ENABLING EXCELLENCE IN CONTRACTOR SAFETY MANAGEMENT: ELEMENTS TO GENERATE SUSTAINED CONTRACTOR SAFETY PERFORMANCE IN OIL & GAS

by

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Dedication

This dissertation is dedicated to the safety professionals in industry and academia who work tirelessly to protect lives. Your unwavering commitment, expertise, and relentless pursuit of excellence serve as the backbone of safer workplaces and communities.

To those who stand at the frontline of risk, ensuring that every worker returns home safely—your efforts do not go unnoticed. Your dedication inspires progress, transforms safety culture, and upholds the fundamental principle that no life should be lost in the name of industry.

This work is a tribute to your passion, resilience, and the vital role you play in shaping a safer future.

Acknowledgements

To my esteemed supervisor, Dr. Mario Silic — I am deeply grateful for your insightful feedback, valuable guidance, and unwavering support throughout this journey. Your encouragement, thoughtful advice, and steadfast belief in my work have been instrumental in helping me navigate challenges and grow both academically and personally. It has been a true privilege to learn under your mentorship.

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To my parents, whose hard work and sacrifices have always propelled me beyond limitations — thank you for being my foundation.

To my beloved wife Nadjet and my precious daughters, Sabreen, Dana, Dania, and Sama — your love, patience, and affection have been my source of strength and purpose.

To my brother Samir and to all my brothers and sisters — thank you for your constant encouragement and unconditional support.

From the bottom of my heart, thank you all!

ABSTRACT

ENABLING EXCELLENCE IN CONTRACTOR SAFETY MANAGEMENT: ELEMENTS TO GENERATE SUSTAINED CONTRACTOR SAFETY PERFORMANCE IN OIL & GAS

Aissam Bouadjel
2025

Dissertation Chair: Dr. Mario Silic

The Oil and Gas (O&G) industry relies heavily on contractors for specialized jobs, particularly high-risk activities such as Facilities Desing and Construction, Shutdowns and Turnarounds, Drilling and Well Servicing and many others. However, managing a diverse contractor workforce presents a lot of challenges that compromise safety, regulatory compliance, and operational efficiency which often results in a high fatality rate among contractors' workers.

This study aims to explore key drivers of excellence in Contractor Safety Management (CSM) and develop a systematic approach to improving CSM in the O&G industry. The research objectives included: (1) reviewing current industry practices in CSM, (2) assessing the effectiveness of existing CSM practices, and (3) designing a comprehensive model integrating key factors, best practices, regulatory requirements, and technological advancements.

A mixed-methods research design was employed, combining both qualitative (document analysis and structured interviews) and quantitative methods (questionnaire surveys), PLS modeling and descriptive analysis were used for data analysis.

The study revealed seven key elements for implementing and sustaining contractors' safety performance in the Oil and Gas industry: (1) Joint leadership Commitment & Accountability, (2) Pre-qualification, (3) On boarding, Training and Competency Assurance (4) Effective

Communication, (5) Effective Supervision, (6) Audits, Compliance Assurance, Performance Management, (7) Digitalization and Data Analytics, (8) Collaboration and Fair Treatment, (9) Risk based Management Approach, (10) Emergency Response and Incident Management.

This, the study has several contributions: first, the study contributes to bridge the gaps arising from limited empirical studies regarding CSM in O&G.

Second: The study contributes to the academic understanding of contractor safety management and its relationship with organizational performance and refines existing theories on safety culture and SMS by incorporating contractor-specific dynamics.

Third, this will help both O&G Companies as well as Service Providers with developing comprehensive CSM Systems that effectively manages risks, enhances safety performance, fosters a culture of continuous improvement and sustainability, and helps policymakers in crafting regulations that better address the complexities of CSM in O&G Industry.

KEY TO ABBREVIATIONS

ANSI	American National Standards Institute
API	America Petroleum Institute
AS/NZS	Australian/New Zealand Standards
BLS	Bureau of Labor Statistics
BSEE	Bureau of Safety and Environmental Enforcement
CANSO	Civil Air Navigation Services Organization
CCPS	Center for Chemical Process Safety
CDC	Centers for Disease Control and Prevention
CI	Continuous Improvement
CPS	Cyber-Physical Systems
CSM	Contractor Safety Management
CSMS	Contractor Safety Management System
EIA	Energy Information Administration
FGD	Focus Group Discussion
GDP	Gross Domestic Product
HIRA	Hazard Identification and Risk Assessment
HRO	High Reliability Organization
IEA	International Energy Agency
ILO	International Labor Organization
IMP	Integrated Management Program
INSAG	International Nuclear Safety Advisory Group
IOGP	International Association of Oil & Gas Producers
IoT	Internet of Things
ISO	International Organization for Standardization
KPI	Key Performance Indicator

LTIFR	Lost Time Injury Frequency Rate
MoC	Management of Change
O&G	Oil and Gas
OH&S	Occupational Health and Safety
OSHA	The Occupational Safety and Health Administration
PDCA	Plan-Do-Check-Act
PPE	Personal Protective Equipment
PSM	Process Safety Management
RBPS	Risk Based Process Safety
RII	Relative Importance Index
SC	Safety Culture
SMART	Specific, Measurable, Achievable, Relevant, Time-bound
SMS	Safety Management System
SOP	Standard Operating Procedure
SoW	Scope of Work
T&I	Turnaround and Inspection
TRIR	Total Recordable Incident Rate
UK HSC	Health and Safety Commission
UNCTAD	United Nations Conference on Trade and Development
VR	Virtual Reality
WEE	World Energy Employment

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CHAPTER I: INTRODUCTION

1.1 Introduction

The Oil and Gas (O&G) industry has been instrumental in shaping modern civilization, providing essential energy for industries, households, and transportation. Without it, many conveniences, such as electricity, mobility, and consumer goods, would not be as accessible or affordable (Matutinović, 2011). These resources fuel over half of the world's energy supply, driving economic growth, industrialization, and technological advancement (ENI World Energy Review, 2024) (Refer Figure 1.1). Their availability has enabled rapid urbanization, improved living standards, and the expansion of global economies (Armaroli and Balzani, V. 2011). The O&G sector alone contributes nearly 3% to global GDP, with crude oil trade valued at approximately $640 billion in 2020, making it one of the most traded commodities (ILO, 2022).

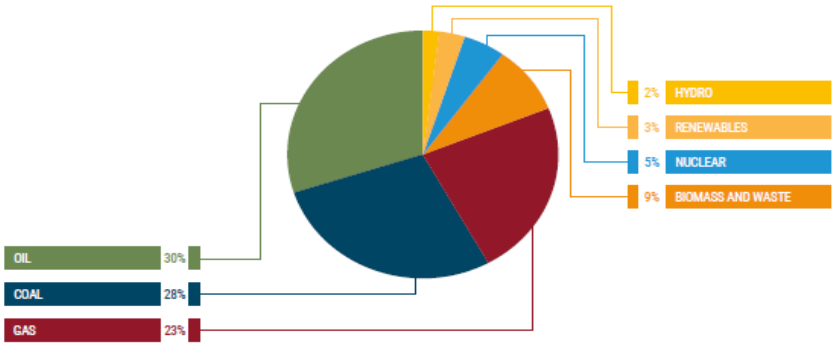

Figure 1.1: World Energy Consumption
Source: ENI. World Energy Review 2024

The industry operates through three key segments: upstream, midstream, and downstream Upstream involves exploration and production, including seismic activities, offshore and onshore drilling, production operations and reservoir management. Midstream focuses on transportation and processing, utilizing pipelines, storage facilities, and terminals to deliver crude oil and natural gas to refineries and markets. Downstream encompasses refining, distribution, and retail (Lima et al., 2016). A significant contribution of O&G is in transportation, where fuels like gasoline, diesel, and jet fuel power millions of vehicles, ships, and airplanes, facilitating global trade and connectivity (IEA, 2021). Efficient movement of goods and people accelerate economic growth, enabling industries to expand and societies to develop (Schwab and Zahidi, S., 2020). The aviation sector relies almost entirely on jet fuel, making large-scale international travel and commerce possible (Bhatt et al., 2022). Similarly, maritime transport, which moves over 80% of global trade by volume, depends on oil-based fuels to keep supply chains operational (UNCTAD, 2021).

However, beyond transportation, O&G serve as the feedstock for countless products. Petrochemicals derived from these resources are used in the production of plastics, synthetic fibers, fertilizers, pharmaceuticals, cosmetics, and electronics (EIA, 2021). These materials are integral to modern life, from clothing and medical equipment to construction and communication technologies. Fertilizers made from natural gas have significantly enhanced agricultural productivity, supporting food security for a growing global population (Liu et al., 2022).

The industry is also a major economic driver, supporting millions of jobs worldwide across exploration, refining, and distribution. In 2022, the global O&G industry directly employed around 32 million people, with millions more working in indirectly related fields such as construction, engineering, manufacturing, and services (WEE 2023). However, the O&G industry continues to

face significant challenges and criticism due to its substantial greenhouse gas emissions, which are a major contributor to global warming and climate change (Calderon et al., 2022). This situation has prompted many companies to invest in different technologies and carbon capture solutions, and alternative energy sources to reduce their environmental impact and support the global transition toward renewable energy (Calvin et al., 2023b).

Despite concerns over climate change and emissions, O&G remains vital to modern civilization. As the world shifts toward a more sustainable energy future, these resources continue to ensure energy security, economic stability, and technological progress. The challenge lies in balancing energy demands with environmental responsibility, driving innovation toward a cleaner and more efficient energy landscape (IEA, 2020). Although, there is a vital role of the (O&G) industry in modern civilization by providing energy and supporting global economic growth, it is considered one of the most hazardous sectors. This industry is inherently hazardous due to the flammable, toxic, and volatile properties of hydrocarbons (Wei et al., 2020). As a result, the O&G sector remains one of the most dangerous industries, with operations involving high-risk activities such as construction, maintenance, and infrastructure repair (Mahmood et al., 2023).

As compared to other industries, the O&G sector continues to report some of the highest rates of severe injuries. Between January 2015 and July 2022, 82,366 severe work-related injuries were recorded in the USA, of which 2,101 (2.6%) were attributed to the O&G industry. Notably, contract workers experienced a disproportionate share of these injuries, particularly in the service and drilling sub-industries (Parasram et al., 2024).

O&G operators heavily rely on contractors for specialized expertise (Awwad, 2016), particularly for high-risk tasks such as Turnarounds & Inspections (T&I), which often come with tight

deadlines. These conditions, coupled with the potential unfamiliarity of contractor personnel with facility operations and existing risks, create significant challenges for safely executing contracted services (Pilbeam et al., 2024; Yoon et al., 2024; Yiu et al., 2018). To mitigate these risks, O&G operators frequently implement Contractor Safety Management Systems (CSMS) designed to identify, assess, and control hazards, thereby ensuring a safer working environment (Ahmad et al., 2024). Unfortunately, despite ongoing safety improvements, contractor-related fatalities remain a critical concern. The Centers for Disease Control and Prevention (CDC) in the USA recorded 470 fatalities in the O&G sector between 2014 and 2019, with approximately three-fourths involving contractors (Wingate et al., 2023). Similarly, the International Association of Oil and Gas Producers (IOGP) reported 119 fatalities between 2019 and 2023, of which 80 were contractors (IOGP, 2023). These statistics underscore the persistent challenges in contractor safety management, highlighting the urgent need for enhanced safety strategies.

Thus, this study is of paramount importance as it seeks to address ongoing major concerns related to contractor safety management within the O&G industry regardless of continuous advancements in contractor safety management practices, the inherent risks associated with hydrocarbons, high-risk operational activities, and alarming injury and fatality rates emphasize the necessity for a comprehensive approach to contractor safety. By exploring and proposing an improved Contractor Safety Management Model, this study aims to identify and validate critical activities and variables essential for developing and implementing an effective, sustainable contractor safety system. Beyond enhancing safety standards, this research contributes to preserving the industry's reputation, ensuring operational efficiency, and protecting the well-being of all stakeholders.

1.2 Research Problem

A thorough examination of the literature reveals that a significant amount of theoretical research has been done regarding workplace contractor safety. According to Yiu et al. (2018), the adoption of the safety management system (SMS) is mostly driven by the obvious leadership commitment, both in terms of budget and staff allocation, and the safety manager's expertise. Specifically, lower accident rates and associated expenses, enhanced organizational structure, and higher safety audit scores were noted as the main advantages of putting the SMS into practice. Meanwhile, the main obstacles to the successful implementation of the SMS were things like a lack of resources, a strict work schedule, and a high incidence of employee turnover. Yiu et al. (2019) recommended that certain pertinent incentives be added to the SMS system to improve it. Given the financial budgetary restrictions as well as the legal and contractual obligations, institutional collaboration between customers, engineers, and contractors would also be crucial. Yiu et al. (2019) also suggested that, given the limitations, the best possible resource allocation might be determined for a long-term improvement in the operational and safety performance of the Oil & Gas (O&G) industry.

More crucially, the authority should encourage more thorough institutional assessments of safety management practices, project operations, and safety education and training protocols. It is recommended that stakeholders exhibit their dedication to safety from the outset of planning. Past studies also focus on compliance, prioritizing lagging indicators rather than fostering a proactive safety culture among contractors, which led to suboptimal safety outcomes and increased risks (Yiu et al., 2018, Yoon et al., 2024). Nevertheless, most studies rely on theoretical frameworks, lacking the empirical rigor needed to validate the findings. Furthermore, there is a dearth of empirical information estimating the efficacy of the contractor safety management systems in

place. The inability to measure the effectiveness of the current methods is the reason for the dearth of empirical data. Moreover, these previous studies on contractor safety management often lack integration among the key activities leading to inconsistent safety performance and increased risks for contracted workers. Finally, most of the studies represented the O&G operator position without considering the contractor's point of view and perspectives.

Thus, this study seeks to bridge these gaps in knowledge. In order to evaluate the impact of each independent variable (activities) on the dependent variable, the study collected qualitative and quantitative data (Refer Chapter 3).

1.3 Purpose of Research

The overall goal of the research is to enable excellence in Contractor Safety Management in Oil and Gas (O&G) industry which involve creating a framework and adopting practices that lead to superior safety outcomes and performance among contractors in O&G. This encompasses various strategies and principles aimed at achieving the highest standards in safety management.

The aim of this research is a thorough review of existing literature and industry practices related to contractor safety management in O&G to investigate and enhance safety management practices for contractors by identifying key factors affecting safety performance, evaluating the effectiveness of existing safety strategies, and developing innovative approaches to mitigate risks and improve safety outcomes.

1.4 Research Objectives

Particularly, the study has the following objectives:

Research Objective 1: *To review current industry practices and research regarding contractor safety management.*

Research Objective 2: *To assess the challenges achieving excellence in contractor safety management practices in O&G industry.*

Research objective 3: *To develop and test a model incorporating factors to enable excellence in contractor safety management systems.*

1.5 Significance of Study

Oil and Gas (O&G) operators rely extensively on contractors for specialized expertise (Awwad, 2016), particularly for high-risk tasks such as Turnarounds & Inspections (T&I), drilling & well servicing, and others. As a result, the operational success of the O&G industry depends significantly on effective contractor management, which is often conducted under tight deadlines. The combination of time constraints, the inherent hazards of these operations, and the potential unfamiliarity of contractor personnel with facility layouts, operating processes, and existing risks creates significant challenges for the safe execution of contracted services (Pilbeam, 2024; Yoon et al., 2024; Yiu et al., 2018).

However, managing such a diverse contractor workforce presents challenges, including inconsistent implementation of safety practices, inadequate safety training, unclear communication, lack of standardization, and resistance to change. In addition to these challenges, poor monitoring and measurement of contractor safety performance can affect safety, compliance, and overall operational efficiency. To address these issues, there is a critical need to develop a comprehensive understanding of the key factors that drive excellence in contractor safety management and how they can be systematically implemented to improve contractor safety performance in the O&G industry.

The history of the O&G industry is marked by catastrophic accidents that have resulted in loss of life, environmental devastation, and significant financial losses. Among the most infamous

incidents are the Deepwater Horizon explosion in 2010 and the Texas City Refinery disaster in 2005. The Deepwater Horizon incident, one of the worst offshore oil spills in history, resulted in 11 fatalities, 17 injuries, and severe environmental damage in the Gulf of Mexico. The explosion was caused by a blowout during drilling operations, exacerbated by failures in well control, poor risk assessment, and lapses in contractor safety management. Similarly, the Texas City Refinery disaster, which killed 15 people and injured 180 others, was attributed to inadequate safety procedures, insufficient hazard recognition, and failures in contractor management. In both cases, contractor personnel played critical roles in key operations, and deficiencies in communication, risk management, and safety oversight significantly contributed to the devastating consequences.

Given the industry's hazardous nature, creating a safer working environment is a top priority for all stakeholders, including operators, contractors, and regulatory bodies. A key approach to improving safety outcomes is fostering a positive safety climate, which emphasizes the integration of safety culture, technology, and operational best practices. A strong safety culture is essential for ensuring that all workers, including contractors, prioritize risk management and adhere to industry safety standards. The establishment of a robust safety framework supports sustainable development in the O&G industry by minimizing risks and enhancing worker protection (Masudin et al., 2024).

The result of this study will help both O&G companies as well as service providers in developing comprehensive Contractor Safety Management Systems that effectively manage risks, enhance safety performance, and foster a culture of continuous improvement and sustainability. This study holds significant importance since, despite continuous attempts to improve safety practices, contractor safety management remains one of the major challenges for the industry. The need to address contractor safety concerns urgently is highlighted by the toxicity and flammability of

hydrocarbons, the high-risk activities involved in O&G operations, and the alarming statistics. By exploring and proposing a new model for contractor safety management, this study aims to identify and validate key activities and variables crucial for developing and implementing an effective and sustainable Contractor Safety Management System (CSMS). This study is essential not just for raising safety standards but also for maintaining the O&G industry's standing and operational effectiveness, which benefits all parties concerned.

1.6 Research Purpose and Questions

Contractor safety management often encounters various challenges, such as inconsistent implementation of safety practices, lack of standardization, and resistance to change. These challenges can lead to higher accident rates, increased costs, and reduced productivity. There is a need for a comprehensive understanding of the factors that contribute to safety management excellence and how these can be systematically applied to enhance contractor safety performance. The purpose of this study is to explore and define the concept of "excellence" in contractor safety management. It seeks to develop a comprehensive framework for contractor safety management excellence based on empirical research and analysis. The following are the resereasch questions:

1. First Research Question: *How effective are the current safety management practices among contractors in mitigating safety risks and improving overall safety performance?*
2. Second Research Question: *What are the common challenges in achieving excellence in contractor safety management, and how can they be addressed?*
3. Third Research Question: *What are the key factors to enable excellence in contractor safety management systems?*

1.7 Proposed Structure of the Study

This research study is structured into the following chapters:

Chapter 1 – Introduction

The first chapter provided an introduction to the study, including the background of the research, a statement of the problem, and the objectives of the study. It also outlined the research questions, the significance of the study, and its scope and limitations.

