodil (2011), the ISO 31000 standard provides a framework

for risk management that highlights the need of incorporating risk management within organisational procedures. According to studies by Khan F. Hashemi et al. (2016) and Mmesomachukwu F. K. (2023), organised risk management frameworks can improve safety outcomes and decision-making. According to the research, a strong risk management strategy includes locating, evaluating, and reducing dangers in order to stop mishaps and injuries.

The oil and gas industry are inherently hazardous, with complex operations, high-risk activities, and the potential for catastrophic incidents (Che R and Zaim, 2023). Therefore, proactive risk management is paramount to protect workers, the environment, and surrounding communities, (Mmesomachukwu F.K 2023). Key Components of Risk management includes hazard Identification, this involves identifying potential hazards within the workplace, such as exposure to chemicals, machinery, or environmental conditions. Another key component is risk assessment; this involves evaluating the likelihood and severity of potential hazards to determine the level of risk.

The third component is risk mitigation, this involves implementing measures to reduce or eliminate identified risks, such as elimination, engineering controls, administrative controls, substitution, personal protective clothing and implementing safety procedures, providing training, (Chizubem B, Izuchukwu C. O, et. al, 2024). They are tools and techniques that are used to conduct risk assessments, and these includes, the job safety analyse, hazard and operability studies (HAZOP), and the failure modes and effects analyses (FMEA). These are used to identify potential hazards and assess the effectiveness of existing safety controls. The purpose of the risk assessment is to prevent incidents from occurring by identifying and mitigating potential hazards before they can cause harm, (Chizubem B, Izuchukwu C. O, et. al, 2024)

2.3 ENVIRONMENTAL QUALITY

Research indicates that effective risk management can significantly improve environmental quality, for instance, Al-Mansoori et al. (2018) found that companies employing comprehensive risk assessments were more likely to implement pollution prevention measures, thus reducing environmental degradation. Additionally, the integration of Environmental Management Systems (EMS) was shown to correlate with lower emission levels (Gonzalez & Arrieta, 2021). The environmental impact associated with the oil and gas industry cant be overstated. Accidental oil spills, gas leaks and pollution from various souces pose grave threats

to ecosystems, wildlife, and human populations. Risk management acts as a shield against such calamities, (Khan F, Hashemi, et al 2016).

The industry minimises the risks of environmental disasters through stringent adherence to safety protocols, regular inspections, and the use of advanced technologies. It ensures that oil and gas exploitation and production occur with minimal ecological footprint, preserving biodiversity and safeguarding delicate balance of our ecosystems, (Paul.A, Mathew. N. O, et al, 2024). Robust risk management also helps identify potential environmental hazards associated with oil and gas operations, such as oil spills, leaks, emissions, and waste disposal. It is also essential in risk assessment by evaluating the likelihood and potential consequences of these hazards, taking into consideration factors like the scale of operations, location, and environmental sensitivity (Siri A and Bodil. A. M. 2011).

A study by Mmesomachukwu F.K (2023) states that environmental management systems (EMS) help to manage environmental risks effectively, including setting environmental objectives, monitoring performance, and conducting regular audits. Contingency planning, it helps develop well-structured contingency plans for responding to environmental incidents, such as oil spills, including procedures for containment, clean up, and remediation. It also helps by implementing best management practices to minimize environmental impacts such as use of low emitting engines, reducing leaks and fugitive emissions and properly managing waste.

Research by H Conner (2015) suggests that a robust risk management is also essential in establishing robust monitoring programs which tracks environmental performance and report any incidents or non-compliance to relevant authorities. It also helps in developing and maintaining robust spill prevention and response plans, including training for personnel and having the necessary equipment and resources readily available. A robust risk management also implements measures to reduce air emissions, such as using cleaner fuels, installing emission control equipment, and optimizing combustion processes. Management of water resources responsibly, including minimizing water usage, preventing pollution, and treating wastewater before discharge. Implement a comprehensive waste management plan, including proper storage, transportation, and disposal of hazardous and non-hazardous is also another benefit of a robust risk management (S.B.Cunha 2016).

2.4 HEALTH IMPACTS

The health of employees and the public is often compromised in oil and gas operations due to exposure to hazardous substances. A study by Wong et al. (2019) demonstrated that organizations with robust risk management protocols reported fewer health-related incidents among workers. Furthermore, McCarthy et al. (2020) illustrated that community health program, which stem from effective risk management strategies, can mitigate the adverse health effects on populations living near oil extraction sites.

2.5 SAFETY STATUS OF EMPLOYEES

Employee safety is a critical concern in the oil and gas industry. The implementation of safety management systems, as discussed by Håvold and Nilsen (2021), has been linked to reductions in workplace accidents. A research by Nguyen, Kiet, N. T, et al (2024) suggested that a proactive approach to identifying hazards and training employees leads to a safer working environment. Moreover, the role of safety culture in risk management cannot be overstated; a positive safety culture enhances compliance with safety protocols, leading to improved employee safety outcomes (Zohar, 2020).

2.6 PUBLIC SAFETY AND COMMUNITY ENGAGEMENT

Public safety concerns arise from potential oil spills, gas leaks, and other industrial accidents. A study by Kwan et al. (2021) emphasizes on the importance of community engagement in risk management. By involving local populations in risk assessments and emergency planning, oil and gas companies can foster trust and improve public safety perceptions. Collaborative efforts between companies and communities have been shown to enhance preparedness and response strategies, thereby minimizing risks to public safety.

2.7 REGULATORY FRAMEWORK AND COMPLIANCE

Regulatory frameworks play an important influence in establishing risk management techniques in the oil and gas industry. Green et al. (2021) stated that following rules not only improves safety and environmental performance, but it also develops an accountability culture. Effective risk management strategies that comply with regulatory standards increase operational performance and decrease liability for businesses. This connection is emphasized further by Patel and Sharma (2023), who suggest that enterprises that actively engage with regulatory agencies have superior safety records.

2.8 TECHNOLOGICAL INNOVATIONS

Technological breakthroughs have transformed risk management in the oil and gas industry. Real-time monitoring systems and predictive analytic are examples of innovations that help discover dangers before they become serious. Liu et al. (2022) found that organization that use sophisticated risk monitoring technology had fewer incidents and greater environmental compliance. The integration of Internet of Things (Io T) sensors has enabled continuous monitoring of environmental factors, resulting in prompt actions.

2.9 EMPLOYEE TRAINING AND AWARENESS

Employee training is an important part of risk management techniques. Harper and Wilson (2020) discovered that comprehensive training programs increase staff understanding of safety standards and environmental policies. Regular drills and simulations not only train staff for emergencies, but they also build a safety culture. The authors emphasize that organization that engage in continuing training experience a significant reduction in accidents and environmental infractions (Ben. I.O. 2022).