Chapter 2 – Literature Review

The second chapter presented a comprehensive review of relevant literature on contractor safety management. It defined key concepts, examined current industry practices, identified existing gaps and challenges, and explored the critical factors influencing contractor safety performance.

Chapter 3 – Research Methodology

This chapter outlined the research design and methodology used in the study. It detailed the research approach, sampling techniques, data collection methods, and analysis techniques. Additionally, it discussed the ethical considerations undertaken to ensure the integrity and validity of the research.

Chapter 4 – Data Analysis

The fourth chapter presented the research findings based on primary data collection and analysis. These findings were examined in relation to existing literature and secondary data to provide a comprehensive understanding of Contractor Safety Management practices.

Chapter 5 – Discussion

This chapter presents a comprehensive discussion of the findings derived from both qualitative and quantitative analyses conducted in this study. The purpose is to interpret and contextualize the results in relation to the research objectives and existing literature on Contractor Safety Management in the Oil and Gas (O&G) industry.

Chapter 6 – Summary, Implications, and Recommendations:

This chapter concluded the study by summarizing the key findings, discussing their practical and theoretical implications, and providing actionable recommendations for enhancing Contractor Safety Management in the O&G industry. Additionally, this chapter identified potential areas for future research to further advance safety performance and management practices in high-risk industrial settings.

1.3 Conclusion

Achieving improved Contractor Safety Management Systems (CSMSs) is essential for managing the complex and ever-changing hazards associated with the Oil and Gas (O&G) sector. Contractor-related safety accidents continue to present significant issues despite extensive efforts to enhance safety procedures, highlighting the need for creative and empirically supported solutions. Through the provision of factual data and insights into the critical actions and variables that impact contractor safety performance, this research endeavour seeks to close the current knowledge gaps. The study provided a comprehensive understanding of the elements that go into excellent Contractor Safety Management. A comprehensive investigation of the connections between safety procedures and results was made possible by the integration of quantitative and qualitative analysis, guaranteeing that the conclusions are both accurate and useful. The ultimate goal of the study is to create a scalable and comprehensive CSMS model that the O&G sector may use. In addition to improving contractor safety performance, the suggested approach will also support the industry's general safety culture. The sector can significantly enhance safety results by encouraging the use of new technology and best practices, as well as by fostering collaboration between O&G operators and contractors.

CHAPTER II: REVIEW OF LITERATURE

2.1 Introduction

The primary objective of this literature review is to examine the existing body of research on contractor safety management within the Oil and Gas (O&G) industry. This review aims to identify the key elements, challenges, and gaps in the current contractor safety management practices and highlights the areas requiring further empirical investigation. The literature review reveals several gaps that need to be addressed. Firstly, there is a need for empirical studies that provide concrete data on the effectiveness of contractor safety management systems. Most existing studies rely heavily on theoretical models, which lack empirical validation. Secondly, developing integrated models that incorporate key safety activities and consider both operator and contractor perspectives is essential. Current research often fails to integrate these activities, leading to inconsistent safety performance and heightened risks. Finally, research focused on fostering a proactive safety culture rather than merely complying with safety regulations. The compliance-focused approach often leads to suboptimal safety outcomes and increased risks, highlighting the need for a cultural shift towards proactive safety management practices.

2.2 Literature Review Mind Map

This mind map organizes (Refer Figure 2.1) the literature review into basic sections. It begins with the objectives of the review, followed by an overview of Safety Management Systems (SMS) and Contractor Safety Management System (CSMS). The significance of CSMS is highlighted, emphasizing the benefits of accessing specialized expertise, supplementing in-house resources, and expanding staffing levels. The challenges in contractor safety management, such as compliance versus proactive culture, lack of empirical data, and integration issues, are outlined.

Key factors influencing contractor safety include leadership commitment, resource allocation, training and education, data sharing and collaboration, and organizational culture. The research gaps and future directions focus on the need for empirical studies, development of integrated models, fostering a proactive safety culture, exploring psychological factors, and studying leadership strategies.

Figure 2.1: Literature Mind Map
Source: Author's Compilation.

2.3 Workplace Safety

The Occupational Safety and Health Administration defines workplace safety as the practice of ensuring a work environment is free from hazards that could cause injuries, illnesses, or fatalities (U.S. Department of Labor, 1970). It involves identifying potential hazards, assessing risks, and

implementing effective measures to ensure that work activities can be performed without harm to people, assets, or the environment (OSHA, 2016). It is a discipline dealing with the prevention of work-related injuries, diseases, and deaths, as well as the protection and promotion of workers' health by eliminating occupational hazards and ensuring safe and healthy working conditions (ILO Convention No. 155, 2002).

Despite this important decision and the significant progress in Occupational Safety and Health (OSH), work-related accidents and diseases still occur too frequently, with devastating impacts on workers, enterprises and entire communities and economies (ILO, 2025).

According to the International Labor Organization, 2.93 million workers are fatally injured each year because of work-related factors, 395 million workers worldwide sustain a non-fatal work injury each year, 2.41 billion workers are exposed to excessive heat each year, and $361 billion of loss globally as result of work-related incidents (ILO, 2023). In the USA only The Bureau of Labor Statistics (BLS) recorded 5283 in 2023 fatal incidents which means that more than 14 workers died every day (U.S. BLS, 2024). This situation has made safety issues have become an integral part of any business and organization. Many theories explain workplace safety management and culture. Heinrich's 1932 Domino Effect Theory explained that accidents result from a chain of events initiated by unsafe acts or conditions (Maiti B., Ray B., 2012). Reason's (1997) Swiss Cheese Model emphasizes organizational factors, proposing that safety incidents occur when multiple layers of protection fail (Da Cunha et al., 2022). Safety at the workplace is a proactive risk-based approach not only safeguards workers but also enhances productivity, reduces costs associated with accidents, and fosters a culture of trust and responsibility (Sousa et al., 2015)

2.3.1 Safety Culture

The term Safety Culture (SC) was mentioned for the first time in the summary report on the post-accident review meeting issued by the International Nuclear Safety Advisory Group (INSAG-1, 1986) after the Chernobyl disaster in 1986, where the report emphasized the creation and maintenance of a nuclear safety culture is vital for ensuring the safety of nuclear plants. In 1991, in Safety Series No. 75-INGSAG-4, International Atomic Energy Agency (IAEA) described the safety culture as “The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance” (Tear M, Reader T., Shorrock S., Kirwan B., 2018; ISAG, 1992). Since then, the concept of SC has been embraced by various types of businesses and industries, particularly those considered high-risk. However, a lack of consensus on its definition among academic and industry professionals across different sectors has led to the emergence of multiple interpretations (Halligan, M., & Zecevic, A. 2011). The literature review highlights that Safety Culture is a multidimensional concept that cannot be created or transformed overnight. It evolves over time and is primarily driven by leadership commitment to promoting safe behaviors through the development of a structured Safety Management System (SMS) (Fernández B., Montes M., Vázquez C., 2007).

The U.K. Health and Safety Commission (HSC) defined the SC as the result of the shared values, attitudes, perceptions, competencies, and behavioral patterns of individuals and groups, which collectively shape an organization’s commitment to, and the effectiveness of, its approach to health and safety." (H.M.S.O., 1993).

Some of the best definitions of the Safety Culture "the way we do things around here", shapes the environment in which people determine what behaviors are acceptable. It has a strong influence on both human behavior and performance in the workplace (Hopkins, 2006).

Organizations with a strong SC are distinguished by open communication built on mutual trust, a shared understanding of the significance of safety, and confidence in the effectiveness of preventive measures (Naji et al., 2022). In many cases, a weak SC has been a contributing factor to major incidents and injuries. The overall culture of an organization can impact safety outcomes just as much as a formal safety management system (Bautista-Bernal et al., 2023). SC, as a subset of organizational culture, reflects not only employee attitudes toward safety but also deeper factors such as leadership style and management priorities. While companies often focus on employee compliance, the broader influence often lies in leadership behaviors, such as prioritizing production over safety or being overly reactive and short-term focused. Achieving a strong SC typically depends on effective leadership, active worker involvement, and open communication (Cooper, 1997). Although there is no universally agreed-upon definition of SC, it is generally understood as the enduring value, importance, and commitment to safety demonstrated by individuals and groups at all levels of an organization. It reflects the shared attitudes, norms, and behaviors that influence how safety is prioritized and practiced (CANSO, 2008).

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2.3.2 Safety Culture Maturity

Following the Chernobyl disaster investigation, considerable efforts have been dedicated to understanding SC and the factors that influence it. This has led to the development of a range of tools and models designed to help organizations assess their SC and determine their level of maturity (Ayob et al., 2022).

One of the earliest SC maturity models is the Bradley Curve, developed by Vernon Bradley in 1995. It illustrates the correlation between an organization's safety incident rate and its behavioral maturity, progressing through four key stages: Reactive, Dependent, Independent, and Interdependent (See Figure 2.2). The model serves as a foundation for employee surveys aimed at evaluating organizational behavior. The insights gained from these surveys enable leaders and managers to create targeted action plans to strengthen the company's overall SC. Thanks to its straightforward design, the Bradley Curve is widely applicable across organizations of all sizes and industries (Goncalves Filho et al., 2018).

The DSS+ Bradley Curve™ outlines four stages of SC maturity. In the Reactive stage, individuals do not take personal responsibility for safety and tend to believe that accidents are inevitable. As organizations progress to the Dependent stage, safety is viewed primarily as rule-following, and this leads to a noticeable reduction in accident rates. In the Independent stage, individuals begin to take personal responsibility for their actions and believe they can actively influence safety outcomes, resulting in further decreases in incidents. Finally, in the Interdependent stage, teams collectively embrace ownership of the SC, working together and supporting one another with the shared belief that achieving zero injuries is a realistic and attainable goal (Dss+ Bradley Curve, 2022).

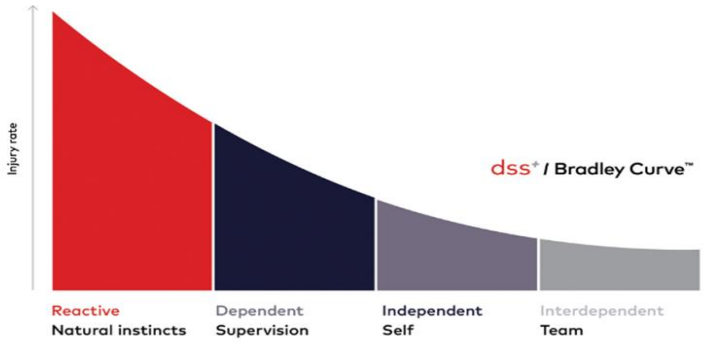

Figure 2.2: Dss+ Bradley Curve
Source: Dss+ Bradley Curve (2022).

In 2000, a different approach to assessing SC emerged with the development of the Hudson Safety Maturity Model. Unlike earlier models, the Hudson Model offered a more detailed analysis focused on the employee's experience within the SC or its absence. Although it gained recognition in select industries, particularly O&G, the model was not officially published until 2005. The framework outlines five stages of cultural maturity (See Figure 2.3 for definitions). Pathological, where safety is ignored or only considered after incidents; Reactive, where action is taken only after something goes wrong; Calculative, where systems and processes are in place but safety is primarily driven by compliance; Proactive, where there is a forward-thinking attitude toward identifying and managing risks; and Generative, where safety is fully integrated into the organization's values and practices, and everyone takes ownership of it. These stages delineate the level of commitment workers have toward safety and illustrate the degree of trust they place in their leaders and managers. When gaps are identified that prevent reaching the Generative stage, an action plan is developed to enhance the SC (Lawrie et al., 2005).

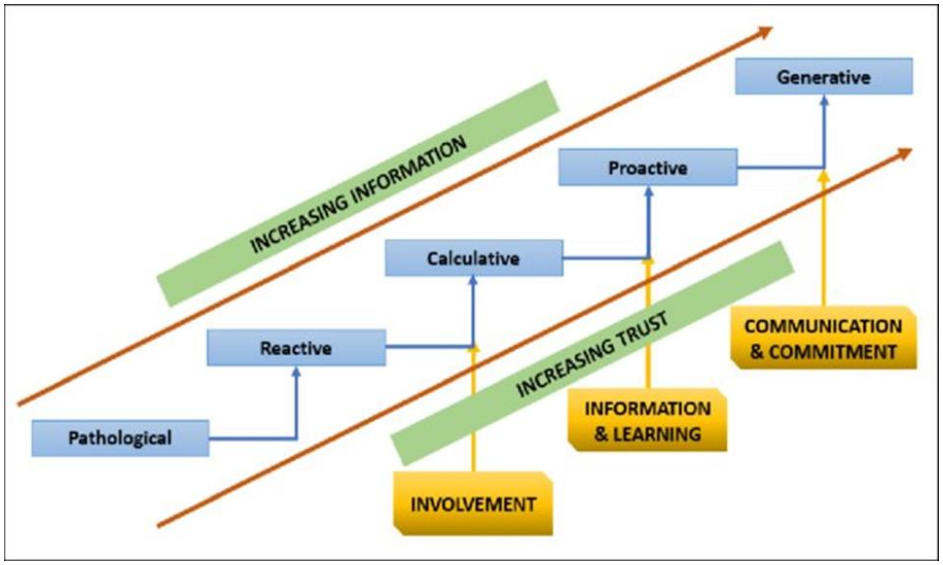

Figure 2.3: The Hudson Safety Culture Maturity Model
Source: Lawrie et al (2005b)

Around the same time, The Keil Centre developed a similar model, which was later adopted by the United Kingdom Health and Safety Executive (UK HSE). Personally, I prefer this maturity model as it is more detailed and prescriptive than the previous two. The UK HSE SC Maturity Model also consists of five stages (See Figure 2.4 for definitions): Emerging, where safety processes are in the early stages of development; Managing, where basic safety management systems are in place and functioning; Involving, where there is active involvement of employees in safety practices; Cooperating, where collaboration and communication across the organization foster a strong SC; and Continually Improving, where continuous improvement is embedded in the organization's safety practices and processes.

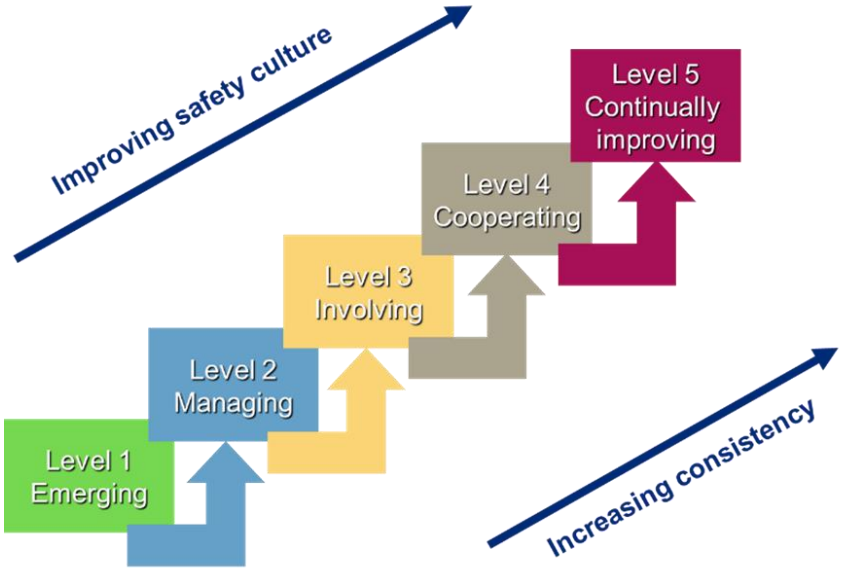

Figure 2.4: The UK HSE Safety Culture Maturity Model
Source: The Keil Centre for the Health and Safety Executive (2000)

Over the years, companies have adopted various methodologies to assess SC and determine their maturity level and evaluate their capabilities of managing safety risks and achieving a consistently high safety performance (Siuta et al., 2022b).

These assessments typically involve a structured and streamlined process that requires intensive preparation and the involvement of both internal and externally dedicated, competent resources. The process begins with defining the company's vision, mission, and strategic goals. From there, organizations must identify the assessment model that best fits their context, considering factors such as industry specifics, organizational structure, and operational maturity (Roberts et al., 2012). Data collection follows, involving both internal and external sources. Internally, this includes surveys, interviews, audits, field walkarounds, incident investigations, and analysis of safety Key

Performance Indicators (KPIs). Externally, it involves evaluating broader contextual factors such as economic, political, technological, environmental, and social dynamics that may influence the organization's safety culture (Stemn et al., 2018). Once data is collected, the next step is data analysis, basically identifying both the strengths the company can capitalize on and the gaps that require corrective action. Based on these insights, a clear and actionable improvement plan is developed. This plan should detail the resources required, define clear roles and responsibilities, and establish SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) objectives along with relevant KPIs to track progress. A well-executed plan not only addresses current gaps but also sets the foundation for sustainable, long-term improvement in safety culture across the organization (Siuta et al., 2022).

Such assessments reveal gaps that require leadership commitment, ranging from procedural improvements and resource allocation to targeted training and active management engagement. Clearly defined and prioritized actions are essential to drive cultural improvement. True commitment to safety culture goes beyond assessment. It demands the full implementation of action plans, supported by regular audits and reviews to ensure continuous improvement and closure of identified gaps. Ultimately, a company’s desired safety culture maturity level reflects its leadership strength and strategic vision (Pei et al., 2023).

2.3.3 Safety Culture and Safety Climate

The terms "safety culture" and "safety climate" are often used in the literature to describe an organization's safety policies and the attitudes of its employees toward safety issues. In some studies, these terms are used interchangeably (Petitta et al., 2016). Although researchers have proposed various definitions, there is no consensus on a single description. Some definitions are favored over others. Safety culture is most defined as the result of individuals' and groups' beliefs,

attitudes, competencies, and behavior patterns, which shape the commitment to and the style and effectiveness of an organization's safety and health management. On the other hand, safety climate is generally seen as a more superficial perspective, often considered a measurement of safety culture that reflects how employees perceive safety in their work environment (Arzahan et al., 2021).

2.3.4 Safety Excellence

Like many terms used in the field of safety, operational excellence has become a popular buzzword across various industries, often referenced when addressing improvements in production, safety, quality, and cost performance. Yet despite its widespread use, the term is often vague and inconsistently defined. At its core, the aim of operational excellence is to achieve exceptional and sustainable performance by engaging every member of the organization in consistently doing the right thing, the right way, every time. The key challenge lies in clearly defining what “the right thing” is and ensuring it is fully understood, embraced, and practiced at all levels of the organization (H. Liu et al., 2017).