2.10 CHALLENGES IN RISK MANAGEMENT

Despite progress in risk management, they are still some difficulties in implementation. Organization resistance to change can make it difficult to implement effective risk management procedures. Furthermore, funding restrictions frequently prevent the implementation of modern technology and training programs. Addressing these impediments is crucial to cultivating a culture of safety and environmental responsibility in the oil and gas industry, (Zwikad.O, et al, 2011).

Operations frequently take place in isolated and dangerous regions;the oil and gas industry are notorious for its high-risk environment. Risk management in this sector thus poses difficulties that call for certain skills and understanding (Paul. A. A, Mathew. N.O, et al. 2024). Commodity price volatility is one of the main risk management issues facing the oil and gas sector. It is crucial for businesses in this industry to properly manage price risk through hedging methods and other risk mitigation approaches since changes in the price of oil and gas can have a big influence on their financial performance (Zwikad.O, et al, 2011).

Risk management also faces challenges such as supply chain complexity. A network of suppliers, contractors, and partners are regularly engaged in the operations of oil and gas firms, which frequently operate across several solid bonds with important players, are necessary for risk management across this intricate supply chain.

Safety of workers is another important risk management issue in the oil and gas industry. There are serious safety concerns for employees in these nations and regions. Strong risk assessment procedures, clear communication, industry due to the nature of the work, which frequently entails large machinery, dangerous chemicals, and high-pressure activities. To avoid accidents and lessen the effect of those that do occur, businesses in the oil and gas industry must place a high priority on safety in their operations. To achieve this, they must put in place stringent safety procedures, training courses, and emergency response plans.

Another important factor to consider while managing risk in the oil and gas sector is environmental concerns. From habitat loss and climate change to air and water pollution, the extraction, processing, and transportation of oil and gas may have a variety of negative effects on the environment. Businesses in this industry are required to follow strict environmental laws, carry out in-depth environmental impact analyses, and have policies in place to reduce their environmental effect.

2.11 FUTURE DIRECTIONS IN RESEARCH

Future study should look at the efficacy of integrated risk management techniques that incorporate environmental, health, and safety considerations. Longitudinal studies assessing the impact of specific risk management approaches on environmental and health outcomes may give useful information. Furthermore, study on the role of stakeholder engagement in establishing risk management methods might help us better understand the effects on communities and attitudes.

2.12 CONCLUSION

The literature shows a clear link between good risk management and better environmental, healthy, and safety outcomes in the oil and gas industry. Organisations that implement comprehensive risk management frameworks are better able to meet the complex problems they encounter. Future researches should focus on longitudinal studies to evaluate the long term

effects of risk management strategies, as well as novel practices that improve safety and environmental stewardship.

CHAPTER 3

3 RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter assesses the research methodology used in the study and discusses the approach used to collect enough data to conduct the research.

According to Dustin J M, (2024), the research methodology is the systematic and theoretical strategy used to gather, analyse, and interpret data to answer research questions or test hypothesis. It describes the procedures, strategies, and methods used to collect and analyse data, assuring the validity, reliability, and credibility of the study, Xun H, Jayanth .J et al (2024). In this chapter, the researcher outlines the research strategy, target population, sample and sampling procedure, and research instruments used in the study to assess the impact of risk management in the oil and gas industry, with an emphasis on NOIC.

3.2 RESEARCH DESIGN

A research design is defined as a thorough strategy or structure that outlines how to perform a study, Adetayo. O.A. et al (2024). To attain these goals; a mixed methods approach will be used. A mixed methods approach combines quantitative and qualitative research techniques. This will allow for a more thorough knowledge of the present risk management frameworks and their efficacy. Data will be collected via surveys, interviews, and document analysis, allowing for a thorough assessment of both statistical patterns and personal experiences with risk management strategies.

The findings of this study intend to bring useful information in the area by making suggestions for enhancing risk management practices in the oil and gas industry, resulting in improved environmental and health outcomes for personnel and the community. This methodology section describes the study design, data collection methods, analytical approaches, and ethical concerns that will guide this inquiry, assuring an organized and a rigorous approach to answering the given research questions.

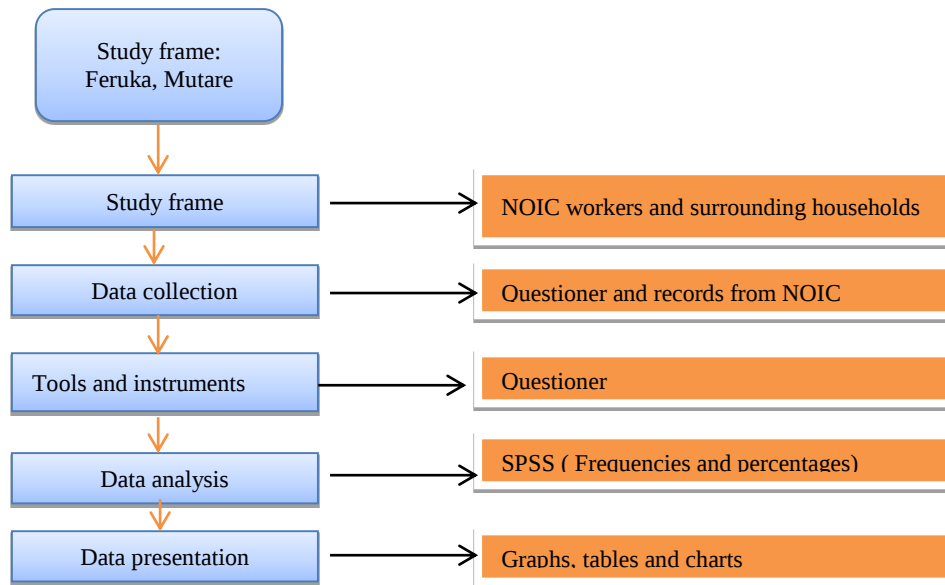


Figure 3.1 Study design flow diagram

3.3 TARGET POPULATION

The target population of a research study is defined as the entire group of people or things that the researchers want to examine, Naomi E A, Ben L., (2024). This group is distinguished by certain characteristics relevant to the study issue, such as age, gender, geographical region, or medical problems. The study's target demographic included personnel of the National Oil Infrastructure Company in Mutare, as well as people who live near the company's facilities. The research population consists of 150 employees from various departments and 100 community members. The area around the NOIC, Feruka depot consists of around 100 households.