Safety excellence must be described in operational terms and make sense to the audience whose behaviors you are trying to influence (H. Liu et al., 2015). Safety excellence is more than just repeating great results. It is also a profound insight into how the results were obtained, with a shared mindset throughout the culture that continuous improvement will always be possible. Once great results are achieved, what beliefs, knowledge, and behaviors would be common that explains the whys, and creates confidence that the results are more than luck or normal variation (Smith & Plunkett, 2018).

Excellence in safety is not only about compliance with regulations; it is about fostering a proactive culture where safety becomes an integral part of every operational decision. In high-risk industries such as O&G, construction, and manufacturing, achieving safety excellence requires a deep commitment from leadership, active employee engagement, and a relentless pursuit of continuous improvement. Leadership is the cornerstone of an effective safety program, requiring senior management to articulate a clear safety vision that prioritizes human life, environmental preservation, and operational integrity. Setting clear expectations, active engagement, investment in safety, and accountability are essential strategies leaders must implement. A strong safety culture is built through open communication, continuous training, employee empowerment, and integration of safety into daily operations. Safety excellence is an ongoing journey that relies on data-driven decision-making, implementing best practices, and establishing feedback loops to refine safety policies and procedures. Organizations that prioritize safety not only protect their employees but also enhance productivity, reputation, and overall business performance. By embedding safety into the core of their operations, companies can create an environment where safety is not just a requirement, it is a fundamental value (Halim & Mannan, 2018).

2.4 Risk Assessment & Management

2.4.1 Hazard

A hazard is commonly defined as something with the potential to cause harm, though its specific definition varies slightly across organizations and disciplines. According to ISO 45001(2018), a hazard is “a source with a potential to cause injury and ill health”. The International Labour Organization (ILO), in its Curriculum on Building Modern and Effective Labour Inspection Systems (2017), defined a hazard as “an agent, condition or activity with potential to cause harm that, if left uncontrolled, may adversely affect the well-being or health of those exposed to it.”

Similarly, OSHA (Occupational Safety and Health Administration) in the Job Hazard Analysis (JHA) Booklet (2002) described a hazard as “The potential for harm”. In practical terms, a hazard often is associated with “a condition or activity that, if left uncontrolled, can result in an injury or illness”. The Center for Chemical Process Safety and the American Institute of Chemical Engineers (2012) offer a broader view, defining a hazard as “an inherent chemical or physical characteristic that has the potential for causing damage to people, property, or the environment.” While the terminology utilized and scope differ, there was a consensus that a Hazard is an element with the potential to cause harm, making it the starting point in any risk management activity.

2.4.2 Risk

The definition of risk has been an important discussion topic within the risk community for a long time. These conversations and opinions have led to risk being defined and used differently depending on the discipline and the context (Aven, 2010). Traditionally, the term risk is generally linked to a negative consequence. This definition has been employed extensively in academic literature. Aven & Renn (2009) defined risk as the likelihood, high or low, of an undesirable occurrence that leads to a negative impact on organizations. Campbell (2005) explains risk is “expected harm”. To get to a more accurate definition of risk, Kaplan and Garrick (1981) suggested three fundamental questions: (1) What can happen or what can go wrong? (2) How likely is it that that will happen? (3) If it does happen, what are the consequences?

However, some risk practitioners opposed this concept and suggested that risk concerns both negative and positive outcomes. For example, Hillson (2002) defined risk as the uncertainty of outcome, whether positive opportunity or negative threat.

Although there is no agreement between all parties within the risk community on the definition of risk, most of the definitions encompass the concept of exposure to a potential danger that might

cause harm to organizations. Risk is also described as an uncertain condition, situation or event that could potentially have either a negative impact on organizations which is referred to as a threat, or a positive effect which is referred to as an opportunity (ISO, AS/NZS 4360:2004).

The first release of ISO 31000 for risk management in 2009 has changed the way risk is defined from ambiguous notions of risk to a focus on uncertainty about achieving objectives, or as stated in the ISO definition "a deviation from expected". It can be positive or negative. Uncertainty can come from both external and internal factors that businesses and organizations might fail to control effectively preventing them from achieving their health and safety, environmental and financial objectives.

ISO 31000 states that risk is characterized by two functions. The first function is the likelihood or probability of an event occurring, and the second function is the expected impact or consequences whether positive or negative, should it happen. The magnitude of risk can be determined by applying quantified probability to the effects either positive or negative. It can be mathematically expressed as follows:

Risk = (Likelihood of an event happening) x (Consequences if it happens).

This goal driven definition makes it suitable for all types of businesses and nonprofit organizations. Most of the definitions that came out after the release of the ISO 31000 somehow link the risk definition to the effect on objectives.

Regardless of the definition that a business or an organization adapts, they can run into unanticipated events, such as assets damage, cyber-attacks, personnel injuries and fatalities, market fluctuation and so on. These unexpected events can lead to significant loss and might lead to

bankruptcy. It is important for every organization to have a strong plan to manage all potential risks, and to avoid disastrous situations.

2.4.3 Risk Management

The definition given to risk management is not any different from what was discussed about risk. Practitioners, professional organizations, and international standards perceive and define risk management differently. Edwards and Bowen (1998) explained that risk management is "a systematic approach to dealing with risk", and that a risk management system should "establish an appropriate context; set goals and objectives; identify and analyze risks; influence risk decision making; and monitor and review risk responses". For Rasmussen, J (1997), risk management encompasses the culture, processes, and structures aimed at effectively managing both potential opportunities and adverse outcomes. J. U. M. Smith (1998b) estimates that the main purpose of risk management is the removal or the reduction of performance loss.

There is an agreement that risk management is a process, or a systematic approach used by businesses or organizations to identify, assess, evaluate, monitor, and control events that could harm organization or prevent them from attaining their business goals and objectives. These actions are meant to carefully examine the different scenarios and situations that can be a source of harm and take the necessary actions to eliminate or reduce the risk to an acceptable level.

ISO 31000 has defined risk management as "coordinated activities to direct and control an organization with regard to risk". This broader definition of risk management makes it a common methodology to handle any kind of risk within any type of industry or organization. The risk management needs to be made integral of the entire management model of the organization, not only to avoid risks and potential threats, but to provide decision-makers with the right information

to make the right decision based on deep understanding of potential risks and eventually develop the course of actions to mitigate them proactively and effectively. In addition, risk management should take advantage of present opportunities, that uncertainty presents to the organization's objectives**.** ISO 31000 (2018) outlines a structured process for managing risk that includes seven steps (Refer Figure 2.5).

1. **Establishing the context** – defining the scope considering internal and external contexts
2. **Risk Assessment –** identifying potential hazards, analyzing their likelihood and potential consequences, evaluating their significance against predefined criteria,
3. **Risk Treatment –** determining appropriate control measures to reduce or manage the associated risks
4. **Recording and Reporting –** documenting each hazard's likelihood, consequences, risk, and control measures, along with assigned responsibilities
5. **Communication and Consultation** – establishing a formal process to communicate the outcomes of all risk management activities
6. **Monitoring and Review** – tracking effectiveness and adapting continuous improvement strategies.

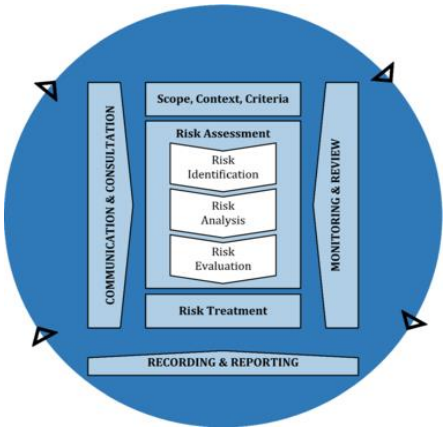

Figure 2.5: Risk Management Process
Source: ISO 31000 (2018)

2.5 Areas of Safety in Oil & Gas

The O&G industry has traditionally been considered a high-risk sector, where workers are exposed to different hazards related to the production, processing, transportation, and storage of petroleum products. O&G safety is generally categorized into two main areas: personal safety and process safety (Swuste et al., 2016).

Personal safety encompasses risks such as exposure to chemicals and noise, ergonomic challenges, and mechanical and electrical hazards, which can lead to worker injuries and fatalities (Mearns et al., 2003). In contrast, process safety focuses on major hazards within O&G installations, including large-scale spills, fires, and explosions. These incidents not only pose risks to personnel but can also cause significant property and environmental damage such fire, explosions and toxic gas release (Knegtering & Pasman, 2008; Swuste et al., 2016). The consequences of a process safety event are often more severe than those of a personal safety incident, as they can result in multiple injuries and fatalities (Knegtering & Pasman, 2008). To ensure the well-being of their workforce,

minimize operational risks, and comply with industry regulations**,** O&G companies rely on developing and implementing effective Safety Management Systems (SMS) (Hopkins, 2008).

2.6 Adoption of Safety Management Systems (SMS)

2.6.1 Safety Management System Overview

A Safety Management System is a structured approach to overseeing safety, encompassing the necessary organizational frameworks, responsibilities, policies, and procedures to manage safety at the workplace (Li & Guldenmund, 2017). The SMS is vital for organizations to ensure the safety of their workforce, protect their assets and minimize the impact of their operations on the environments and preserve their reputation, along the life cycle of their assets from planning to execution and continuous improvement (Wang et al., 2022).

In 2001, International Labor Organization published "Guidelines on occupational safety and health management systems ILO-OSH 2001" which encompassed a set of interconnected elements to develop OSH system including policies and organization capabilities development, planning and implementation, evaluation and actions for improvement. The adoption of a systematic approach to managing OSH where the risks are continuously assessed, and the mitigations and safeguards are always verified and confirmed for effectiveness.

The international standard ISO (45001, 2018) specified the requirements for an occupational health and safety (OH&S) management system. It establishes a framework for organizations to manage risks and enhance the performance of OH&S. The standard provides criteria for developing meaningful OH&S policies, objectives, planning, implementation, operations, and continuous improvement including auditing and performance review. The standard identified some Key elements include leadership commitment and accountability, active participation of personnel, effective hazard identification and risk assessment, compliance with the regulatory requirements,

proactive emergency planning, incident investigation and root cause identification lessons learned, in addition to continual improvement.

ISO 45001 adopts the Plan-Do-Check-Act approach to structurally manage health and safety risks related to organizations' operations. This standard can be utilized by all types and sizes of organizations and can be easily integrated with other ISO management system standards. To achieve an effective Safety Management, a comprehensive approach should be followed encompassing (1) the implementation of safety regulations, (2) leadership, (3) safety planning, (4) safety compliance, (5) performance measurement, (6) risk assessment, (7) safety inspection, and (8) safety culture. These factors are interconnected and cannot be addressed in isolation (Khalid et al., 2021). For industries that handle flammable, explosive and toxic substances such as O&G, Safety Management Systems should incorporate both personnel and process safety focusing on preventing and responding to catastrophic incidents caused by the release of chemicals or energy from the processes associated with facilities operations (CCPS, 2007).

2.6.2 Safety Management System (SMS) Development & Implementation Roadmap

Implementing an effective Safety Management System is a multi-step process that requires careful planning, resource allocation, and continuous monitoring (Refer Figure 2.6). This roadmap outlines the key steps involved in building and rolling out a robust SMS, designed to enhance safety, mitigate risks, and drive continuous improvement (Stolzer et al., 2018).

Step 1: Develop the Design Specification for the Safety Management System (SMS)

The foundation of a successful SMS begins with a well-defined design specification. This phase involves identifying the organization's safety goals, defining system boundaries, and establishing the core elements required for effective risk management. It is essential to conduct comprehensive risk assessments to understand potential hazards, define safety performance expectations and

metrics, and outline system requirements aligned with industry standards, such as API or OSHA PSM. Engaging key stakeholders is also critical to ensure the system design aligns with operational realities and gains buy-in from all levels of the organization (CCPS, 2016; Grote, 2011; Zhou et al., 2014).

Step 2: Estimate the Workloads and Resources

Once the system design is established, the next step is to estimate the resources required for implementation. This includes calculating manpower needs for development, training, and ongoing monitoring, as well as allocating budgets for tools, technology, and external consultations. Defining realistic timelines for each development phase ensures that expectations are managed, and progress remains measurable. Establishing a dedicated project team with clear roles and responsibilities is equally important, as this team will drive the implementation process and ensure all elements are properly executed (CCPS, 2016; Grote, 2011; Zhou et al., 2014).

Step 3: Create Element and System Workflows

Developing clear workflows is critical to ensure system elements function smoothly. This step involves designing detailed processes for key safety elements such as hazard identification and risk assessment, management of change (MoC), incident investigation, and emergency response planning. Each workflow should clearly define triggers, decision points, and escalation protocols to ensure safety processes are well-integrated into daily operations. By carefully mapping out these workflows, organizations can ensure a systematic, repeatable approach to safety management, reducing the likelihood of oversight or human error (CCPS, 2016; Grote, 2011; Zhou et al., 2014).

Step 4: Roll Out the Elements and System

With the design and workflows established, the next phase is system rollout. It is often helpful to begin by piloting key elements in select areas before expanding to full-scale deployment. Conducting training sessions to build employee competency and familiarizing staff with the new safety processes is crucial for successful adoption. Establishing clear communication channels helps reinforce safety culture, ensuring workers feel empowered to voice concerns or suggest improvements. A phased rollout approach allows teams to address initial challenges, refine processes, and gradually expand implementation across all operational units (CCPS, 2016; Grote, 2011; Zhou et al., 2014).

Step 5: Develop Written Programs/Procedures

Documenting safety practices is essential for consistency, compliance, and knowledge retention. During this stage, detailed written procedures are created for each safety element, ensuring that employees have clear, step-by-step guidance to follow. Standard Operating Procedures (SOPs), checklists, and safety manuals are developed, reviewed, and validated against industry regulations and standards. Maintaining accessible, up-to-date documentation ensures that safety practices are consistently applied, even as workforce composition or operational conditions change over time (CCPS, 2016; Grote, 2011; Zhou et al., 2014).

Step 6: Implement the System

Full-scale system implementation integrates safety processes into routine operations. This step involves embedding safety practices into day-to-day activities, conducting regular audits to ensure procedural adherence, and fostering a culture of safety ownership among employees. Encouraging active participation through safety committees, feedback loops, and incident reporting mechanisms further strengthens system effectiveness. Integrating the safety management system with other

business management systems, such as quality and environmental programs, helps streamline operations and reinforces safety as a core organizational value (CCPS, 2016; Grote, 2011; Zhou et al., 2014).

Step 7: Monitor the SMS System's Implementation, Initial Performance, and Progress

The final step in the roadmap focuses on ongoing monitoring and performance reviews to ensure continuous improvement. This involves tracking both leading and lagging safety indicators to measure performance, conducting periodic management reviews to assess system effectiveness, and investigating incidents or near-misses to identify areas for improvement. Regular reviews allow management to make data-driven decisions, refine system elements, and proactively address emerging risks. By maintaining this cycle of monitoring and improvement, organizations can sustain long-term safety excellence, adapt to evolving industry standards, and continuously raise the bar for process safety performance (CCPS, 2016; Grote, 2011; Zhou et al., 2014).

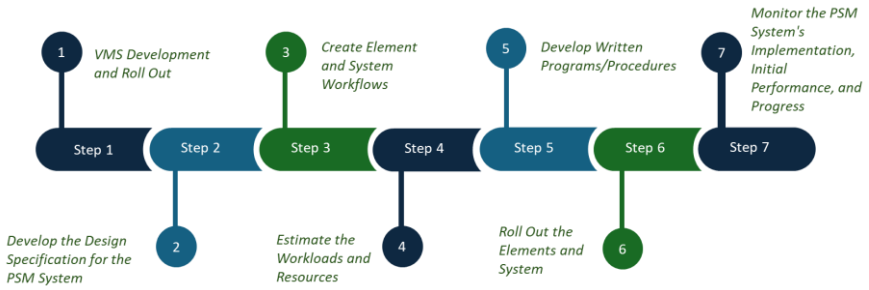

Figure 2.6.: SMS Development Road Map
Source: (CCPS, 20016)

While the SMS requires active involvement from all levels of the organization, its successful implementation fundamentally relies on a top-down approach. Senior leadership is crucial for

setting the strategic direction, allocating resources, enforcing policies, and fostering a safety culture. Their commitment and actions drive the effectiveness of the SMS and ensure that safety becomes an integral part of the organizational ethos. By leading from the top, management can create a robust framework that supports effective safety management throughout the organization (Yiu et al., 2018; ISO 45001, 2018).

Implementing SMS in the O&G industry presents several challenges, including complexity of operations, regulatory compliance, cultural barriers, resource constraints, operational issues, integration with existing systems, training, data management, stakeholder engagement, and continuous improvement. Contractor Management is a vital element of a Safety Management System (SMS) in O&G industry due to the high dependency on executing their operations activities. The IOGP life-Saving Rules, (2018) report showed that over 80% of the workforce are contractors, and around 80% of the fatalities, are contractor employees (See Figure 2.7 “IOGP Life-Saving Rules,” 2018). This has made the integration of CSM into the SMS an obligation not a choice for O&G organizations to ensure maintaining a safe working environment, minimizing risks, and achieving compliance with regulatory requirements.

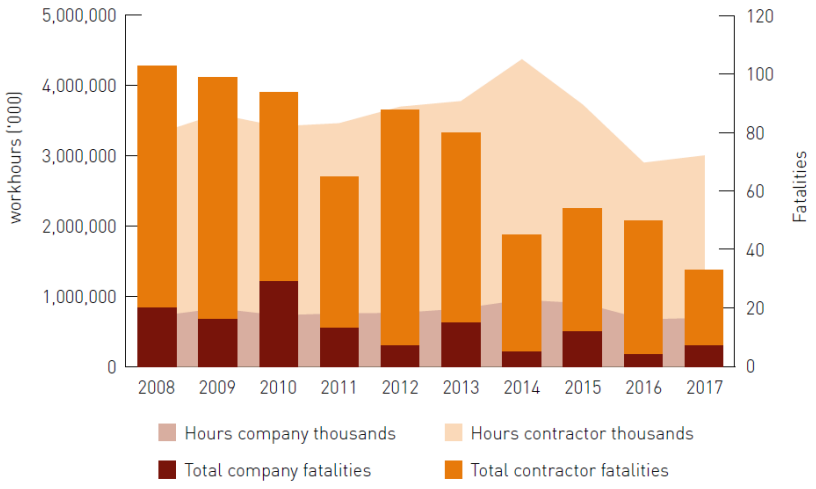

Figure 2.7: Company/Contractor Workhours & Fatalities
Source: IOGP Life-Saving Rules (2018)

2.7 Contractor Safety Management System

A Contractor Safety Management System (CSMS) is a systematic and coordinated approach that organizations use to ensure the safety of contractors working at their facilities or on their projects. It comprises a thorough set of policies, procedures, and practices aimed at identifying, evaluating, and managing potential risks linked to contractor activities. The main objective is to establish a safe working environment for both contractors and the organization's permanent employees.

International standards and best practices for high-risk process industries, such as OSHA's PSM framework (OSHA 29 CFR § 1910.119, 1992), the Center for Chemical Process Safety's (CCPS) Risk-Based Process Safety (RBPS), ANSI/API Recommended Practice 1173 for pipeline safety management systems (PSMS, 2015) framework for organizations that operate hazardous liquids and gas., and ISO 45001(2018) for an Occupational Health and Safety (OH&S) Management System, emphasize that contractor safety management should not be treated as an isolated element. Rather, it must be an integral part of a fully integrated SMS to be truly effective. These standards

highlight that in high-risk industries, where the consequences of process safety incidents can be catastrophic, contractor safety is a critical factor in ensuring overall safety performance.

OSHA's PSM, for example, stresses the importance of managing hazards associated with highly hazardous chemicals, involving both employees and contractors in safety processes. It underscores that contractor safety cannot be adequately addressed without incorporating it into the broader organizational safety culture and operational processes. Similarly, the CCPS's RBPS approach advocates for a comprehensive, system-wide strategy that ensures both employees and contractors adhere to safety protocols that minimize risk, proactively identify hazards, and control potential dangers before they escalate.

ANSI/API 1173, which provides guidelines for the management of pipeline safety, also calls for a systematic, risk-based approach to safety that includes the effective integration of contractors into SMSs. This involves not just monitoring contractor performance but also involving contractors in safety planning, risk assessments, and emergency response protocols to ensure alignment with the organization's safety goals.

ISO Standard 45001 provides a framework for organizations to create a safe and healthy work environment by identifying hazards, assessing risks, and implementing preventive measures. It specifically emphasizes the need for an integrated approach to safety management, where contractor safety is embedded in the overall safety system. ISO 45001 requires organizations to establish processes for communicating and engaging with contractors, ensuring that they are aligned with the company's health and safety objectives and are adequately supported to maintain a safe working environment.

In all these frameworks, the underlying principle is clear: contractor safety management should not operate in isolation. It should be embedded within an organization's broader safety

management system, ensuring that contractors are not only compliant with safety standards but are also actively engaged in the safety culture. This integrated approach is essential for managing risks, enhancing safety, improving operational reliability, and preventing accidents that could result in severe consequences for both personnel and the environment (CCPS, 2007).

2.7.1 Significance of Contractor Safety Management System

The O&G industry increasingly utilizes external resources by outsourcing a variety of services in different phase of their assets life cycle management such as design, construction, maintenance, inspection, testing, and other support activities (See Figure 2.8). This approach helps companies achieve several objectives:

1. Accessing specialized expertise that is not needed on a continuous or regular basis.
2. Supplementing limited in-house resources during peak periods of demand.
3. Expanding staffing levels without incurring the overhead costs associated with direct-hire employees (Walter, 2016).

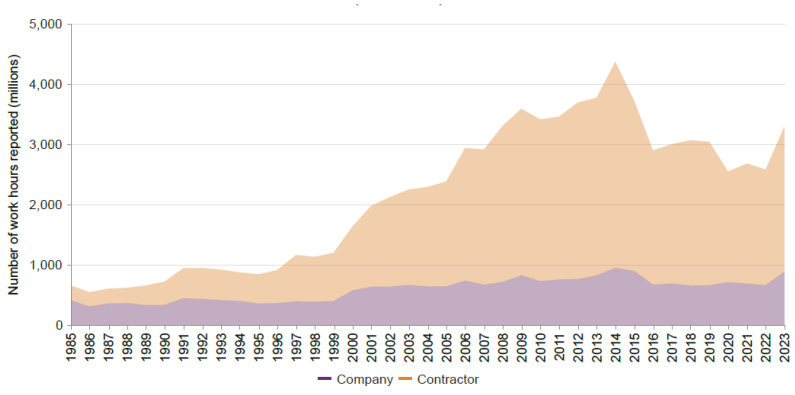

Figure 2.8: Company/Contractor Workhours
Source: IOGP Safety Performance Data (2023)

However, engaging contractors introduces external entities into the company's risk management framework. Contractors may be unfamiliar with the facility's specific hazards and protective measures, potentially exposing them to process-related dangers. Additionally, their activities can introduce new hazards, such as unique chemical exposures or radiation sources, and might inadvertently compromise existing safety controls (Iyer et al., 2019). Therefore, companies must address these new challenges by adapting contractor management strategies and introducing best practices to ensure that the risks related to introducing contractors' s into their operating model are thoroughly assessed and effective control measures are in place (Zhang et al., 2020). This includes having a thorough contractor selection process (Vardin et al., 2021), implementing tailored training and oversight that differ from those required for permanent employees. Effective collaboration between companies and contractors is essential to ensure a safe working environment that safeguards the workforce, community, and environment, while also protecting the company's interests and welfare (Ahmad et al., 2024). The Contractor Safety Management must be structured as a repeatable process to emphasize the principle of continuous improvement (See Figure. 2.9).

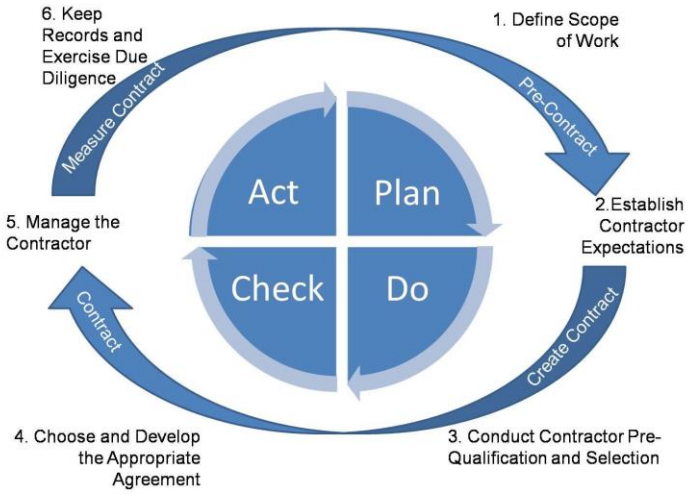

Figure 2.9: Contractor Safety Management Life Cycle
Source: Energy Safety Canada CSM Guide (2018)

The CSM should start well before any service contract is awarded. It is crucial to establish systems for evaluating potential contractors based not only on their technical skills but also on their safety programs and track record (Ameh et al., 2022).

Before starting work, contractor personnel must undergo orientation and training. Responsibilities for providing this training should be clearly defined, with some training typically conducted by the contractor's employer and some by the contracting company. Clear boundaries of authority and responsibility must be established for any contractor working at the facility. Ongoing monitoring of contractor safety performance and auditing of their management systems are essential. After each contract period, a review of the contractor's safety performance should guide decisions on whether to continue working with that contractor or consider others for future projects ensuring that lessons learned are effectively integrated into business processes, so they are retained and applied rather than lost (Ahmad et al., 2024).

Although most of regulatory bodies put the responsibility for both contract and permanent workers on the shoulders of the host plant (Hadidi & Khater, 2015), some responsibilities for implementing CMSs are assigned to the contractor’s staff. CSM is a shared responsibility between the contractor and the company. Both parties play crucial roles in ensuring a safe working environment and effective safety management. By working together, they can effectively manage risks, ensure compliance, and create a safe working environment for everyone involved (Greenwood & Wu, 2012).

An effective CSMS requires careful planning and execution. By developing clear policies, selecting and training contractors appropriately, implementing rigorous supervision, and fostering open communication, organizations can manage contractor safety effectively. Regular evaluations

and continuous improvement efforts are essential to maintaining high safety standards and ensuring that contractors contribute to a safe working environment. Enhancing management commitment and improving training programs are crucial for the effective implementation of CSMSs. These measures significantly contribute to safety, especially in high-risk industries like O&G (Ahmad et al., 2024). Furthermore, employee engagement plays a vital role in the effectiveness of CSMSs, as engaged employees are more likely to adhere to safety protocols and participate actively in safety training sessions, thereby reducing the likelihood of accidents and injuries (Quansah et al., 2023).

Effective stress management strategies should also be integrated into the CSMS to ensure a safer working environment. The outcomes from the Focus Group Discussion (FGD) reveal that enhancing management commitment, improving training programs, and strengthening partnerships with contractors can substantially enhance occupational safety in specific industries, particularly in the context of the high-risk O&G industry (Ahmad et al., 2024).

Additionally, safety climate plays a crucial role in improving safety outcomes. Research has shown that a positive safety climate, which reflects the shared perceptions of employees regarding safety policies, procedures, and practices, can lead to significant improvements in safety behavior and a reduction in workplace accidents (Omidi et al., 2020). For instance, safety training interventions have been shown to enhance the safety climate by increasing awareness and promoting safer work practices among employees (Omidi et al., 2020). This approach is especially relevant in the context in the O&G industry, where the safety climate can significantly impact the effectiveness of CSMSs (Ahmad et al., 2024).

2.7.2 Contractor Safety Management Practices

Yiu et al. (2019) advocate for the integration of targeted incentives within SMS framework to enhance its overall effectiveness. They emphasize that strong institutional collaboration among clients, engineers, and contractors is essential, particularly in navigating financial and legal constraints. The study highlights the importance of optimizing resource allocation to drive sustainable improvements in safety and operational performance. Additionally, regulatory authorities should promote comprehensive institutional evaluations of safety practices, project operations, and training protocols to ensure continuous enhancement.

A comparative study in Nigeria further reinforces these findings, demonstrating that the O&G industry benefits from structured supervision, consistent provision of personal protective equipment (PPE), and regular safety briefings. These practices align with the incentive-driven and collaborative safety strategies proposed by Yiu et al. (2019), underscoring their relevance across different operational contexts (Olaniran & Akinbile, 2023).

Studies predominantly represent the perspective of O&G operators, neglecting the contractors' viewpoints and experiences. This one-sided approach needs to provide a comprehensive understanding of the safety challenges faced by contractors. Effective collaboration between companies and contractors is essential to ensure a safe working environment that safeguards the workforce, community, and environment, while also protecting the company's interests and welfare. Incentives play a critical role in fostering this collaboration. For instance, psychological factors such as trust, risk perception, and personal incentives significantly influence technology adoption and collaboration within the O&G industry (Roberts et al., 2021). Understanding these factors is vital for organizations aiming to accelerate technology adoption and enhance safety management practices (Roberts et al., 2021).

Corporate decision-makers, often acting as gatekeepers, can facilitate or hinder technology and safety practices adoption based on their psychological inclinations towards innovation and risk (Roberts et al., 2021). Aligning personal and organizational incentives can motivate contractors to prioritize safety (Roberts et al., 2021). Additionally, fostering a culture of trust and open communication between contractors and the contracting company can significantly improve safety outcomes. Trust is identified as a key facilitating factor that can help overcome resistance to new safety technologies and practices (Roberts et al., 2021).

2.7.3 Significance of Study

This study holds significant importance since, despite continuous attempts to improve safety measures, safety problems within the O&G industry remain. The need to address contractor safety concerns urgently is highlighted by the toxicity and flammability of hydrocarbons, the high-risk activities involved in O&G operations, and the alarming statistics. By exploring and proposing a new model for CSM, this study aims to identify and validate key activities and variables crucial for developing and implementing an effective and sustainable CSMS. This study is essential not just for raising safety standards but also for maintaining the O&G industry's standing and operational effectiveness, which benefits all parties concerned (See Figure 2.10).

Figure 2.10: Significance of Study
Source: Author's compilation

2.7.4 Challenges and Key Factors Influencing Contractor Safety Management

2.7.4.1. Compliance and Proactive Safety Culture

Past studies often emphasize compliance with safety regulations, focusing on lagging indicators over proactive safety measures (Yiu et al., 2018). This compliance-focused approach can lead to suboptimal safety outcomes and increased risks (Yoon et al., 2024). To achieve better safety performance, it is crucial for both clients and contractors to foster a proactive safety culture. A positive safety climate, reflecting shared perceptions of safety policies, procedures, and practices, significantly enhance safety behavior and reduce workplace accidents (Omidi et al., 2020).

Organizational culture plays a pivotal role in shaping safety perceptions and behaviors within the O&G industry. A strong safety culture is essential for reducing incidents, enhancing workforce engagement, and ensuring sustainable operations. Studies indicate that employees' attitudes toward safety are directly influenced by leadership commitment, supervisory behaviors, and the overall organizational approach to safety management (Al Mazrouei et al., 2019; Guldenmund, 2018).

According to Iqbal et al. (2019), an effective SMS cannot function efficiently without an Integrated Management Program (IMP) combined with strong safety culture. The IMP should integrate all organizational business aspects including policies, processes and procedures, while safety culture measures views, beliefs, and traditions about safety. Compliance audits assessing both the IMP and safety culture maturity can help identify gaps and prioritize improvement plans. This integrated approach can significantly enhance the efficacy of SMS in the O&G industry by promoting a safety culture that is aligned with existing compliance requirements. Iqbal et al. (2019)

developed an integrated framework based on regulatory audits to assess safety culture maturity through the efficacy of the IMP using a risk-based approach. The framework focuses on three aspects: the probability of failure occurrence due to non-compliance, the severity of non-compliance, and the effectiveness of corrective actions. Sensitivity analysis revealed that four critical components of the IMP, organizational roles and responsibilities, policy and commitment, risk assessment, and training and competency significantly affect safety culture maturity (Iqbal et al., 2019).

Thus, an effective SMS requires proactive safety culture, which can be promoted through different ways including leading by example, regular safety meetings, provision of safety incentives, and effective emergency response plans and drills (Olaniran and Akinbile, 2023). Moreover, integrating smart technologies such as IoT and CPS can significantly improve operational safety and efficiency (Masudin et al., 2024). The O&G industry must adopt a comprehensive approach that includes both compliance and proactive safety measures to effectively manage contractor safety. This involves regular assessments, continuous improvement of safety policies, procedures and protocols, and fostering a safety culture that prioritizes proactive risk management over mere compliance (Alsehaimi et al., 2025b).

2.7.4.2 Lack of Empirical Data

A significant gap in the literature is the lack of empirical data to validate theoretical frameworks of CSM. Most studies rely heavily on theoretical models, which do not provide concrete evidence of the effectiveness of current safety practices. This lack of empirical rigor limits the ability to measure and improve the efficacy of existing CSMSs.

The comparative analysis in Nigeria also emphasises the necessity for empirical data to validate the effectiveness of health and safety practices. The study utilized a survey questionnaire and a

Relative Importance Index (RII) to analyse the data, providing a methodological framework that can be replicated in other studies to gather empirical evidence (Olaniran and Akinbile, 2023).

2.7.4.3 Leadership Commitment

Leadership commitment is crucial for the successful implementation of SMS. This includes not only financial investment but also the allocation of appropriate staffing and resources. The dedication of safety leaders and the overall organizational commitment to safety play a significant role in improving safety outcomes. Effective leadership, particularly transformational leadership, is paramount in enhancing contractor safety in the O&G industry. Transformational leadership, which involves intellectual stimulation, individualized consideration, inspirational motivation, and idealized influence, has been shown to significantly impact safety outcomes (Ismail et al., 2011). For instance, intellectual stimulation, where leaders encourage problem-solving and the consideration of diverse perspectives, can lead to more effective safety practices. Additionally, individualized consideration, which includes showing genuine concern for workers' well-being, and inspirational motivation, where leaders emphasize the importance of safety tasks, contribute to a positive safety culture (Grill et al., 2017). Research indicates that transformational leadership behaviors are positively associated with employees' perceptions of safety priority, commitment, and competence, thereby fostering a safer working environment (Grill et al., 2017). Conversely, passive/avoidant leadership behaviors, which involve delayed responses to safety issues and a lack of proactive engagement, are negatively associated with safety outcomes, highlighting the importance of active and engaged leadership in promoting contractor safety (Grill et al., 2017). Therefore, fostering transformational leadership behaviors among site managers can significantly enhance safety performance and mitigate risks in high-hazard industries like O&G (Grill et al., 2017).

2.7.4.4 Resource Allocation

Optimal resource allocation is critical for enhancing safety performance within CSMSs. Given budgetary and contractual constraints, organizations must strategically determine the most effective use of available resources to achieve sustainable improvements in both safety and operational performance (Bachar et al., 2024). A risk-based approach should guide resource allocation, prioritizing high-risk activities, critical safety controls, and areas with the greatest potential impact on reducing incidents. This approach ensures that investments in contractor safety such as training, supervision, and the provision of safe tools and equipment are directed toward mitigating the most significant hazards (CCPS, 2007).

2.7.4.5 Training and Education

Comprehensive safety education and training protocols are essential to ensuring that contractors possess the necessary knowledge and skills to perform high-risk tasks safely. Effective training programs not only enhance safety awareness but also improve hazard recognition, emergency response preparedness, and adherence to safety regulations. A well-structured training framework should include both initial and ongoing education to reinforce best practices and instill a strong safety culture among contractors (Demirkesen & Arditi, 2015).

Contractor safety training should be tailored to the specific risks associated with their tasks and work environment. This includes specialized instruction on hazard identification, safe work procedures, permit-to-work systems, confined space entry, and the proper use of personal protective equipment (PPE). Additionally, hands-on training, such as simulations and on-site drills, can enhance practical understanding and improve contractors' ability to respond to emergency situations effectively (Namian et al., 2016).

To maintain high safety standards, continuous training and periodic competency assessments are crucial. These assessments help identify gaps in knowledge and ensure that contractors remain up to date with evolving safety requirements and technological advancements (Alsehaimi et al., 2025). Moreover, integrating digital learning tools, such as Virtual Reality (VR) simulations and e-learning modules, can make training more engaging and accessible while reinforcing critical safety concepts. In addition, organizations should also foster a culture of knowledge-sharing by encouraging experienced contractors to mentor new workers and participate in safety workshops. By prioritizing continuous education and competency development, companies can significantly reduce the incidence of workplace accidents and strengthen overall contractor safety performance (Lin et al., 2023).

2.7.4.6 Data Sharing and Industry Collaboration

Recent discussions at industry conferences underscore the critical need for a stronger safety culture that fosters collaboration across the O&G sector. A key component of this effort is the establishment of an industry-wide data-sharing system, which enables operators, contractors, regulators, and other stakeholders to collectively analyze safety trends, identify systemic risks, and implement proactive mitigation strategies (Offshore Oil & Gas Industry Needs Industry Data Sharing System, Panel Says, 2016).