3.4 SAMPLE SIZE DETERMINATION

Sample size determination is defined as the process of calculating the number of participants required to achieve the objective of a research study, Kirill B, Xavier J, et.al (2024). The calculation ensures that the study has significant statistical power to detect significant differences and relationships while minimizing unnecessary resources and potential risks.

Slovin's formula was utilized to ascertain the sample size.

$$n = N / (1 + (N * e^2))$$

Calculation for community members

Where: n = sample size
 N = population size(100 respondents)
 e = precision level (0.05)

Entering the values yields:

$$n = 100 / (1 + (100 * 0.05^2))$$

$$n = 100 / (1 + (100 * 0.0025))$$

$$n = 100 / (1 + 0.25)$$

$$n = 100 / 1.25$$

$$n \approx 80$$

Calculation for the workers

Where: n = sample size
 N = population size (150 workers)
 e = precision level (0.05)

Entering the values yields:

$$n = 150 / (1 + (200 * 0.05^2))$$

$$n = 150 / (1 + (200 * 0.0025))$$

$$n = 150 / (1 + 0.5)$$

$$n = 150 / 1.5$$

$$n \approx 109.09$$

The estimated sample size was 80 households and 109 workers (round up to the next full number). Based on the demographic being studied, the sample size for this study was initially calculated to be 189 and 180 respondents gave their full answers to the questionnaires.

3.4.1 SAMPLING APPROACH

1. Assign each household a special identification number for the community samples.
2. Give every one of the 100 households in the sampling frame a special number or code.
3. Produce random integers
4. Choose 80 random numbers at random from 1 to 100 by picking any number at random.
5. Choose the appropriate households.
6. Once the randomly selected numbers are compared to the individual identities given to every household, 80 households are chosen to participate in the survey.

7. Get in touch with particular homes. Invite the chosen homes to take part in the survey by contacting them and giving them the questionnaires.

The respondents to the study will be the heads of every household.

3.5 PRIMARY DATA SOURCES

Primary data refers to information acquired directly from sources for a given research, James P.T. (2024). Data is obtained using a variety of approaches, including observations, surveys, experiments, interviews, and questionnaires. Primary data is carefully tailored to the researcher's aims, providing a higher level of relevance and accuracy than secondary data, which is pre-existing and collected for other purposes. Primary data is especially important for testing hypotheses in experimental research, where controlled settings are necessary to witness outcomes and demonstrate causality, Kirill B, Xavier J, et.al (2024). This technique allows researchers to handle study issues more efficiently and accurately. The researcher used a questionnaire that may be completed on their own.

3.6 SECONDARY DATA

The researcher collected the following secondary data:

1. National Oil Infrastructure Company (NOIC) Risk Management Policies and Report. This gave a direct insight into the actual risk management practices at NOIC, Feruka depot (Mutare). Examples include:

- NOIC's internal safety manuals, risk register, and SOPs.
- Annual reports (especially sustainability or EHS sections).
- Audit or compliance reports, if publicly available.

2. Environmental Impact Assessment (EIA) Reports for NOIC or Similar Facilities, EIAs are comprehensive and show how the company's operations affect air, water, soil, and ecosystems, which directly supports Objective 2 of the study. Examples:

- Pollution levels (air, water, soil).
- Waste management practices.
- Mitigation measures implemented.

3. Occupational Health and Safety (OHS) Statistics. This data shows the actual impact of risk management on employees, allowing you to analyse injury, illness, and fatality trends. This is critical for objective 4 of the study. Examples of data include:

- Lost time injury frequency rate (LTIFR).
- Near- miss incidents and incident reports.
- Employee illness records (related to occupational hazards).

This data was obtained from

- NOIC's internal reports.
- NSSA (National Social Security Authority) reports.
- WHO or ILO publications on the oil and gas sector.

4. Government and Regulatory Reports (Zimbabwe EMA, NSSA, Ministry of Energy). Regulatory data helps you evaluate compliance levels, policy context, and industry-wide performance, strengthening the case study by supporting objectives 1, 2, and 3. Examples include:

- EMA reports on environmental violations or compliance by NOIC.
- NSSA safety inspection outcomes.
- Ministry circulars or policies on oil and gas risk management.

5. Industry Benchmarking Reports and Best Practices (e.g. ISO). These allow the researcher to compare NOIC's practices with global standards, enabling a strong evaluation of Objective 3 of the study.

3.7 DATA COLLECTION TOOLS

The primary data that was used in this study was obtained using self-administered questionnaires and observations.

3.8 QUESTIONNAIRES

Questionnaires gather quantitative data from employees and stakeholders regarding current risk management practices and perceptions of environmental quality and safety. The searcher created structured questionnaires with both closed and open-ended questions to measure risk management knowledge, attitudes, and behaviours.

The researcher sent questionnaires to the adult inhabitants of the residences as well as chosen staff. Adult inhabitants were handed surveys since they were considered to be literate. The researcher presented each question aloud to the respondents' one at a time, making it easy to resolve any confusion regarding the content of the questions straight immediately. Questionnaires offer the advantages of being simpler to use, less costly, and able to reach a large number of people at once. To answer questions, respondents must fulfil specified motivational, educational, and skill prerequisites, Giuseppe C, Ciro C, et al (2024).

3.9 RESEARCH ETHICS

Research ethics is a collection of principles that help researchers do their job ethically and with integrity, Adetayo. O.A. et al (2024). According to Giuseppe C, Ciro C, et al (2024), research ethics address a wide range of concerns, including informed consent, data accuracy, confidentiality, and the study's potential repercussions on participants and society.

The first one is informed consent, which requires that participants be fully informed about the goal, risks, and benefits of the research before deciding to participate, Naomi E A, Ben L., et al (2024). The study followed ethical requirements by collecting participants' agreement and protecting the privacy of their data. Participants were informed about the study and volunteered to participate on their own. The second one is about secrecy; researchers must respect participants' privacy and manage their data properly. The participants' identities were kept confidential to ensure that they felt comfortable giving their ideas. To safeguard the participants' privacy, it was stated that no names would be used in the study, Naomi E A, Ben L, et al (2024).

The researcher validated the data-gathering method to ensure its integrity and veracity. Misrepresenting or manipulating data to get the intended conclusions is unethical and can undermine the study's credibility, Naomi E A, Ben L, et al (2024). The researcher was respectful of the community being studied, especially when dealing with issues that may bring

attention to its negative aspects. There was an endeavour to ensure that the results were communicated in a way that respected the community and considered any potential social repercussions.