Representatives from the U.S. Coast Guard and the Bureau of Safety and Environmental Enforcement (BSEE) emphasized that achieving long-term safety improvements requires not only committed leadership but also active worker involvement at all levels. BSEE Director Brian Salerno advocates for moving beyond company-specific safety analyses toward a shared data model that benefits the entire industry. By collectively identifying key safety indicators and learning from past incidents, companies can enhance operational resilience, minimize risk

exposure, and drive continuous improvement in safety performance (Offshore Oil & Gas Industry Needs Industry Data Sharing System, Panel Says, 2016).

Although concerns about competitive advantage and intellectual property rights often hinder data-sharing initiatives, industry leaders recognize that the consequences of major incidents extend far beyond individual companies. A single catastrophic event can result in regulatory overhauls, financial liabilities, environmental damage, and a loss of public trust, affecting the entire sector. Therefore, fostering a collaborative approach to safety where companies view safety data as a shared resource rather than a proprietary asset is essential for reducing incidents and ensuring the sustainability of the industry (Ahamed et al., 2024).

In addition to data sharing, joint safety initiatives, cross-company training programs, and collaborative emergency response frameworks can further strengthen industry-wide safety resilience. By embracing a collective mindset, O&G players can move beyond compliance-driven approaches to a culture of continuous learning and innovation, positioning safety as a fundamental pillar of a sustainable and responsible energy (Adams & Mueller-Hirth, 2021).

2.8 Conceptual Model

The High Reliability Organization (HRO) theory explains how organizations operating in complex, high-risk environments such as the O&G sector maintain a consistent track record of preventing major incidents. It emphasizes key enablers such as leadership dedication, communication, safety culture, learning, risk management, and systematic performance oversight, all of which directly align with the hypotheses underpinning this study.

For the purpose of this study, the following constructs were employed (See Figure 2.11): contractor onboarding, communication, safety culture, leadership, Safety Management System (SMS),

collaboration and supervision, and performance management. Organizations in high-risk industries remain vigilant to minimize operational failures and prevent catastrophic events, closely adhering to the principles of continuous improvement, organizational learning, and a proactive safety culture.

Leadership commitment is a critical driver, enhancing an organization's capacity to detect early warning signs, respond effectively to incidents, and foster a resilient operational environment. Leaders ensure effective communication and comprehensive induction, thereby avoiding the oversimplification of complex threats. Ongoing communication, structured contractor onboarding, and robust contractor management ensure that only qualified, competent personnel are authorized to perform safety-critical tasks.

Moreover, the implementation of an integrated Safety Management System (SMS) provides the framework for risk identification, procedural compliance, and continuous monitoring. Collaboration and supervision between companies and contractors are essential to ensure mutual understanding of safety expectations and to reinforce accountability at all levels. Performance management systems, including safety metrics and audit feedback loops, support the evaluation and continuous enhancement of contractor safety performance.

The literature clearly highlights the impact of leadership commitment, safety culture, communication, onboarding, SMS implementation, collaboration, supervision, and performance management on Contractor Safety Management (CSM). These elements are inherently aligned with HRO principles, reinforcing that sustained operational reliability and safety excellence in high-risk sectors can only be achieved through a cohesive, system-wide approach. This alignment

provides a robust theoretical foundation for the study's proposed hypotheses.

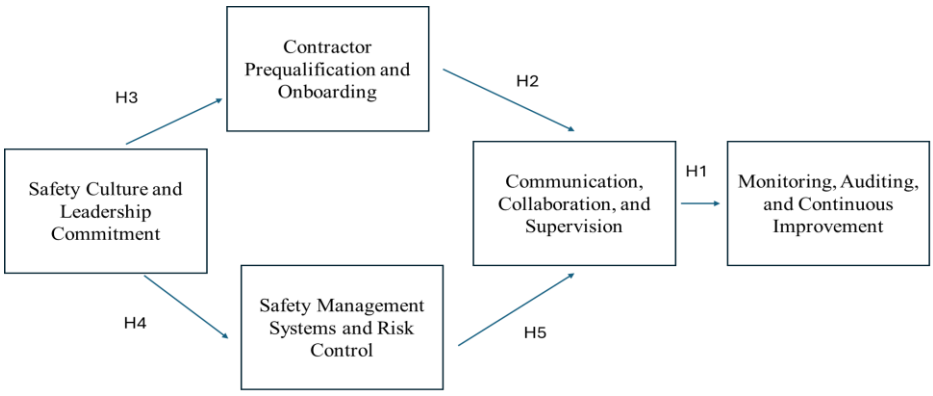

Figure 2.11: Research Conceptual Model
Source: Author's compilation

2.8.1 Effective Communication and Continuous Improvement

Communication plays a crucial role in driving Continuous Improvement (CI) by ensuring effective information flow across all levels of the organization, fostering collaboration, knowledge sharing, and problem-solving. It helps align everyone with CI goals, ensuring that employees understand the purpose behind changes and are more likely to engage and commit to improvement efforts. Communication also aids in identifying problems and implementing solutions by capturing and conveying relevant information in a timely manner, encouraging active participation from employees in finding and implementing improvements. Open communication promotes a culture of knowledge sharing, enabling employees to exchange insights, lessons learned, and best practices, which helps avoid repeating past mistakes and accelerates the adoption of successful strategies. Additionally, communication enhances employee engagement by ensuring individuals

understand how their contributions impact overall improvement goals, leading to greater motivation. However, ineffective communication can create barriers, such as confusion and resistance to change, which can hinder CI. Clear, transparent communication addresses these issues, ensuring smooth information flow and alignment across all stakeholders. In summary, effective communication is essential for CI, driving alignment, problem-solving, knowledge sharing, and employee engagement, all of which are vital for successful continuous improvement initiatives. Thus, we propose that:

H1: Effective Communication Significantly Impacts Continuous Improvement.

2.8.2 Contractor Onboarding and Communication

Contractor onboarding plays a critical role in enhancing communication effectiveness within an organization. By providing contractors with the necessary tools, information, and training during the onboarding process, organizations establish clear communication channels and set expectations for how communication should occur throughout the project. Effective onboarding ensures that contractors are well-informed about company policies, safety procedures, and operational processes, which reduces the likelihood of miscommunication and confusion during the project execution phase (Prajogo & Sohal, 2016). When contractors understand their roles and the company's standards for communication, they are more likely to engage actively and share important feedback, concerns, or ideas that can contribute to project success (Sánchez et al., 2017).

Additionally, a well-structured onboarding process promotes mutual understanding between internal teams and contractors, fostering a collaborative environment where communication flows more seamlessly (C. E. Smith et al., 2022). By aligning everyone with the same goals and expectations from the beginning, contractor onboarding directly impacts the effectiveness of communication, ensuring that all parties are on the same page regarding key objectives, deadlines,

and responsibilities. This leads to better decision-making, quicker problem resolution, and an overall smoother operation, enhancing both productivity and safety on the job site (Zwetsloot et al., 2017).

Employee onboarding is a crucial process that shapes an individual's ability to integrate and collaborate. Effective onboarding fosters knowledge transfer, socialization, and role clarity, all enhancing teamwork and collaboration (Bauer et al., 2007). This section explores the relationship between onboarding effectiveness and collaboration, drawing from empirical studies and theoretical frameworks. Onboarding plays a fundamental role in the socialization of new employees, enabling them to assimilate into the organizational culture and establish essential relationships (Byford et al., 2017). According to Bauer and Erdogan (2010), structured onboarding programs provide new hires with the knowledge, skills, and connections to collaborate effectively. When onboarding is well-designed, employees develop stronger bonds with colleagues, enhancing teamwork and communication (Saks & Gruman, 2018). Knowledge sharing is a key component of collaboration, and onboarding significantly influences an employee's ability and willingness to share knowledge (Kmieciak, 2020). Research suggests that effective onboarding programs introduce employees to the organization's formal and informal networks, helping them understand knowledge-sharing norms (Cooper-Thomas & Anderson, 2006). Furthermore, new hires who undergo structured onboarding are more likely to engage in collaborative problem-solving and knowledge exchange (Ellis et al., 2017). Psychological safety, the perception that one can express ideas without fear of negative consequences is essential for collaboration (Edmondson, 1999). Effective onboarding improves psychological safety by providing clear role expectations, mentoring, and early peer interactions (Fang et al., 2021). Studies indicate that when new employees feel supported and valued during onboarding, they are more likely to engage in open

discussions and contribute to team efforts (C. E. Smith et al., 2022). Several studies have demonstrated a direct link between onboarding effectiveness and collaboration. For example, a longitudinal study by Ellis et al. (2017) found that organizations with comprehensive onboarding programs reported higher levels of team cohesion and cooperative behavior among new employees. Similarly, research by Sluss et al. (2012) highlights that employees who undergo mentorship-based onboarding are more likely to develop collaborative relationships with colleagues. Thus, we propose that:

H2: Contractor Onboarding Significantly Impacts Communication Effectiveness.

2.8.3 Leadership Commitment and Contractor Pre-qualification

The effectiveness of leadership commitment plays a pivotal role in shaping the contractor prequalification process within an organization. Leadership commitment refers to the visible and sustained involvement of senior management in promoting safety, quality, and performance standards. When leadership is fully committed to setting clear expectations and providing the necessary resources for contractor prequalification, it significantly enhances the rigor and success of the process. Senior leaders, by actively supporting and reinforcing contractor prequalification criteria, ensure that only the most qualified contractors are selected, contributing to project success, safety, and compliance (Sánchez et al., 2017).

Effective leadership commitment fosters a culture of accountability and transparency, where contractors clearly understand the standards they must meet to be considered for projects. This includes meeting safety performance standards, demonstrating technical competency, and adhering to environmental regulations. A committed leadership team ensures that contractors are prequalified based on objective, well-communicated criteria, and that the process is fair, efficient,

and aligned with organizational goals (Prajogo & Sohal, 2016). Furthermore, leadership's ongoing engagement during the prequalification process provides guidance, resolves conflicts, and promotes collaboration, which is essential in maintaining strong relationships between contractors and the organization (Suprapto et al., 2015 & Memon et al., 2021).

Ultimately, the effectiveness of leadership commitment directly impacts the thoroughness and success of contractor prequalification, ensuring that only contractors who align with the organization's values and standards are chosen, thus reducing risks and improving project outcomes (Zwetsloot et al., 2017). Thus, we hypothesize that:

H3: Effectiveness of Leadership Commitment Significantly Impacts Contractor Prequalification.

2.8.4 Safety Culture and Safety Management System

Safety culture plays a crucial role in shaping the effectiveness of a SMS within an organization. A strong safety culture is characterized by shared values, attitudes, and practices that prioritize the health and safety of workers at all levels. When an organization fosters a positive safety culture, it significantly influences the implementation, effectiveness, and continuous improvement of its SMS. A well-established safety culture ensures that safety is integrated into every aspect of the organization’s operations, from leadership to frontline workers, promoting consistent adherence to safety protocols, risk assessments, and emergency response procedures (Prajogo & Sohal, 2016).

A robust safety culture encourages employees to actively participate in safety initiatives, report hazards, and follow safety protocols, which enhances the overall functionality of the SMS. As employees take ownership of safety, the SMS becomes more effective in preventing accidents, managing risks, and ensuring compliance with industry standards (Sánchez et al., 2017). Furthermore, safety culture provides the foundation for continuous improvement within the SMS,

as it encourages open communication, feedback, and learning from incidents to refine safety practices (Zwetsloot et al., 2017). Leadership's commitment to safety, which is a fundamental element of safety culture, is critical in ensuring that safety management processes are followed diligently, and that safety is prioritized across all levels of the organization (Suprapto et al., 2015 & Memon et al., 2021). Ultimately, a strong safety culture leads to a more robust SMS, which not only reduces the occurrence of incidents and injuries but also enhances the overall safety performance and regulatory compliance of the organization (García-Alcaraz et al., 2017).

Thus, we hypothesize that:

H4: Safety Culture Significantly Impacts Safety Management System.

2.8.5 Safety Management and Communication

An effective SMS significantly enhances communication within an organization by establishing clear, structured channels for sharing critical safety information. A well-implemented SMS ensures that safety protocols, policies, and procedures are communicated consistently and transparently across all levels of the organization, which helps in aligning employees with safety objectives and fosters a culture of safety. Clear communication of safety procedures is essential in reducing misunderstandings, improving hazard identification, and ensuring that everyone, from leadership to frontline workers, is aware of their responsibilities in maintaining a safe work environment (Prajogo & Sohal, 2016).

An effective SMS also facilitates timely reporting of incidents, near-misses, and safety hazards, which promotes proactive safety measures and continuous improvement. Through effective communication, organizations can ensure that safety concerns are quickly addressed, and

corrective actions are taken, thereby minimizing risks and preventing accidents (Sánchez et al., 2017). Moreover, an SMS with robust communication mechanisms encourages employee involvement in safety initiatives, allowing them to contribute feedback, raise concerns, and share suggestions for improvement, which leads to a more inclusive and effective safety culture (Zwetsloot et al., 2017). Leadership's role in reinforcing communication within the SMS is also crucial. When leaders prioritize open and transparent communication, it sets the tone for the entire organization, ensuring that safety remains a shared value, and everyone is engaged in the process. Ultimately, an effective SMS fosters a communication environment where safety information is not only disseminated clearly but is also acted upon, improving overall safety performance and reducing the likelihood of incidents (Suprapto et al., 2015 & Memon et al., 2021).

Thus, we hypothesize that:

H5: Effective Safety Management Systems Significantly Impacts Communication

2.9 Research Gaps and Future Directions

The literature review reveals several gaps that need to be addressed. Firstly, there is a need for empirical studies that provide concrete data on the effectiveness of CSMSs. Most existing studies rely heavily on theoretical models, which lack empirical validation. Secondly, developing integrated models that incorporate key safety activities and consider both operator and contractor perspectives is essential. Current research often lacked integrating these activities, leading to inconsistent safety performance and heightened risks. Finally, research should focus on fostering a proactive safety culture rather than merely complying with safety regulations. The compliance-focused approach often leads to suboptimal safety outcomes and increased risks, highlighting the need for a cultural shift towards proactive safety management practices.

Thirdly, research should focus on fostering a proactive safety culture rather than merely complying with safety regulations. The compliance-focused approach often leads to suboptimal safety outcomes and increased risks, highlighting the need for a cultural shift towards proactive safety management practices. Future research should also explore the specific elements of safety climate that most significantly impact human-technology interaction and sustainable development in the O&G industry (Masudin et al., 2024). This includes investigating the long-term impacts of integrating smart technologies like IoT and CPS on safety and sustainability outcomes.

Moreover, the role of psychological factors in shaping safety behaviors and perceptions among contractors needs further exploration. Understanding how trust, risk perception, and personal incentives influence safety practices can provide deeper insights into enhancing contractor safety management (Roberts et al., 2021). Additionally, future studies should examine the effectiveness of safety leadership and communication strategies in promoting a positive safety climate. Research indicates that transformational leadership behaviors, such as intellectual stimulation and individualized consideration, positively influence safety-related behaviors and perceptions of safety priority, commitment, and competence (Grill et al., 2017). Conversely, passive/avoidant leadership behaviors are associated with negative safety outcomes, underscoring the importance of active and engaged leadership in promoting a strong safety culture (Grill et al., 2017).

Comparative studies across different industries could provide valuable insights into best practices for safety management and sustainable development. By examining safety management approaches across various high-risk industries, researchers can identify successful strategies that can be adapted to the O&G sector. This comparative analysis can highlight innovative solutions and common challenges, fostering a broader understanding of effective safety management practices.

Additionally, more empirical studies are needed to validate the theoretical models proposed in the study, particularly in different geographical and operational contexts. Examining the effectiveness of various safety training programs in enhancing human-technology interaction and promoting a positive safety climate is also recommended (Masudin et al., 2024). Furthermore, the integration of advanced data analytics and machine learning techniques could provide predictive insights into safety risks and help in developing more robust SMSs.

Furthermore, the development of frameworks to assess the maturity of safety culture, integrating SMSs with integrity management programs, can offer a comprehensive approach to improving safety practices (Iqbal et al., 2019). These frameworks can facilitate the identification of key performance indicators and critical attributes of safety culture, aiding in the prioritization of improvement plans and resource allocation.

Addressing these gaps will contribute to improved safety outcomes in the O&G industry. It will also ensure that CSMSs are not only compliant with regulations but are also effective in preventing accidents and injuries, thereby enhancing the overall safety culture within the industry. Future research directions should focus on developing comprehensive, empirically validated models that integrate both technological advancements and human factors to create a safer and more sustainable O&G industry.

2.10 Discussion and Recommendations

This literature review underscores the importance of leadership commitment, resource allocation, comprehensive training, and industry-wide data sharing in enhancing contractor safety management. It highlights the need for empirical studies to validate theoretical models and the development of integrated SMSs that consider both operator and contractor perspectives. Addressing these gaps will contribute to improved Contractors' safety performance in the O&G

industry. The findings from Parasram et al. (2024) further emphasize that contract workers in the O&G industry are particularly vulnerable to severe injuries, reinforcing the need for proactive safety measures, including their inclusion in job hazard analyses, consistent safety training, and daily safety meetings to address evolving work hazards. Furthermore, a positive safety climate can enhance human-technology interaction, leading to better sustainable development outcomes (Masudin et al., 2024).

Integrating safety culture attributes with Integrity Management Programs (IMP) is crucial for achieving comprehensive safety assessments. (Iqbal et al. 2019) propose a framework that links IMP components with safety culture attributes using a risk-based approach, that is element based such as leadership and accountability, policies and standards, risk assessment, and training. This integrated approach can streamline regulatory audits and enhance the overall safety culture maturity in O&G operations. By leveraging this framework, organizations can prioritize improvement plans and ensure a more effective allocation of resources towards safety initiatives.

The proactive safety culture is another critical area that requires attention. Moving beyond mere compliance, fostering a proactive approach involves continuous engagement from leadership, robust safety training, and a culture that encourages the reporting and analysis of near misses and incidents. Research indicates that such a culture not only mitigates risks but also fosters innovation and resilience in safety practices (Iqbal et al., 2019). Therefore, future studies should explore strategies to embed proactive safety behaviors at all organizational levels.

Moreover, the lack of empirical data to support theoretical safety models remains a significant gap. Empirical studies that provide concrete evidence on the effectiveness of contractor safety management practices are essential for validating and refining these models. This empirical rigor

will help organizations identify the most effective strategies for improving safety outcomes and ensuring the well-being of both permanent employees and contractors.

The integration of advanced technologies like the Internet of Things (IoT) and Cyber-Physical Systems (CPS) offers promising avenues for enhancing safety and operational efficiency. These technologies can provide real-time monitoring and predictive analytics, which are vital for proactive risk management. Future research should investigate the long-term impacts of these technologies on safety and sustainability outcomes in the O&G industry.

Cross-industry comparative studies and benchmarking could also provide valuable insights into best practices for safety management. By examining safety management approaches across different high-risk industries, researchers can identify successful strategies that can be adapted to the O&G companies. This comparative analysis can highlight innovative solutions and common challenges, fostering a broader understanding of effective safety management practices.