3.10 DATA ANALYSIS

Statistical Package for Social Sciences (SPSS) was used to code and store data that came from the questionnaires. The data that was gathered was arranged in tables and the SPSS version's crosstalk tool was applied to do a descriptive analysis. The percentiles and frequencies were obtained using the program.

3.11 CONCLUSION

The data collection tools outlined in this chapter provides a comprehensive understanding of the impact of risk management on environmental quality, health, and safety in oil and gas industry. Mixed approached has is very crucial so as to obtain valid data that isn't biased. The research ethics are also important in obtaining valid and reliable data and also ensuring validity, trust , credibility and avoiding consequences of unethical research.

CHAPTER 4

4.1 RESULTS

4.0 INTRODUCTION

This chapter presents the findings of the study on the impact of risk management on environmental quality, health, and safety in gas and oil industry, with a focus on the National Oil Infrastructure Company (NOIC). The data collected from the questionnaires administered to employees and community members are analysed to address the research objectives. The chapter includes descriptive statistics, a thematic analysis of qualitative responses, and a discussion of key findings.

4.2 SUMMARY OF RESPONDENTS' PROPORTION

The overall summary of the respondents is presented below in a table. The results showed that more males participated in the survey; also most of the participants have 5 or less years of experience.

Table 4.2 Summary of respondent's demographics

Category	Subgroup	Frequency (n=180)	Percentage (%)
Respondent Type	Employees	109	60.6
	Community Members	71	39.4
Gender	Males	115	63.9
	Females	65	36.1
Employee Position	Managers	2	1.8
	Technicians	4	3.7
	Administrative Staff	20	18.3
	Engineers	10	9.2
	Grounds men	18	16.5
	Loaders	30	27.5
	Security	14	12.8
Years of Experience	<5 years	50	45.9

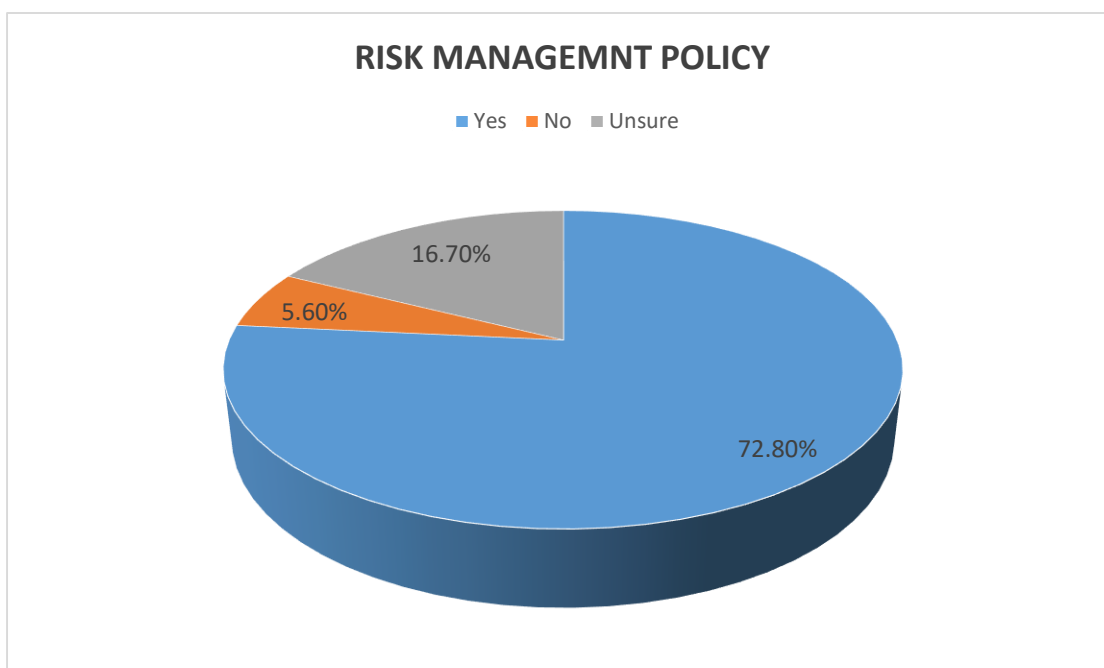
	6-10 years	34	35.8
	>10 years	25	22.9

4.3 RISK MANAGEMENT PRACTICES

4.3.1 FORMAL RISK MANAGEMENT POLICY

The results show that the largest proportion of the workers 140 (77.8%) are aware of the company formal risk management policy, while 10 (5.6 %) are not aware and 30 (16.7 %) are not sure if the company have one or not. This distribution shows that the company has a formal risk management policy and most of the workers are aware except for a few.

Figure 4.1 Chart showing awareness of environmental policy



4.3.2 IMPLEMENTED STRATEGIES

Multiple choices are allowed. Frequency of mentions: Risk Assessment: 160 Frequencies, Mitigation Plans: 140 Frequencies, Training Programs: 125 Frequencies, Emergency Response Plans: 110 Frequencies and Others: (e.g., ISO audits, community drills) 30 Frequency

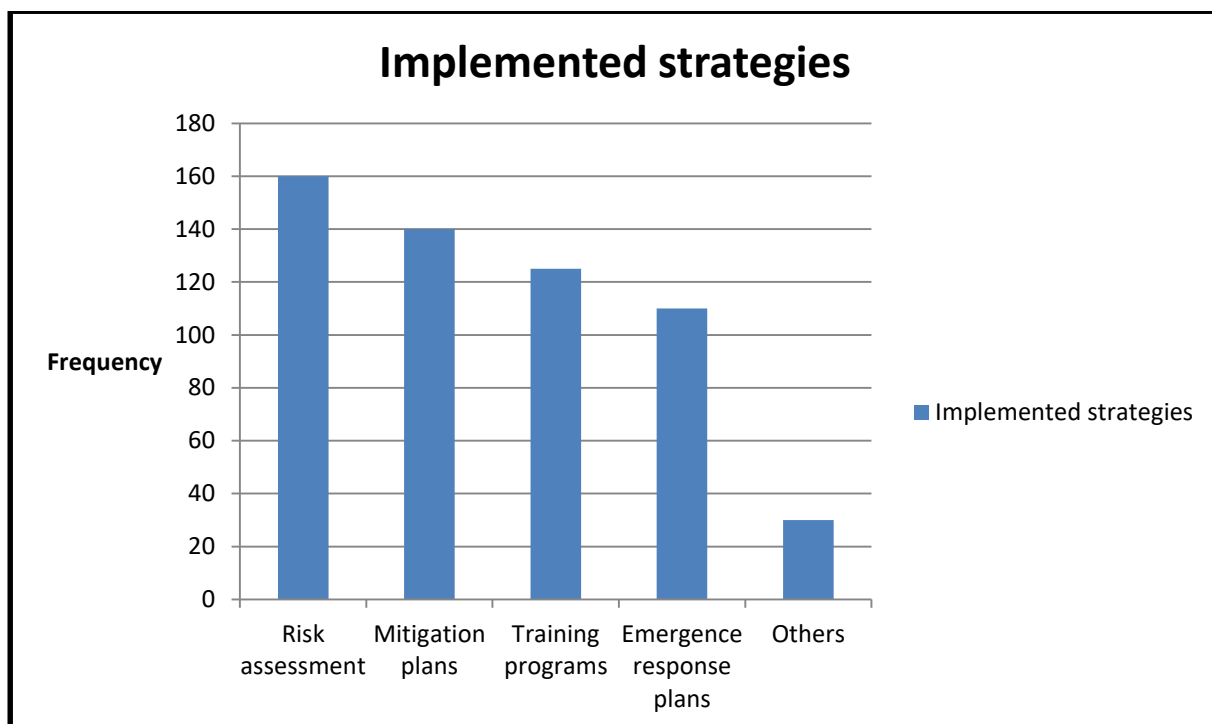


Figure 4.2: showing the frequency of implemented strategies at NOIC

4.3.3EFFECTIVENESS OF STRATEGIES

Very Effective: 55 respondents

Effective: 85 respondents

Neutral: 32 respondents

Ineffective: 7 respondents

Very Ineffective: 1 respondent

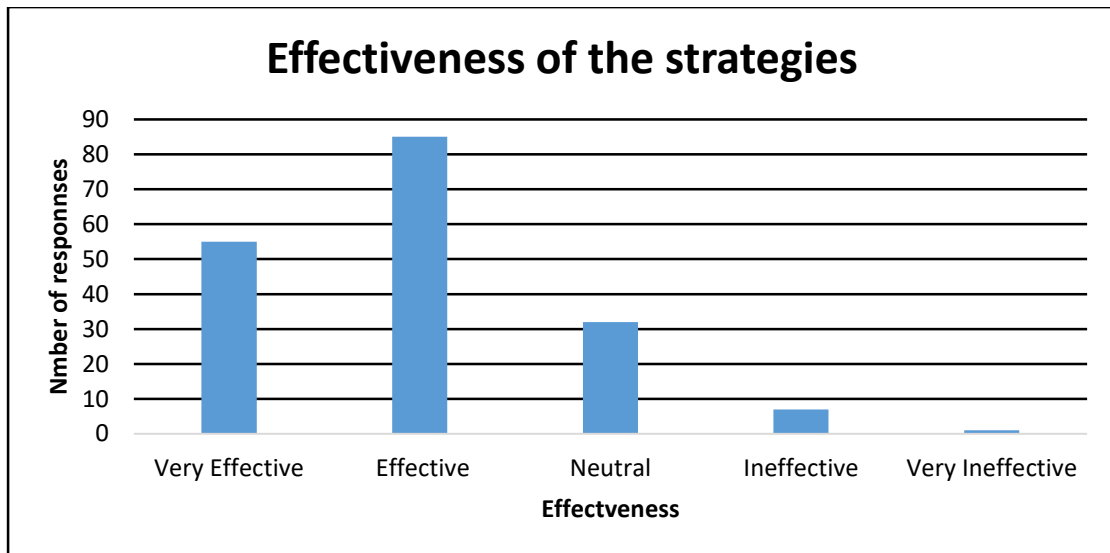


Figure 4.3: showing the effectiveness of the implemented strategies.

4.3.4 FREQUENCY OF RISK ASSESSMENTS

The results on the frequency of risk assessment were presented in a table. The results showed that the majority voted quarterly which is agreeing with the NOIC OHS policy.

Table 4.2: showing the frequency of risk assessments.

Frequency	Number of respondents	Percentage%
Monthly	40	22.2%
Quarterly	80	44.4%
Annually	30	16.7%
Other	30	16.7%

4.4 ENVIRONMENTAL IMPACT MONITORING

4.4.1 WATER QUALITY IMPACT

Table 4.3: showing water quality impact.

Impact	Number of respondents	Percentage%
Very Significant	75	41.7
Significant	60	33.3
Neutral	25	13.9

Minor	15	8.3
Not significant	5	2.8

4.4.2. MEASURES IN PLACE TO MONITOR WATER POLLUTION

Table 4.4: showing measure in place to monitor water pollution.

Measure	Frequency	Percentage%
Regular Testing	150	83.3
Compliance with Regulations	130	72.2
Community Reporting	5	2.8
Other	10	5.6

4.5 EMPLOYEE HEALTH AND SAFETY

4.5.1 TRAINING QUALITY

Table 4.5: showing the rating of the quality of the training at NOIC.

Rating	Frequency	Percentage%
Excellent	75	41.7
Good	85	47.2
Average	15	8.3
Poor	5	2.8
Very Poor	0	0

4.6 PUBLIC SAFETY AND COMMUNITY ENGAGEMENT

Table 4.6: showing the frequency of public safety and community engagement

Public Engagement Method	Frequency	Percentage%
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Engagement through meetings	90	50
Reports/Publications	60	33.3
Social Media	29	16.1
No Engagement	1	0.6
Very Poor	0	0

4.7 OVERALL PERCEPTION

4.7.1 PERCEIVED IMPACT OF RISK MANAGEMENT:

According to the results, 55 workers voted very positive, 80 voted positive, 30 voted neutral, 10 voted negative and 5 voted very negative.