Additionally, the role of leadership behaviors, particularly transformational leadership, in enhancing safety outcomes cannot be overlooked. Transformational leadership, characterized by intellectual stimulation and individualized consideration, has been shown to positively influence safety-related behaviors and perceptions of safety priority, commitment, and competence (Grill et al., 2017). On the other hand, passive/avoidant leadership behaviors are associated with negative safety outcomes, underscoring the importance of active and engaged leadership in promoting a strong safety culture (Grill et al., 2017). Future research should focus on how such leadership behaviors can be fostered and their impact on safety outcomes empirically validated.

Moreover, understanding the psychological factors influencing safety behaviors, such as trust and risk perception, can provide deeper insights into enhancing contractor safety management (Roberts et al., 2021). By integrating these factors into SMSs, organizations can develop more effective

strategies for improving safety performance. Addressing these gaps will contribute to improved safety outcomes in the O&G industry. It will also ensure that CSMSs are not only compliant with regulations but are also effective in preventing accidents and injuries, thereby enhancing the overall safety culture within the industry. Future research directions should focus on developing comprehensive, empirically validated models that integrate both technological advancements and human factors to create a safer and more sustainable O&G industry.

2.11 Conclusion

This literature review highlights the critical elements necessary for enhancing contractor safety management in the O&G sector. It underscores the importance of leadership commitment, comprehensive training, optimal resource allocation, and industry-wide data sharing in developing a robust CSMSs. The analysis reveals significant gaps, such as the need for empirical validation of theoretical models, the integration of contractor perspectives, and the fostering of a proactive safety culture.

Addressing these gaps requires a multifaceted approach that combines empirical research, technological advancements, and psychological insights to create a safer and more sustainable working environment. The integration of advanced technologies like the Internet of Things (IoT) and Cyber-Physical Systems (CPS) and predictive analysis offer promising avenues for real-time monitoring and proactive risk management. Moreover, fostering transformational leadership behaviours can significantly enhance safety outcomes by promoting a culture of safety and continuous improvement.

CHAPTER III: METHODOLOGY

The third chapter provides detailed information about the research methodology adopted. This chapter describes the research process, elaborates on sampling design and explains the process of surveys and interviews script design. Then the chapter explains the process of data collection followed by statistical tools used for analysis.

3.1 Overview of Research Methodology

The methodology that was utilized in this research included both primary and secondary research methods. The research methodology also combined quantitative and qualitative methods together to allow numerical measurement and in-depth exploration.

3.2 Data Collection

3.2.1 Primary data

The research study aimed at answering three research questions (Refer Table 3.1). For the purpose of data collection, I primarily relied on primary data collection through surveys and interviews. Primary research methodology is used to collect quantitative and qualitative data extracted from surveys and interviews. The quantitative component consisted of a survey of 27 questions administered to 142 O&G professionals to gather data on contractor safety practices and performance metrics in the O&G industry. The qualitative component consisted of interviewing 20 O&G professionals from clients and services providers to gain deeper insight into CSMSs challenges and industry's best practices.

Table 3.1. Research methodology

Research Question	Data Collection Technique	Methodology Explanation
First Research Question: • Interview Questions (Q1, Q2, Q3). • Survey questions.	Interviews + Survey	Semi-structured interviews were conducted with a purposive sample of 20 O&G professionals from both client and contractor organizations. Additionally, a survey consisting of 27 questions was administered to 142 participants from various geographical areas, disciplines, experience levels, and business segment.
Second Research Question: • Interview Questions (Q4, Q5, Q6). • Survey questions.		
Third Research Question: • Interview Questions (Q7, Q8). • Survey questions.		

3.2.2 Secondary Research

The secondary research methodology explored existing answers to research questions in different fields that have been done in the past and that are already available in academic databases, published books, journals, and articles, etc.

3.3.3 Ethical Considerations

Participants were informed about the study's purpose and their rights, including confidentiality and the option to withdraw at any time. Data was anonymized to protect participants' identities. This study was conducted between September 2024 and March 2025.

3.3 Operationalization of the Theoretical Constructs

The study utilized theoretical model for the purpose of answering the research questions. The items for the construct were extracted from standard academic literature (Refer Table 3.2) and measured on a Likert scale. Safety Culture and Leadership Commitment was measured using five items adapted from Grill et al. (2017). Contractor Prequalification and Onboarding was measured using

three items from Ameh et al. (2022), Safety Management Systems and Risk Control was measured using four items adapted from Iqbal et al. (2019). Monitoring, Auditing, and Continuous Improvement was measured using four items from Masudin et al. (2024). Communication, Collaboration, and Supervision were measured using four items from Suprapto et al. (2015) and Memon et al. (2021). Constraints and Resource Allocation was measured using three items from Pilbeam (2024). Enablers for Contractor Safety were measured using multiple choice questions from Al Mazrouei et al. (2019).

Table 3.2. Operationalization of Constructs

Constructs	Code	Items	Developed by
Safety Culture and Leadership Commitment	SC1	The safety culture at our organization promotes a strong focus on contractor safety.	Grill et al., 2017
	SC2	Leadership is committed to and accountable for Contractor Safety.	
	SC3	Leadership effectively communicates HSE expectations to contractors prior to start of contract work and during the work execution.	
	SC4	Contractors can easily report safety incidents or concerns without fear of repercussions.	
	SC5	Contractors are treated fairly and actively involved in the decision-making process related to safety.	
Contractor Prequalification and Onboarding	CPO1	Contractor's historical safety performance is considered as a go/no-go criterion in the contractor selection process.	Ameh et al., 2022
	CPO2	Contractors receive adequate safety training, and records are verified before starting SOW.	
	CPO3	The contractors' workforce is competent and adequately skilled to meet the SOW requirements.	

Safety Management Systems and Risk Control	SMS1	Contractor Management System is available and implemented effectively so that contracted work is completed safely.	Iqbal et al., 2019
	SMS2	The contractors' safety management plans effectively address known risks and hazards of assigned SoW	
	SMS3	Contractors' Safety Management practices are integrated with project planning and execution from the start.	
	SMS4	Contractors are actively involved in identifying and managing risks associated with their work.	
Monitoring, Auditing, and Continuous Improvement	MAC1	Contractor HSE performance is regularly evaluated and tracked and used to guide continuous improvement in safety management practices.	Masudin et al., 2024
	MAC2	Contractors are audited and compliance assured during the execution of the SOW.	
	MAC3	Effective processes and procedures are in place to monitor contractor compliance with HSE protocols.	
	MAC4	The organization uses technology and data analytics to monitor and improve contractor safety performance.	
Communication, Collaboration, and Supervision	COMM1	The SOW is clearly defined, with well-communicated expectations, milestones, and deliverables.	Suprapto et al., 2015 & Memon et al., 2021
	COMM2	Effective communication and collaboration processes are available to ensure successful HSE management.	
	COMM3	Contractors receive the necessary support and supervision to improve safety practices from internal teams.	
	COMM4	Contractors are adequately supervised during the execution of the SOW.	
Constraints and Resource Allocation	CONS1	Cost considerations take precedence over safety performance when managing contractors.	Pilbeam, 2024
	CONS2	Time and budget constraints often hinder the implementation of necessary safety measures.	

	CONS3	Adequate time and resources are allocated to ensure contractor HSE measures are implemented effectively.	
Enablers for Contractor Safety	From your perspective, which of the following factors are most important in enabling contractor safety? (Check all that apply)	Joint Leadership Commitment.	Al Mazrouei et al., 2019
		Accountability.	
		Pre-qualification.	
		Training and competency assurance.	
		Effective Supervision.	
		Collaboration air treatment.	
		Effective Communication.	
		Performance Management.	
		Digitalization.	
		Data analytics are effectively used to improve contractor safety.	
		Contractor Audits and Compliance Assurance.	
		Incentivizing.	
		Other (Please specify).	

3.4 Research Purpose

The purpose of this study is to explore, define, and establish a comprehensive framework for achieving excellence in CSM. The research aims to go beyond compliance with regulatory standards and industry best practices by identifying the critical attributes, enablers, and challenges that influence safety performance among contractors. Through empirical research and systematic analysis, this study will provide actionable insights to enhance CSM strategies, improve risk mitigation efforts, and promote a culture of continuous improvement.

To achieve these objectives, the study addressed the following key research questions:

1.First Research Question: How effective are current safety management practices among contractors in mitigating safety risks and improving overall safety performance?

2.Second Research Question: What are the common challenges in achieving excellence in Contractor Safety Management, and how can they be addressed?

3.Third Research Question: What are the key factors to enable excellence in Contractor Safety Management Systems?

By answering these questions, this study aims to bridge existing gaps in CSM and provide practical recommendations for organizations seeking to elevate their safety performance and foster a proactive safety culture.

3.5 Research Design

The study is a descriptive research based on interview and survey technique.

3.5.1 Population and Sample

3.5.1.1 Qualitative: The qualitative methology included 20 professionals from different dsciplines and diferent roles from about 16 companies operating in different geographical areas, covering all the segments of the business (upsteam, midstam and downstream) including major O&G procuders such Saudi Aramco, Shell, Chevron, Cenovus Energy, Suncor Energy, ENOC, ADNOC, BAPCO Pembina Pipeline Corporation, Royal Vopack and others .

3.5.1.2 Quantitative : Questionnaire was shared to contacts working in O&G Sector arround the world.

3.5.2 Participant Selection

For the survey technique we used Email, Linkedin (Shukla et al., 2022) for sharing questionnaire to people of concern thus using Stratified random sampling. Linkedin connects were scrutinised to identify prospective respondents at various designation and managerial levels. Then selectively the questionanires were shared after taking permission from them. For the interviews, we got in touch with 20 professinals involved in CSM life cycle from 16 companies Then

interviews were conducted at a predefined time. Few of them were face to face while the majority were conducted online using online using Microsoft Teams (Refer Table 3.3).

Table 3.3. Interview Participants Details

	Name	Company	Country	Designation
1	Interviewee #1	Husky Energy	Canada	Drilling and Well Completion Director
2	Interviewee #2	Cenuvus Energy	Canada	Training Manager
3	Interviewee #3	Saudi Aramco	Saudi Arabia	Loss Prevention Consultant
4	Interviewee #4	ADNOC	UAE	Wells Production Consultant
5	Interviewee #5	John Crane	UK	General Manager
6	Interviewee #6	Safety Erudite Inc	USA	CEO
7	Interviewee #7	VOPAK Royal	Vietnam	Project Manager
8	Interviewee #8	VTTI	Netherland	Managing Director
9	Interviewee #9	MUC Engineering	UAE	Engineering Manager
10	Interviewee #10	Husky Energy	Canada	Wells Project Manager
11	Interviewee #11	Shell Petroleum	Brunei	Wells Completion Manager
12	Interviewee #12	Saudi Aramco	Saudi Arabia	Porcess Safety Consultant
13	Interviewee #13	Dragon Oil/ENOC	UAE	HSE Manager
14	Interviewee #14	SouthBow	Canada	Senior Project Mnager
15	Interviewee #15	Project Manager	Canada	National Research Council Canada
16	Interviewee #16	VTTI	Netherland	HSE Manager
17	Interviewee #17	Saudi Aramco	Saudi Arabia	T&I Consultant
18	Interviewee #18	MUC Engineering	UAE	HS Manager
	Interviewee #19	BAPCO	Bahrain	HSE director
20	Interviewee #20	Petrobakr Petroleum	Egypt	QHSE General Manager

3.6 Data Analysis

The data was analysed as per the purpose of the study. The qualitative aspect of the study was assessed using interviews and was analysed using thematic analysis. The quantitative aspect of the study was analysed using survey and evaluated using PLS SEM on SMARTPLS 4.0 software. For descriptive analysis we have used Excel (Refer Table 3.4).

Table 3.4. Data Analysis Technique.

Research Question	Data Collection Methodology	Analysis
First Research Question	Interviews + Survey	Qualitative – Thematic Analysis. Quantitative – PLS SEM SMART PLS 4.0.
Second Research Question		
Third Research Question		

3.7 Research Design Limitations

There are a few limitation factors in this study. It is very difficult to guarantee that the participants' responses are honest and open, ensuring the confidentiality and the anonymity of the responses is crucial as it gives the participants the assurance needed to provide honest feedback knowing that they will not suffer any adverse consequences. Still, complete anonymity does not ensure responders' honesty, data accuracy and reliability (Heffetz & Reeves, 2018). Another limiting factor for this study is the difficulty to obtain clear data due to different interpretations responders may have with the multiple choice options. An option may represent different things to different participants. In addition, sample representation is also a limiting factor. Of the estimated 11.9 million direcly employed in the O&G sector worldwide (IEA, 2022), less than 1% participated in the survey. This size sample may not be representative. Furthermore, participants might not

have a good understanding of the topic or might not dedicate enough time to carefully read and answer the questions**.**

3.8 Conclusion

This chapter summarised the method of data collection, analysis and sampling. The study used a mixed method approach: qualitative and quantitative. Qualitative study was conducted using answers generated form interviewing 20 participants from 16 Operators in O&G such as Saudi Aramco, Shell, Chevron, Cenovus Energy, Suncor Energy, ENOC, ADNOC, BAPCO Pembina Pipeline Corporation, Royal Vopac. Quantitative study was done using survey of 142 professionals online using Linkedin and personal invites.

CHAPTER IV: RESULTS

The fourth chapter explains the methodology used for data analysis and the results of study. Firstly, the demographic analysis of the respondents is done followed by analysis of their responses related to the factors influencing CSMSs. Afterwards, the model assessment was done to evaluate the hypotheses. The data analysis was done using various statistical tools like mean, standard deviation, regression, SMARTPLS and bootstrapping.

4.1 Qualitative Analysis

The study aimed at addressing challenges and issues in CSM practices in O&G sector. Three research questions were framed to bridge the existing gaps. For the purpose of qualitative data collection, interviews were conducted analyzed using thematic analysis.

4.1.1 Research Question One

The first research question measured the specific safety management practices implemented for contractors using three questions (Refer Table 4.1).

Table 4.1. Measurement of Research Questions

Research Question	Corresponding Interview Questions
RQ1: What specific safety management practices do you currently implement for contractors?	Q1. What specific safety management practices do you currently implement for contractors?
	Q2. How do you ensure that contractors comply with safety regulations and standards?
	Q3. What key performance indicators do you use to assess contractor safety performance?

Research Question 1 addressed what specific safety practices operators in Oil and Gas currently implement for managing contractors. For this research question, 20 participants were interviewed, and their responses were recorded. The Level 1 and 2 codes are reflected in Table 4.2.

Table 4.2. Coding for RQ1

Q1. What specific safety management practices do you currently implement for contractors?	
Level 2 coding	Level 1 coding
Contractor Selection & Pre-Qualification	• Pre-qualification of contractors. • Prepare Contractor Safety Management Plans (SMPs). • Ensure compliance with industry regulations. • Ensure effective subcontractor safety oversight.
Safety Training & Awareness	• Conduct safety inductions and orientation, consistent toolbox talks. • Assign contractor safety champions. • Implement health and wellness programs.
Risk Management & Hazard Control	• Conduct thorough risk assessments for all contracted work. • Follow a risk-based approach in managing contractor safety. • Implement a robust permit-to-work systems that ensures effective hazard communication, specific safety protocols and behavior-based safety observations.
Safety Performance Monitoring & Accountability	• Conduct regular safety audits. • Perform incident reporting and investigation. • Adopt contractor safety performance tracking, including third-party safety audits and safety incentive programs.
Emergency Preparedness & Response	• Develop Emergency plans based on credible scenarios, conduct emergency response drills, enforce incident reporting and investigation.
Q2. How do you ensure that contractors comply with safety regulations and standards?	
Leadership	• Demonstrate personal commitment to safety by consistently emphasizing its importance.

	• Foster a strong safety culture by integrating contractors into the company's safety programs. • Engage contractors as partners in safety, promoting collaboration and shared accountability. • Lead by moral responsibility, emphasizing that safety is non-negotiable.
Pre-Qualification	• Screen contractors based on their past safety performance, certifications, and alignment with company standards. • Include specific safety requirements, KPIs, and penalties in contracts. • Conduct risk assessments for contractor activities and ensure controls are in place before work begins. • Define clear roles and responsibilities for contractor safety compliance.
Training and Communication	• Ensure contractors receive comprehensive induction training tailored to site-specific hazards. • Hold regular toolbox talks, safety briefings, and joint safety committee meetings. • Involve contractors in emergency response drills and site-specific procedures. • Organize safety workshops to review challenges, share best practices, and drive improvements.
Monitoring and Evaluation	• Assign safety supervisors to monitor contractor activities and conduct regular inspections. • Evaluate contractor safety performance through audits, incident reports, and inspections. • Use technology like contractor management software and real-time monitoring systems.

	• Investigate contractor-related incidents thoroughly and implement lessons learned.
Motivation and Compliance	• Implement reward systems for contractors demonstrating exemplary safety compliance. • Ensure contractors stay up to date with relevant local, national, and international safety regulations. • Promote Behavior-Based Safety (BBS) initiatives to address unsafe actions and reinforce positive behaviors. • Emphasize continuous improvement by identifying gaps and driving long-term safety enhancements.
Q3. What key performance indicators do you use to assess contractor safety performance?	
Leadership and Accountability	• Leadership demonstrates safety-first behaviors and sets clear expectations for contractors. • Contractors are held to the same high safety standards as employees. • Accountability is reinforced through transparent processes and consequences for non-compliance. • Leaders empower contractors to develop safety leadership within their teams. • Regular monitoring and evaluation ensure alignment with safety goals
Collaboration and Inclusivity	• Contractors are treated as partners in achieving safety excellence. They are integrated into safety planning, decision-making, and committees. • The organization fosters mutual respect and adapts to cultural diversity.

	• A shared responsibility for safety is cultivated across all levels.
Communication and Training	• Open communication is encouraged through toolbox talks, safety briefings, and an open-door policy. • Comprehensive training is tailored to site-specific risks for contractors. • Contractors are equipped to mitigate hazards proactively. • Continuous engagement ensures contractors are consistently informed and involved.
Innovation and Continuous Improvement	• Advanced technologies like real-time monitoring systems enhance contractor safety. • Feedback loops and performance reviews identify gaps and drive improvements. • Lessons learned from incidents are shared to prevent recurrence. • Contractors participate in safety innovation and improvement initiatives.
Ethical Commitment and Incentives	• Ethical principles prioritize contractors' health and well-being. Contractors are made to feel their safety is valued above all else. • Recognition and rewards are given to contractors with exemplary safety performance. • Safety values are extended to positively impact contractors' families and communities.

4.1.2 Research Question Two

The second research question measured the common challenges and obstacles in achieving excellence in CSM and their solution which was measured using three questions (Refer Table 4.3).