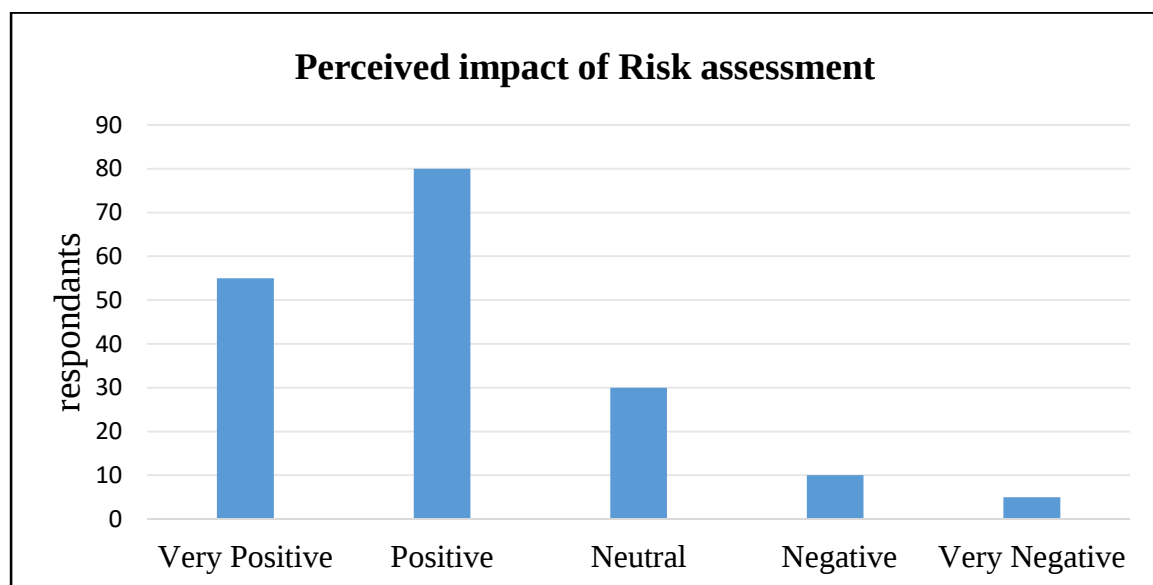


Figure 4.4: showing the overall perceived impact of risk assessment.

4.8 CONCLUSION

The results presented in this chapter showed that a majority of respondents confirmed the existence of formal risk management policies at NOIC. Risk assessment and mitigation plans turned out to be the most widely practiced strategies. Many respondents view the impact of risk management as positive, especially concerning environmental quality and workplace safety. There is room for improvement in community engagement and addressing habitat disruption.

Public perception is generally favorable but highlights areas needing transparency and responsiveness.

CHAPTER 5

5.0DISCUSSION

5.1 INTRODUCTION

This chapter contains an analysis of the data obtained and presented in the last chapter. The results were obtained using a questioner and secondary data collected from the National Oil Infrastructure Company, Zimbabwe.

5.2 THE IMPACT OF RISK MANAGEMENT ON ENVIRONMENTAL QUALITY, HEALTH, AND SAFETY STATUS IN THE OIL AND GAS INDUSTRY.

5.2.1 ENVIRONMENTAL QUALITY IMPACT

The study found that 75% of respondents (135/180 respondents) reported significant or very significant water quality impacts near NOIC facilities. This indicates that current risk management practices are insufficient in mitigating environmental contamination. While regular testing (83.3%) which is in line with NOIC environmental management policy and also regulatory compliance (72.2%) are implemented, community reporting is critically low (2.8%). This suggests a gap in community-inclusive monitoring, potentially undermining environmental safeguards. Risk management fails to fully prevent environmental degradation, highlighting a need for stronger pollution control and community-involved oversight.

5.2.2 EMPLOYEE HEALTH AND SAFETY

The study found that 88.9% of employees rated safety training as excellent or good (41.7% + 47.2%). This correlates with a high awareness of formal risk policies (77.8%), reflecting a robust internal safety culture. The results showed that 77.8% (140/180) viewed implemented strategies (e.g., risk assessments, mitigation plans) as effective or very effective supported by frequent risk assessments (quarterly for 44.4% of respondents). Low years of experience (<5 years for 45.9% of staff) may indicate newer employees rely heavily on training, but long-term health outcomes (e.g., occupational illnesses) are not reported.

5.2.3 COMMUNITY HEALTH AND SAFETY

According to the research results, 50% of engagement occurs via meetings, but social media (16.1%) and published reports (33.3%) are underutilized. The near-absence of no engagement (0.6%) is positive, yet methods may not reach all stakeholders. The research results showed that 75% (135/180) reported a positive or very positive impact of risk management on community safety. However, 8.3% (15/180) noted negative effects, signalling unresolved risks.

However, the research showed a critical gap; only 2.8% cited community reporting as a pollution-monitoring tool, suggesting weak feedback mechanisms for addressing local health concerns.

5.3 CURRENT RISK MANAGEMENT PRACTICES AND POLICIES AT NATIONAL OIL INFRASTRUCTURE COMPANY (NOIC), MUTARE.

5.3.1 AWARENESS OF FORMAL RISK MANAGEMENT POLICY

The research revealed that 77.8% of the employees are aware of a formal risk management policy at NOIC, this is backed by the presence of the training registers documented by NOIC. This indicates that the company has a documented policy framework in place to guide its risk management efforts. However, the 16.7% who are unsure and 5.6% who are unaware highlight a communication or training gap that could be addressed to ensure uniform understanding across all departments.

While the policy exists, its dissemination and reinforcement among all employees need improvement to enhance policy effectiveness.

5.3.2 IMPLEMENTED RISK MANAGEMENT STRATEGIES

The study identified several strategies actively implemented by NOIC; risk assessment (160 mentions), mitigation Plans (140 mentions), training programs (125 mentions), emergency Response Plans (110 mentions), and other strategies (30 mentions), which included ISO audits and community drills.

These results suggest that NOIC has adopted a multi-pronged approach to risk management, combining both preventative and reactive measures. The prevalence of risk assessment and mitigation plans indicates a proactive stance in identifying and addressing potential hazards. The company demonstrates a structured and layered approach to risk management, though the relatively lower frequency of emergency preparedness and community involvement suggests potential areas for further strengthening.

When participants were asked to rate the effectiveness of these strategies, 85 rated them as effective, 55 respondents as very effective and only 8 (combined) saw them as ineffective or very ineffective. This majority perception reflects employee confidence in the measures implemented by NOIC and suggests that the strategies are not only in place but are functioning as intended. They is a positive perception regarding the company's risk management efforts, which contributes to employee morale and operational safety.

The predominance of quarterly assessments with 80 respondents shows a regular and systematic approach, though the variation in frequency suggests differences across departments or lack of standardization. While assessments are periodic, NOIC may benefit from standardizing assessment intervals and ensuring consistency across all units.

5.3.3 TRAINING PROGRAMS FOR EMPLOYEES

Training was largely rated positive, with 41 % voting excellent and 47.2% voting: 41.7% good. This indicates that employees are not only trained but also value the quality of training they receive regarding risk management. Effective training supports the implementation of risk policies and ensures that staffs are well-equipped to respond to hazards.

5.3.4 COMMUNITY ENGAGEMENT

Half of the respondents (50%) noted that engagement occurred through community meetings, with others citing reports and social media. However, 1 respondent indicated no engagement, which although minimal, suggests the need for inclusive and consistent outreach. While engagement exists, enhancing transparency and exclusivity could further improve the public's perception and cooperation in risk management efforts.