Table 4.3. Measurement of Research Question 2

Research Question	Corresponding interview Questions
RQ2: What are the common challenges and obstacles in achieving excellence in contractor safety management, and how can they be addressed?	Q4. What are the most frequent challenges you've encountered when trying to align contractor safety practices with your organization's safety standards?
	Q5. Can you share examples of obstacles that hinder contractors from fully integrating into the company's safety culture?
	Q6. What key factors influence the development of a strong and sustainable safety culture that includes contractors, and how can leadership actively foster alignment between the organization's safety values and contractor?

Research question 2 addressed the common challenges and obstacles that O&G operators face in achieving excellence in CSM, and how they can be tackled. For this research question, 20 participants were interviewed, and their responses were recorded. The Level 1 and 2 codes are reflected in Table 4.4.

Table 4.4. Coding for RQ2

Q4. What are the most frequent challenges you've encountered when trying to align contractor safety practices with your organization's safety standards?	
Level 2 Coding	Level 1 Coding
Safety Culture and Leadership Commitment	• Strong leadership and a commitment to safety are essential for fostering a robust safety culture. However, gaps in contractor leadership's dedication to safety, coupled with a lack of proactive safety supervision, can weaken overall safety performance.

	• Resistance to change, especially from contractors with long-established practices, further complicates efforts to improve safety standards. Additionally, the pressure to meet tight deadlines sometimes leads contractors to prioritize speed over safety, while frequent turnover within contractor teams disrupts safety continuity and makes it harder to build lasting safety habits. • Addressing these challenges requires sustained leadership engagement, continuous safety reinforcement, and fostering a culture where safety is valued as much as productivity.
Training, Awareness, and Hazard Understanding	• Inadequate training and limited hazard awareness expose workers to unnecessary risks. • A lack of proper safety training before contractors arrive on site, combined with a limited understanding of site-specific hazards, increases the likelihood of incidents. • Contractors may not fully participate in safety meetings or toolbox talks, missing opportunities to deepen their safety knowledge. • Underestimating the importance of proper adequate equipment, tools and PPE usage and relying on outdated safety equipment further compounds these risks. • To improve safety readiness, it's crucial to ensure contractors receive thorough, site-specific training, actively engage in safety discussions, and have access to modern, well-maintained safety gear.
Communication, Collaboration, and Relationship Dynamics	• Clear and consistent communication is vital for aligning safety expectations and fostering a collaborative work environment. Inadequate communication between contractors and the company's safety team can create dangerous gaps in understanding, while cultural and language differences may cause misunderstandings that compromise safety. • Misalignment in risk perception between contractors and company teams can further widen this gap, making it difficult to establish a unified approach to safety. • Enforcing compliance without straining the working relationship is another delicate challenge.

	• Building trust, promoting open communication channels, and encouraging mutual respect for safety priorities can help bridge these divides and strengthen safety collaboration.
Incident Management and Safety Monitoring	• A lack of proper incident management and safety monitoring weakens safety oversight and prevents learning from past events. • Insufficient reporting of near-misses and smaller incidents limits the ability to identify and address potential hazards early. • Poor documentation and record-keeping of safety practices hinder efforts to track progress and maintain compliance. • Inconsistent application of stop-work authority can allow unsafe practices to continue, while insufficient follow-up on corrective actions undermines long-term safety improvements. • Establishing a robust incident management system, standardizing safety documentation, and reinforcing the consistent use of stop-work authority can drive continuous safety improvement and create a safer work environment.
Resource and Standardization Gaps	• Inconsistent safety standards and resource limitations can compromise safety outcomes across operations. • Varying safety standards among different contractors create inconsistencies, making it difficult to maintain a uniform safety culture. • Limited contractor resources can prevent teams from meeting high safety standards, while reliance on outdated safety equipment increases the risk of accidents. • Addressing these gaps requires standardizing safety requirements across all contractors, providing adequate resources to meet safety expectations, and ensuring access to up-to-date safety equipment. This can help strengthen safety performance across the entire operational landscape.
Q5. Can you share examples of obstacles that hinder contractors from fully integrating into the company's safety culture?	

Building Inclusion and Trust in Safety Culture	• Contractors often feel like outsiders, leading to disengagement from safety practices. Language barriers, cultural differences, and short-term contracts can further distance them from company safety values. • To overcome this, companies should recognize contractor contributions through safety awards and incentives, provide multilingual safety materials and cultural sensitivity training, and foster belonging through team-building activities and including contractors in safety committees.
Strengthening Onboarding and Continuous Training	• Incomplete onboarding and lack of recurring training can leave contractors unaware of critical safety protocols or evolving standards. • Companies can address this by conducting thorough safety orientations and recurring refresher courses, hosting joint hazard hunts and risk assessments to build site-specific awareness and offering ongoing tech and safety leadership training for contractor supervisors.
Aligning Safety Priorities and Leadership Commitment	• Differing safety priorities, contractor's or company leadership neglecting safety, and cost concerns can undermine safety efforts. • Alignment strategies include holding joint safety vision workshops to establish shared safety goals, embedding safety goals and KPIs into contracts and rewarding safety excellence with preferred vendor status, and coaching contractor leaders to reinforce safety values and model safe behaviors.
Encouraging Hazard Reporting and Feedback Loops	• Contractors may hesitate to report hazards due to fear of blame or lack of trust in safety processes. • Companies can build a learning-oriented environment thorough promoting a no-blame culture and celebrating proactive safety actions, creating clear action-tracking systems and holding regular safety review meetings and ensuring contractors are protected when raising concerns, reinforcing psychological safety.
Enhancing Supervision and Communication	• Inadequate supervision, slow adoption of safety technology, and inconsistent hazard communication can leave contractors vulnerable to preventable incidents. • Solutions include assigning safety liaisons to provide close oversight and support, using shared safety dashboards and standardized

	communication protocols and hosting hands-on demos to help contractors confidently use new safety technologies.
Q6. What key factors influence the development of a strong and sustainable safety culture that includes contractors, and how can leadership actively foster alignment between the organization's safety values and contractor?	
Leadership Commitment and Safety Integration	• Visible Leadership Commitment where Leaders participate in site visits and safety walks to show safety is a top priority. • Contractors' Leadership Engagement through continuous coaching for contractor supervisors empowers them to drive safely practices. • Facilitating workshops and joint sessions to align company and contractor safety visions and goals. • Adopting a Safety-Centric Procurement where priority is given to contractors with strong safety records sets clear expectations from the start.
Communication, Inclusion, and Psychological Safety	• Promote Two-Way Communication and open feedback channels which encourage contractors to report safety concerns without fear. • Contractors' involvement such as inclusion in Safety Committees, giving contractors a seat at the table fosters shared responsibility. • Encouraging hazard reporting without fear of repercussion builds trust, • Maintain consistent Safety Messaging during regular leadership townhalls, toolbox talks and multilingual materials to reinforce safety values
Training, Knowledge Sharing, and Continuous Learning	• Integrated Safety Training: Providing contractors with the same training as employees ensures consistency. • Proactive Incident Learning: Sharing past incidents and lessons learned helps prevent future accidents. • Behavior-Based Safety (BBS) Programs: Tracking and rewarding safe behaviors reinforces positive practices. Cultural Awareness Training: Bridging cultural gaps reduces misunderstandings and misinterpretations of safety norms.

Collaborative Safety Planning and Emergency Preparedness	• Pre-Job Safety Planning: Collaborative risk assessments and JSAs ensure everyone understands the hazards. • Emergency Response Drills: Joint simulations prepare teams to respond cohesively to incidents. • Ongoing Safety Culture Assessments: Regular surveys help refine safety strategies and close gaps. • Mentorship & Buddy Systems: Pairing contractors with experienced employees facilitates safety knowledge transfer.
Incentives, Accountability, and Resource Sharing	• Shared Accountability: Joint safety KPIs foster collective responsibility for safety outcomes. • Contractor Safety Incentives: Rewards and public recognition motivate contractors to prioritize safety. • Resource Sharing: Giving contractors access to safety manuals and monitoring tools elevates safety standards.

4.1.3 Research Question Three

The third research question focused on identifying key factors that enable excellence in CSM. It was measured using two interview questions (Refer Table 4.5).

Table 4.5. Measurement of Research Question 3

Research Question	Corresponding interview Questions
RQ3: What are the key factors to enable excellence in contractor safety management?	Q7. What best practices would you recommend for organizations looking to improve contractor safety management?
	Q8. How can collaboration between O&G companies and regulators enhance contractor management systems, and what practical strategies have proven effective?

Research question 3 talked about the strategies and best practices that O&G operators can adopt to improve and sustain the safety performance of their Contractors. For this research question, 20

participants were interviewed, and their responses were recorded. The Level 1 and 2 codes are reflected in Table 4.6.

Table 4.6. Code for RQ 3

Q7. What best practices would you recommend for organizations looking to improve contractor safety management?	
Level 2 coding	Level 1 coding
Joint Leadership Commitment	• The leadership team should demonstrate personal commitment to safety by consistently emphasizing its importance in meetings and site visits. • Establish Clear Safety Expectations: Define safety requirements in contracts and during onboarding. • Create a Contractor Safety Management System: Provide a comprehensive guide outlining roles, responsibilities, and procedures. • Enforce Zero Tolerance for Non-Compliance: Set strict consequences for safety violations. • Regularly Update Policies and Standards: Ensure safety procedures align with the latest regulations and industry practices.
Training and Awareness	• Implement a Robust Training Program: Tailor safety training to contractors' tasks and environments. • Hold Daily Toolbox Talks: Reinforce safe practices with daily safety discussions. • Share Lessons Learned: Use insights from past incidents and near-misses to enhance training. • Develop Emergency Preparedness Plans: Train contractors through drills and simulations for effective emergency response.
Monitoring and Evaluation	• Conduct pre-qualification assessments: Evaluate contractors' safety records before engagement. • Monitor Key Performance Indicators (KPIs): Use metrics like TRIR and LTIFR to assess contractor performance. • Conduct regular safety audits and inspections: Ensure ongoing compliance with safety standards. • Use technology for safety management: Leverage digital tools for tracking and monitoring safety practices.

Engagement and Collaboration	• Foster a collaborative safety culture: Build teamwork and alignment between contractors and employees. • Integrate contractors into safety committees: Enhance accountability and collaboration by including contractors in decision-making. • Conduct joint risk assessments: Involve contractors in identifying and mitigating risks. • Provide regular feedback and support: Engage contractors in constructive discussions to improve safety practices.
Recognition and Continuous Improvement	• Recognize and reward good safety performance: Use incentive programs to motivate contractors. • Benchmark against industry leaders: Learn from leading organizations to adopt proven safety practices. • Foster open communication: Encourage contractors to report hazards and share suggestions freely. • Continuously update policies and standards: Emphasize improvement by adapting to new safety challenges and innovations.
Q8. How can collaboration between O&G companies and regulators enhance contractor management systems, and what practical strategies have proven effective?	
Joint Leadership Commitment	• Leadership team to demonstrate personal commitment to safety by consistently emphasizing its importance in meetings and site visits. • Establish clear safety expectations: Define safety requirements in contracts and during onboarding. Create a Contractor Safety Management System: Provide a comprehensive guide outlining roles, responsibilities, and procedures. • Enforce zero tolerance for non-compliance: Set strict consequences for safety violations. • Regularly update policies and standards: Ensure safety procedures align with the latest regulations and industry practices.
Training and Awareness	• Implement a robust training program: Tailor safety training to contractors' tasks and environments. • Hold daily toolbox talks: Reinforce safe practices with daily safety discussions. • Share lessons learned: Use insights from past incidents and near-misses to enhance training.

	• Develop emergency preparedness plans: Train contractors through drills and simulations for effective emergency response.
Monitoring and Evaluation	• Conduct pre-qualification assessments: Evaluate contractors' safety records before engagement. • Monitor Key Performance Indicators (KPIs): Use metrics like TRIR and LTIFR to assess contractor performance. • Conduct regular safety audits and inspections: Ensure ongoing compliance with safety standards. • Use technology for safety management: Leverage digital tools for tracking and monitoring safety practices.
Engagement and Collaboration	• Foster a collaborative safety culture: Build teamwork and alignment between contractors and employees. • Integrate contractors into safety committees: Enhance accountability and collaboration by including contractors in decision-making. • Conduct joint risk assessments: Involve contractors in identifying and mitigating risks. Provide regular feedback and support: Engage contractors in constructive discussions to improve safety practices.
Recognition and Continuous Improvement	• Recognize and reward good safety performance: Use incentive programs to motivate contractors. • Benchmark against industry leaders: Learn from leading organizations to adopt proven safety practices. • Foster open communication: Encourage contractors to report hazards and share suggestions freely. • Continuously update policies and standards: Emphasize improvement by adapting to new safety challenges and innovations.

4.1.4 Summary of Findings

Thematic analysis was applied to identify recurring themes and extract key elements considered fundamental for an effective CSMS. By grouping responses into distinct themes, the analysis highlights the shared perspectives and collective perception of professionals within the O&G industry.

4.1.4.1 Research Question One

For the first research question, "How effective are current safety management practices among contractors in mitigating safety risks and improving overall safety performance?" three interview questions were identified to gather data addressing this topic. Participants unanimously agreed that while CSMSs in the O&G industry have made significant progress, they are not yet fully effective in preventing contractor-related incidents, as the industry continues to record a high number of fatalities and serious injuries annually. The themes related to this research question will be explored individually in the sections that follow, highlighting the key elements essential for building and sustaining an effective CSMS that enhances safety performance and reduces incidents.

4.1.4.1.1 Leadership Commitment and Safety Culture

Leadership commitment emerged as the cornerstone of an effective CSMS, with participants emphasizing that safety culture cascades from the top. In the high-risk environment of O&G operations, senior management plays a pivotal role in setting safety priorities and driving safety excellence. Leaders must articulate a clear safety vision that aligns with the organization's overall strategic objectives, emphasizing the protection of human life, environmental preservation, and operational integrity. This vision should be communicated across all levels of the organization, ensuring that both internal teams and external contractors understand and demonstrate commitment to the company's safety values.

Leadership strategies should extend beyond surface-level initiatives, focusing on embedding safety into every aspect of business processes. This includes allocating dedicated resources and budget for safety training, equipment, and technology adoption, while also fostering a proactive safety culture through continuous improvement programs. Leaders can demonstrate their

commitment by consistently reinforcing safety messages, conducting regular site visits, and actively participating in safety meetings and incident investigations and lessons learned sharing and implementation. These visible actions build trust and reinforce the idea that safety is not just a metric but a fundamental organizational value.

Crucially, leadership must oversee the development and continuous evolution of a comprehensive SMS where contractor's safety is a critical component. This involves establishing clear safety expectations for contractors, integrating them into the organization's safety culture, and involving them in safety planning and decision-making processes. By fostering a collaborative environment where contractors are seen as safety partners rather than external entities, leadership can create a cohesive safety ecosystem. This approach drives mutual accountability, enhances hazard identification, and promotes knowledge-sharing, ultimately strengthening safety performance across the entire operational landscape.

4.1.4.1.2 Comprehensive Contractor Prequalification

Comprehensive Contractor Prequalification serves as the first line of defense in mitigating contractors' safety risks, emphasizing the importance of clarity in the scope and setting clear criteria for evaluation. Companies must have clear procedures in place that cover the entire cycle, starting from developing the scope, collecting business requirements, and continuing through to the award of the contract. Rigorous prequalification processes are essential for assessing a contractor's historical safety performance, certifications, and adherence to industry standards. Companies that fail to thoroughly vet contractors risk introducing safety gaps into their operations. Best practices include evaluating leading indicators such as safety training records, participation in behavior-based safety programs, and proactive hazard identification, ensuring that safety is prioritized from the beginning. Furthermore, incorporating safety clauses in contracts, with explicit

penalties for non-compliance and incentives for exemplary performance, reinforces safety expectations and sets clear criteria for evaluating contractor performance, ensuring a robust commitment to safety standards throughout the entire contracting process.

4.1.4.1.3 Clear Roles, Responsibilities, and Accountability

Clarity in safety roles and responsibilities is crucial for ensuring seamless safety integration, with safety requirements meticulously defined and communicated to all stakeholders involved in the project including leaders and frontline workers. Monitoring mechanisms, such as safety performance scorecards and incident investigation panels, are essential for tracking individual and collective safety responsibilities. Contractors must be treated as safety partners, with joint accountability for incident prevention and response, reinforcing the shared commitment to safety across all levels of the organization. This integrated approach ensures that safety is not only clearly defined but also actively upheld through collaborative efforts and transparent performance tracking.

4.1.4.1.4 Robust Risk Management Practices

Proactive risk management emerged as a recurring theme, with participants emphasizing the importance of continuously identifying, assessing, and mitigating risks through structured processes such as Hazard Identification & Risk Assessment (HIRA) and Job Safety Analysis (JSA), following a risk-based approach that focuses on high-risk activities and preventing process safety events. The use of digital risk assessment tools, real-time hazard tracking, and predictive analytics was also highlighted as a means to further enhance these practices by providing timely insights and anticipating potential hazards. Regularly updating risk registers, conducting dynamic risk assessments, and involving workers in hazard identification significantly bolster overall safety

resilience, ensuring that risk management remains robust, adaptable, and responsive to evolving operational conditions.

4.1.4.1.5 Training, Competency, and Awareness Programs

Continuous education and competency assurance are vital for equipping contractors with the knowledge and skills needed to navigate high-risk environments. Participants emphasized the importance of both site and job-specific training, recurrent safety refreshers, and targeted training for high-risk activities. Incorporating blended learning approaches, which combine in-person workshops, e-learning modules, and virtual reality simulations, can further enhance knowledge retention. Tracking training completion rates, competency test results, and worker feedback ensures ongoing competency development, fostering a continuous loop of improvement that reinforces safety and performance standards.

4.1.4.1.6 Communication and Information Sharing

The participants emphasized the importance of communication as a key success factor for any CSMS. Clear, consistent communication throughout all phases from prequalification to contract award and project execution ensures that safety policies are effectively conveyed, concerns are addressed, and safety improvements are shared. Regular safety meetings, toolbox talks, and real-time communication channels, such as safety apps and messaging platforms, play a vital role in maintaining transparency, fostering collaboration, and enabling timely incident and safety observations reporting. By prioritizing communication, organizations can ensure a more proactive and resilient safety culture, essential for the success of CSMSs.

4.1.4.1.7 Contractor Engagement and Collaboration

Promoting a win-win culture is crucial for fostering strong, mutually beneficial relationships between clients and contractors. By encouraging collaboration, open communication, and shared

goals, both parties work together toward common objectives, especially in safety. This approach ensures that safety is prioritized, leading to better outcomes for everyone involved. Recognizing and rewarding contractor safety champions, involving them in decision-making, and celebrating collective achievements reinforce this culture. A win-win mindset not only strengthens safety performance but also builds long-term trust and commitment, creating a sustainable and positive safety ecosystem.