5.4 THE RELATIONSHIP BETWEEN RISK MANAGEMENT METHODS AND ENVIRONMENTAL QUALITY.

The research results showed that water pollution is perceived as either very significant (41.7%) or significant (33.3%), indicating on-going environmental concerns. Measures in place includes regular testing (83.3%), compliance with regulations (72.2% and community reporting (2.8%.

While environmental monitoring efforts, particularly water quality testing and regulatory compliance, are strong, the perception of significant pollution indicates that environmental risk remains a major challenge. This may be due to legacy pollution, insufficient infrastructure, or limited community involvement. The low percentage of community reporting (2.8%) suggests a gap in public engagement or awareness, which could be improved to enhance real-time data collection and public trust.

5.5 ANALYSIS OF THE RISK MANAGEMENT METHODS AT NOIC

The results from the study provide significant insights into the risk management methods employed by National Oil Infrastructure Company (NOIC) and their effectiveness in addressing environmental quality, health, and safety concerns. The data collected from 180 respondents—including both employees and community members allow for a comprehensive analysis of these methods.

5.5.1 AWARENESS OF RISK MANAGEMENT POLICIES

A notable finding is that 77.8% of workers are aware of the company's formal risk management policy. This high level of awareness suggests that NOIC effectively communicates its policies, which is crucial for fostering a safety culture and compliance within the organization. However, the 5.6% who are unaware and 16.7% who are unsure indicate areas for improvement in communication and training efforts.

5.5.2 IMPLEMENTED RISK MANAGEMENT STRATEGIES

The survey results highlight several key strategies implemented by NOIC, including risk assessment (160 mentions). This indicates a robust approach to identifying potential hazards, which is fundamental in risk management. Mitigation plans (140 mentions); the existence of formal plans to address identified risks demonstrates proactive measures taken to minimize

potential impacts. Training Programs (125 mentions), effective training is essential for ensuring that employees are prepared to respond to risks, which is reflected in the high frequency of mentions.

Emergency Response Plans (110 mentions), adequate emergency preparedness is critical in the oil and gas sector, where incidents can have severe consequences. These strategies collectively contribute to a comprehensive risk management framework aimed at enhancing safety and environmental protection.

The effectiveness of these strategies is reflected in the responses regarding their perceived impact, 55 respondents rated strategies as very effective, while 85 rated them as effective. This indicates that the majority of respondents believe that the risk management methods are successful in mitigating risks. A small percentage (8.8%) rated the strategies as ineffective or very ineffective, suggesting that while overall perceptions are positive, there are still concerns that need to be addressed.

5.5.3 FREQUENCY OF RISK ASSESSMENTS

The frequency of risk assessments is crucial for on-going evaluation and improvement, 80 respondents indicated assessments are conducted quarterly, which is a positive practice that allows for regular updates to risk management strategies. Monthly assessments (40 respondents) suggest a commitment to continuous monitoring, while annual assessments (30 respondents) may indicate areas where more frequent evaluations are warranted.

5.5.4 ENVIRONMENTAL IMPACT MONITORING

Regarding environmental monitoring, the results show that 41.7% of respondents believe that the impact on water quality is Very Significant. This highlights the importance of rigorous monitoring and the need for effective measures to mitigate environmental risks. 83.3% of respondents reported regular testing for water quality, indicating a strong commitment to compliance and environmental stewardship.

5.5.5 EMPLOYEE HEALTH AND SAFETY TRAINING

The results indicate that 41.7% rated training quality as excellent, and 47.2% as good. This reflects a positive perception of the training programs in place, which are essential for ensuring employee safety and preparedness. However, the presence of respondents who rated training

as average or poor indicates the need for on-going assessment and enhancement of training programs.

5.5.6 Public Safety and Community Engagement

The engagement methods used by NOIC also show promising results, 50% of respondents indicated that public engagement occurs through meetings, which fosters community relations and transparency. However, the low percentage of community engagement through social media (16.1%) suggests a potential area for improvement in outreach and communication strategies.

Overall, the analysis of the risk management methods used by NOIC reveals a structured and proactive approach to managing risks in the oil and gas industry risks in the oil and gas. While the majority of respondents perceive these methods as effective, continual evaluation and enhancements are necessary to address areas of concern and ensure the on-going success of risk management practices. The findings underscore the importances of communication, training, and community engagement in fostering a safe and environmentally responsible operational framework.

5.6 EFFECTIVENESS OF RISK MANAGEMENT STRATEGIES

Respondents were asked to rate the effectiveness of implemented risk management strategies. The responses were as follows, 55 respondents voted very effective, 85 respondents voted effective, 32 respondents voted neutral, 7 respondents voted ineffective and 1 respondent voted very ineffective. A total of 140 respondents (77.8%) found the strategies either very effective or effective. This suggests a strong perception of the efficacy of the current risk management methods in protecting both employees and the surrounding communities. Only 4.4% found them ineffective, indicating a relatively small margin of dissatisfaction.

5.6.1 EMPLOYEE HEALTH AND SAFETY TRAINING

A combined 88.9% of respondents rated the training as good or excellent, which reflects a strong commitment to employee health and safety. Effective training is a key preventive method against injuries and illnesses at the workplace.

5.6.2 FREQUENCY OF RISK ASSESSMENTS

The results showed that 66.7% of respondents indicated that assessments occur monthly or quarterly, this supports the notion that risk is being proactively monitored. Frequent assessments are essential for identifying and addressing hazards before they result in injury or illness.

5.6.3 ENVIRONMENTAL IMPACT MONITORING – WATER QUALITY

The company has implemented strong environmental monitoring tools, such as routine testing and regulatory compliance. However, the perception that 75 respondents view the impact on water as very significant raises concerns about the sufficiency of existing pollution controls, which may indirectly affect community health.

5.6.4 PUBLIC SAFETY AND COMMUNITY ENGAGEMENT

There is considerable effort in keeping the community informed and involved, which is critical for ensuring transparency and building trust. This is indirectly linked to safeguarding public health by enabling prompt community reporting and participation in safety measures.

5.6.5 OVERALL PERCEPTION

The majority perceive the risk management strategies to have a positive impact, reinforcing that the methods used are generally effective in safeguarding health and environmental quality.

5.6. 6 .CONCLUSION

This chapter presented the analysis of the results collected using a questioner and relevant documents collected from NOIC and presented in chapter 4. The analysis of the risk management methods used by NOIC reveals a structured and proactive approach to managing risk in the oil and gas industry. While the majority of respondents perceive these methods as effective, continual evaluation and enhancements are necessary to address areas of concern and ensure the on-going success of risk management practices. The findings underscore the importance of communication, training, and community engagement in fostering a safe and environmentally responsible operational framework.

CHAPTER 6

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This chapter provides a summary of the current study by outlining the conclusions drawn from each of the mentioned particular objectives. The chapter also offers suggestions that various stakeholders should consider addressing issues found in the current study.

6.2 CONCLUSION

The results collectively support that risk management practices at NOIC have had a clear and largely positive impact on; environmental quality, specifically through water quality monitoring and pollution control. Employee health and safety evidenced by high-quality training and effective risk strategies.

The analysis of the results also strongly supports the conclusion that NOIC, Feruka Depot, and Mutare have established a comprehensive risk management framework. The presence of a formal policy as evidenced by the secondary data, multiple active strategies, regular assessments, and favorable employee feedback points to a well-structured system.

The results also showed a moderate to strong relationship between risk management methods and environmental quality, particularly in monitoring and mitigating water pollution. Awareness and implementation of risk assessments, mitigation plans, and compliance monitoring are relatively high, yet perceptions of environmental degradation remain significant, especially regarding water quality.

While some environmental concerns remain (e.g., significant water impact), the presence of mitigation measures and positive perceptions indicate that risk management is functioning effectively and should be strengthened further to consolidate these gains.

RECOMMENDATIONS

1. Enhance policy awareness across all staff- provide regular training to educate all the staff on risk management principles and best practices. Also promote risk awareness encouraging a culture of risk awareness, where employees feel empowered to identify and report potential risks.

2. Increase the frequency and thoroughness of emergency preparedness- conduct regular drills and exercises i.e. conduct drills at least twice a year. Also ensure that all the staff receives regular training on emergency procedures. Also regularly review and update emergency plans.
3. Standardize risk assessment practices, and strengthening community engagement- provide training and guidance to ensure that all staff understands the standardized framework and can apply it effectively. Also establish community outreach programs and conduct public education and awareness campaigns.
4. Introduce long-term health tracking for employees (e.g., exposure-related illnesses) - conduct regular health assessments i.e. perform regular health checks and medical evaluations to identify potential health issues. Also analyze health data to identify trends and potential health risks.
5. Address discrepancies between high compliance rates (72.2%) and significant environmental impacts (75%) by identifying gaps in compliance, also assessing the effectiveness of the existing controls and procedures. The company should enhance monitoring and reporting by implementing robust reporting systems. It is also crucial to strengthen procedures and training and fostering a culture of continuous improvement.

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APPENDIX.

QUESTIONNAIRE

TITLE: AN INVESTIGATION ON THE IMPACT OF RISK MANAGEMENT ON ENVIRONMENTAL QUALITY, HEALTH, AND THE SAFETY STATUS OF EMPLOYEES AND THE PUBLIC IN THE OIL AND GAS INDUSTRY: A CASE STUDY OF NATIONAL OIL INFRASTRUCTURE COMPANY, MUTARE.

My name is Mordkai D Mahlangu a part 4.2 student from Bindura Univesity of Science Education. I am currently studying towards attaining a degree of Bachelor of Enviroonmental Sciences Honours n Safety, Healthy and Environmental Management. I am carrrying out a study to assess the impact of risk management on environmental quality, health and the safety status of employees and public in the oil and gas industry. I am therefore requesting you to help by participating in this survey.The data collected will be used strictly for accademic purposes only and your identity will be kept confindenta.

Could you please tick where applicable?

Questioneer No.....

Date...../...../.....

Name (optional):

Gender:

☐ Male

☐ Female

☐ Other

Position/Title:

Years of Experience in the Industry:

Section 1: Risk Management Practices

Does your company have a formal risk management policy?

- ☐ Yes
- ☐ No
- ☐ Unsure

What risk management strategies are currently implemented at your company?

- ☐ Risk assessment
- ☐ Mitigation plans
- ☐ Training programs
- ☐ Emergency response plans
- ☐ Others (please specify): _____

How effective do you believe these strategies are?

- ☐ Very effective
- ☐ Effective
- ☐ Neutral
- ☐ Ineffective
- ☐ Very ineffective

How often are risk assessments conducted?

- Monthly

- Quarterly
- Annually
- Other (please specify)

What tools or methodologies do you use for risk management?

(e.g., ISO standards, HAZOP studies, etc.)

Section 2: Environmental Quality

To what extent does your company monitor environmental impacts?

- ☐ Regularly
- ☐ Occasionally
- ☐ Rarely
- ☐ Never

To what extent do you believe habitat disruption is addressed in your risk management strategies?

- Fully Addressed
- Partially Addressed
- Not Addressed

In your opinion, how significant is the impact of oil and gas operations on local water quality?

- ☐ Very Significant
- ☐ Significant
- ☐ Neutral
- ☐ Minor

- ☐ Not Significant

What measures are in place to monitor water pollution?

- ☐ Regular testing
- ☐ Compliance with regulations
- ☐ Community reporting
- ☐ Other (please specify)

Have there been any instances of habitat disruption due to company activities?

- ☐ Yes (please provide details)
- ☐ No

How is waste management handled in your operations?

- ☐ Recycling programs
- ☐ Safe disposal methods
- ☐ No specific measures

Section 3: Employee Health and Safety

How would you rate the health and safety training provided to employees?

- ☐ Excellent
- ☐ Good
- ☐ Average
- ☐ Poor
- ☐ Very poor

In your opinion, has risk management led to a decrease in workplace accidents?

- ☐ Yes, significantly
- ☐ Yes, somewhat
- ☐ No change
- ☐ Yes, increased accidents

How often are risk management methods reviewed and updated?

- Monthly
- Quarterly
- Annually
- Other (please specify)

Do you feel safe working in your current environment?

- ☐ Always
- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

How does the company support employee health and safety?

- ☐ Health programs
- ☐ Regular health check ups
- ☐ Mental health support
- ☐ Other (please specify)

Section 4: Public Safety and Perception

How does your company engage with the local community regarding safety concerns?

- ☐ Regular meetings
- ☐ Reports and publications
- ☐ Social media updates
- ☐ No engagement

What is the public perception of your company's safety practices?

- ☐ Very positive
- ☐ Positive
- ☐ Neutral
- ☐ Negative
- ☐ Very negative

Section 5: Overall Impact

Overall, how do you perceive the impact of risk management on environmental quality, health, and safety?

- ☐ Very positive
- ☐ Positive
- ☐ Neutral
- ☐ Negative
- ☐ Very negative

10. Please provide any additional comments or suggestions regarding risk management practices in your company:

Thank you for your participation!