4.1.4.1.8 Performance Monitoring and Auditing

Performance management starts with setting SMART objectives (Specific, Measurable, Achievable, Relevant, and Time-bound) along with meaningful Key Performance Indicators (KPIs) that cover both leading and lagging indicators. By establishing clear, actionable goals and tracking proactive measures (leading indicators), like near-miss reports and safety observations, training compliance, alongside historical outcomes (lagging indicators), such as Total Recordable Incident Rate (TRIR) and Lost Time Injury Frequency Rate (LTIFR), organizations can monitor safety performance comprehensively. Participants also highlighted the importance of frequent safety audits, site inspections, and real-time safety performance tracking as essential components for identifying gaps and addressing them. This balanced approach ensures that safety is continuously improved through proactive actions while also assessing past performance to identify trends and drive long-term safety enhancements.

4.1.4.1.9 Incident Reporting and Investigation

Transparent incident reporting and thorough investigations are critical for continuous learning and safety improvement. Participants emphasized that contractors should be encouraged and not penalized for reporting incidents and near misses, fostering a culture of trust and openness. Adopting a no-blame culture, combined with rigorous root cause analysis, ensures that systemic

safety gaps are identified and addressed. Regular incident debriefs, safety alerts, and lesson-sharing forums help embed these learnings into organizational safety practices, reinforcing a proactive and resilient safety culture.

4.1.4.1.10 Emergency Preparedness and Response

Given the high-risk nature of O&G operations, robust emergency preparedness is not a choice. Participants highlighted the need for comprehensive emergency response plans, regular simulation drills, and seamless multi-agency coordination. Contractors should be fully integrated into emergency plans, ensuring they understand their roles and responsibilities during crises. This not only enhances the effectiveness of emergency response activities but also fosters a unified safety culture. Emergency response KPIs, such as drill participation rates and response times, provide measurable insights into preparedness levels. Post-drill evaluations and gap analysis drive continuous improvement of emergency protocols, strengthening the collective ability to respond effectively to incidents minimizing the impact on people, assets, and the environment.

4.1.4.2 Research Question Two

For the second research question, "What are the common challenges and obstacles in achieving excellence in contractor safety management, and how can they be addressed?", three interview questions were identified to gather data on this critical topic. Participants unanimously agreed that, despite efforts to strengthen safety protocols, contractor safety management systems in the O&G industry face numerous challenges that hinder their effectiveness and limit incident prevention.

The sections that follow will explore the key themes that emerged from these discussions, outlining the most pressing challenges organizations face when developing, implementing, and enhancing CSMSs. By addressing these barriers, organizations can build and sustain a safety management

framework that not only enhances safety performance but also drives continuous incident reduction and strengthens overall operational resilience.

4.1.4.2.1 Lack of Engagement and Commitment to Safety from Both Contractors' and Client Leadership

Lack of engagement and commitment to safety from both contractors and clients' leadership can severely undermine safety efforts, leading to preventable incidents, misalignment, and a weakened safety culture. Participants highlighted key aspects of this challenge, emphasizing the need for clear goals and expectations, as well as actionable strategies to address them. When leadership fails to set clear and measurable safety goals, teams operate without direction, resulting in inconsistent safety practices and complacency. Establishing SMART (Specific, Measurable, Achievable, Realistic, and Timely) safety goals collaboratively, communicating expectations through regular safety meetings and site visits, and tracking progress via safety indicators can reinforce commitment. Conflicting priorities, where safety competes with production deadlines or budget constraints, can signal that safety is negotiable. Implementing a "Stop Work Authority" program, integrating safety into project planning, and reinforcing safety as a core value through stand-downs and town halls help mitigate this issue. Limited leadership visibility, such as infrequent site visits and low participation in safety meetings, disconnects leaders from frontline realities, potentially causing safety risks to be underestimated. A structured site visit program, leader participation in toolbox talks and safety meetings, and using digital tools like real-time incident dashboards can help with bridging this gap. Additionally, insufficient resources for safety training, equipment, or personnel can undermine safety performance. Allocating dedicated budgets, implementing competency assurance systems, and creating safety suggestion schemes empower teams to enhance safety practices. By addressing these leadership challenges with

proactive strategies, organizations can foster a stronger safety culture, drive continuous improvement, and ensure safety remains a non-negotiable priority.

4.1.4.2.2 Poor Prequalification Process and Lowest Bidder Approach

Interviewees indicated that one of the biggest issues facing project execution teams is the selection of contractors based solely on cost, without adequately assessing safety performance, this practice can introduce high-risk contractors who may lack experience, cut corners on safety, neglect equipment maintenance, or provide inadequate workers' training. These gaps can lead to accidents, inconsistent safety practices, regulatory violations, reputational damage, and higher long-term costs. To mitigate these risks, organizations should implement a robust prequalification process where safety is a non-negotiable factor, emphasizing safety performance through safety audits, incident history reviews, and SMS evaluations. Audits should assess adherence to industry standards, with third-party reviews providing objective assessments and corrective action plans for safety deficiencies. Incident history reviews help benchmark safety records against industry best practices, while SMS evaluations ensure contractors have effective safety policies, training programs, and internal audit mechanisms. Compliance checks for industry standards, safety certifications, and regulatory history are crucial, as contractors with a history of violations pose serious risks. Beyond compliance, contractors must demonstrate a strong safety culture, with leadership visibly committed to safety, continuous improvement initiatives, and worker involvement in safety decisions. Collaboration in safety planning, joint risk assessments, and clear communication of safety expectations foster alignment between contractors and clients, reducing inconsistencies and strengthening site-wide safety culture. By prioritizing safety performance in contractor selection, organizations protect their people, operations, and long-term project success.

4.1.4.2.3 Lack of Contractors' Engagement

The lack of contractors' engagement and integration into the safety culture can create a serious disconnect between contractors executing the work and client's personnel, ultimately undermining safety performance across operations. This disconnect often arises from a "slave-master" mentality, where contractors are treated as external entities rather than integral team members, leading to disengagement, reluctance to adopt safety practices, and resistance to safety values. When contractors are viewed as outsiders, trust deteriorates, communication strains, and contractors may hesitate to report safety concerns or share insights. Without a sense of ownership, safety becomes a compliance exercise rather than a shared responsibility, causing inconsistencies in safety practices and elevating the risk of incidents. This dynamic diminishes contractor engagement and commitment, where workers may do the bare minimum for safety instead of actively contributing to safety excellence. In such an environment, safety becomes a top-down requirement rather than a collective effort, weakening accountability, teamwork, coordination, and the shared responsibility essential for achieving safety outcomes.

To address these challenges, organizations must take intentional steps to fully integrate contractors into the safety culture. Leadership must treat contractors as partners, involving them in safety discussions, initiatives, and decision-making processes. Contractors should receive the same level of safety training as internal employees, with regular updates and drills to reinforce safety knowledge. Establishing shared safety metrics and goals aligns everyone to common safety objectives, while recognizing and rewarding contractors for their safety contributions fosters motivation and continuous improvement. Daily operations should include contractors in safety briefings and debriefings, helping align their focus with the organization's safety priorities. Ultimately, fostering a "One Team" mentality through joint team-building activities, shared safety

goals, and cross-functional safety committees helps break down barriers, promote collaboration, and create a unified, high-performing safety culture across the entire workforce.

4.1.4.2.4 Inadequate Onboarding and Competency Management Processes:

Rushed or incomplete onboarding for contractors, combined with inadequate training and competency management, can have serious consequences for both safety and operational performance. When contractors are not thoroughly onboard or lack the necessary skills and knowledge, they may be unaware of critical safety protocols, site-specific hazards, and organizational expectations, increasing the risk of accidents, injuries, and compliance violations. Without proper training, contractors may struggle to identify hazards, apply safety procedures consistently, or understand their role in maintaining safety, weakening the overall safety culture. A lack of competency management further compounds this issue, as contractors may be assigned tasks beyond their capabilities, leading to unsafe practices, errors, and heightened risks.

A standardized onboarding process is essential to mitigate these risks and ensure contractors are fully prepared. This process should begin with thorough safety briefings, covering general safety protocols, PPE requirements, emergency response procedures, and incident reporting. Site walkthroughs are equally vital, helping contractors identify hazards, locate emergency exits, and understand site-specific safety rules. Competency assessments should be incorporated to verify that contractors possess the necessary skills and knowledge for their roles, with safety tests, one-on-one evaluations, and hands-on demonstrations of key safety practices.

Clear documentation, including safety manuals, emergency instructions, and key safety contacts, should be provided, with contractors signing acknowledgments of their understanding and commitment to safety. Onboarding does not end after orientation, continuous reinforcement through regular safety meetings, toolbox talks, refresher training, and ongoing competency

evaluations ensures contractors stay aligned with evolving safety expectations. By implementing a structured, ongoing onboarding process with robust training and competency management, organizations can enhance safety awareness, foster contractor accountability, and build a unified safety culture. This proactive approach not only reduces the risk of incidents but also strengthens the organization's safety performance, creating a safer and more cohesive work environment for everyone on-site.

4.1.4.2.5 Communication and Language Barriers

Participants expressed high frustration due to ineffective safety communication, which was exacerbated by language differences, inconsistent hazard communication, and fear of punishment or blame. These factors severely undermine safety efforts, especially in diverse environments like the Middle East, where large-scale projects rely on contractors from varied cultural and linguistic backgrounds. Such barriers can lead to misunderstandings, misinterpretations of safety protocols, and reluctance to report hazards, ultimately compromising site safety and operational integrity.

Language gaps may cause contractors to struggle with safety instructions or emergency procedures, while inconsistent hazard communication can result in critical safety information being misinterpreted or overlooked. In some cultures, fear of retaliation or deep respect for authority can discourage workers from voicing safety concerns, while cultural differences may influence how safety is perceived and practiced. This communication breakdown not only increases the risk of incidents but also fuels frustration across teams, as workers feel unheard, unsupported, and disconnected from the broader safety culture.

To overcome these challenges, companies must implement strategies to foster honest, inclusive communication. Providing multilingual safety materials including translated documents, multilingual signage, and digital platforms ensures that everyone can access and understand safety

information. Establishing anonymous reporting channels, conducting safety surveys, and appointing safety representatives help contractors raise concerns without fear of reprisal. Regular toolbox talks, safety briefings, and one-on-one check-ins promote ongoing safety discussions, while inclusive meetings with interpreters ensure all voices are heard.

Reinforcing a no-blame policy, visibly supporting workers who speak up, and recognizing safety contributions can further normalize hazard reporting. Cultural sensitivity training equips teams to navigate cultural nuances, while teaching communication best practices helps supervisors convey safety protocols with clarity and empathy.

By prioritizing language accessibility, fostering open feedback, and cultivating cultural awareness, companies can dismantle communication barriers and reduce frustration. This approach not only lowers the risk of incidents but also strengthens team cohesion, drives long-term safety performance, and creates a safer, more collaborative work environment for everyone.

4.1.4.2.6 Inconsistent Safety Standards and Expectations Across Clients

This problem was highlighted primarily by participants with contractor experience. Inconsistent safety standards and expectations across different clients create significant challenges in hazard management, especially when contractors transition between projects with varying requirements. This lack of standardization makes adaptation difficult, leading to confusion, increased risks, and potential safety failures. When safety protocols differ, contractors may assess risks inconsistently, potentially overlooking hazards or addressing them inadequately, which raises the likelihood of incidents. This inconsistency not only causes regulatory non-compliance but also fragments safety culture, weakens safety leadership, and erodes trust across teams.

To mitigate this, organizations operating in the same geographical areas should collaborate to align safety standards, ensuring all contractors and employees adhere to unified protocols. This

alignment should be supported by centralized safety documentation, clear safety expectations, and shared performance metrics. Standardized training and onboarding processes, supplemented by regular refresher courses and joint safety drills, help maintain consistent safety knowledge across teams.

Collaborative risk assessments using standardized tools and site-specific evaluations promote a unified approach to hazard identification and mitigation, while joint safety management plans align contractors and employees under common safety objectives. Regular joint safety audits, with immediate corrective actions and continuous improvement processes, reinforce compliance and drive safety excellence.

A unified safety culture, anchored in leadership commitment, shared accountability, reward systems, and open communication channels, further strengthen alignment. This creates an environment where everyone, regardless of their role or employer, is equally invested in maintaining the highest safety standards. By implementing these strategies, organizations can eliminate inconsistencies, enhance hazard management, and build a resilient, high-performing safety culture that protects lives and ensures operational integrity.

4.1.4.2.7 Budget Constraints

Tight profit margins and limited budgets can drive contractors to prioritize cost-cutting measures at the expense of safety, neglecting critical investments in equipment, training, and safety systems. This approach increases the risk of accidents, injuries, legal penalties, and long-term costs. Contractors may skip safety training, delay equipment maintenance, or bypass regulatory requirements to save money creating unsafe conditions, lowering worker morale, and leading to compliance violations.

To address this, organizations should implement strategies that embed safety as a core, non-negotiable element of project planning. Contracts should include a dedicated safety section with a properly allocated budget, ensuring contractors have the resources needed to uphold safety standards without excessive financial strain. Project management teams can further support safety by integrating it into project timelines, allocating flexible safety budgets, and prioritizing funding for high-risk activities or areas with higher incident potential.

Incentive programs, such as performance-based bonuses or cost-sharing for safety improvements, can motivate contractors to exceed safety expectations. Additionally, organizations can foster collaboration through resource sharing, joint safety initiatives, and access to specialized safety equipment or training, reducing financial burdens while strengthening safety outcomes.

By proactively supporting contractors and making safety financially feasible, organizations protect workers, reinforce safety culture, and ensure long-term project success proving that safety and profitability can coexist without compromise.

4.1.4.2.8 Contractor Fatigue and Repetitive Task Burnout

Contractor fatigue and repetitive task burnout are significant safety risks in industries with long shifts and back-to-back projects, especially during Turnaround and Inspection (T&I) activities, which are typically scheduled during periods of low oil demand, like summertime, or when projects fall behind schedule and try to catch up. Extended working hours and monotonous tasks deplete physical and mental capacity, leading to reduced attention, impaired decision-making, and a higher likelihood of human error. All of which heighten the risk of accidents and injuries. Fatigue can also weaken physical performance, increasing susceptibility to musculoskeletal injuries, while prolonged exhaustion may lead to stress, sleep disorders, and chronic health issues.

To mitigate these risks, organizations should implement comprehensive fatigue management policies that set clear limits on shift lengths, mandate rest breaks, and promote fatigue awareness through training and reporting systems. Providing designated rest areas, encouraging hydration, and facilitating relaxation during breaks help workers recharge. Task rotation and cross-training diversify responsibilities, balancing physical and cognitive workloads to prevent mental exhaustion.

Proactive fatigue monitoring through supervisor observations, peer support systems, and even wearable technology adds an extra layer of safety, enabling early detection and intervention. Flexible work arrangements, staggered shifts, and strategically scheduled rest days ensure workers have sufficient recovery time, even when project timelines are tight.

By adopting these strategies, organizations can protect workers' well-being, enhance safety performance, and cultivate a resilient, high-functioning workforce capable of sustaining operational demands without compromising safety.

4.1.4.2.9 Inadequate Supervision and Safety Oversight

Inadequate contractor supervision and safety oversight often due to understaffed teams, lack of experience, or disengaged safety personnel can significantly compromise safety, especially in dynamic and high-risk environments like O&G or construction sites. Without proper supervision, contractors may unknowingly deviate from safety protocols, overlook hazards, or take unsafe shortcuts, increasing the risk of accidents. The absence of experienced safety leaders can lead to missed real-time corrective actions, while poor communication of safety expectations fosters inconsistencies, weakening overall safety culture.

To mitigate these risks, organizations should prioritize increasing site supervision by assigning dedicated safety officers, maintaining optimal supervisor-to-contractor ratios, and ensuring

supervisors are well-trained and actively engaged in safety leadership. Frequent site walkthroughs and real-time safety observations help catch unsafe behaviors early, while regular safety audits both scheduled and unannounced ensure continuous compliance and highlight areas for improvement.

Peer-to-peer safety observation programs encourage collective accountability, empowering workers to look out for one another, while safety briefings, toolbox talks, and open reporting channels promote continuous safety dialogue. Leveraging technology can further enhance oversight through safety monitoring software, mobile apps for hazard reporting, and video surveillance of high-risk areas, providing supervisors with real-time insights and faster response capabilities.

By combining proactive supervision, rigorous audits, peer-based safety culture, and tech-driven monitoring, organizations can strengthen safety performance, ensure consistent adherence to safety protocols, and cultivate a culture of shared responsibility for safety at all levels of the workforce.

4.1.4.2.10 High Contractor Turnover

Frequent contractor turnover, often driven by factors such as project-based work, short-term contracts, intense work conditions, and limited career progression, can severely disrupt safety knowledge transfer, leading to gaps in critical safety practices, increased risk of accidents, and resource-draining retraining processes. When experienced workers leave, their knowledge of site-specific hazards and safety protocols may be lost, leaving new hires struggling to catch up especially without proper mentoring or structured knowledge transfer. The transient nature of contract work can cause workers to move between sites frequently, further compounding the challenge of maintaining safety continuity.

New workers often require repeated safety training, which can cause disengagement or overlooked safety practices, while fragmented on-the-job knowledge transfer may result in inconsistencies and heightened safety risks. To address these challenges, organizations should adopt strategies to improve contractor retention, such as career development plans, loyalty bonuses, and structured salary increments that reward long-term commitment. These incentives can help contractors feel valued, encouraging them to stay longer and contribute to a stable, safety-conscious workforce.

In parallel, organizations can assign safety mentors to guide new staff, fostering continuous feedback and hands-on learning. Creating a centralized digital safety knowledge base ensures that safety protocols, incident reports, and lessons learned are accessible and updated in real time, preserving critical safety knowledge even as personnel change. Regular refresher training, combined with cross-training programs and knowledge-sharing sessions, reinforces safety awareness and broadens workers' understanding of site risks.

Technology can further support knowledge retention through mobile safety apps, digital training platforms, and safety dashboards that track safety KPIs and encourage continuous improvement. By adopting these strategies, organizations can reduce the impact of high turnover, safeguard safety continuity, and cultivate a resilient safety culture where every worker, regardless of tenure, feels equipped and empowered to uphold safety standards.

4.1.4.2.11 Poor Post-Project Evaluation: Contractor Performance Review, Lessons Learned, Documentation, and Continuous Improvement

Lack of contractor lifecycle management and poor post-project evaluation can significantly undermine long-term operational success and safety. Without thorough contractor performance reviews, lessons learned identification, proper documentation, and continuous improvement processes, organizations miss valuable opportunities to enhance safety practices, operational

efficiency, and contractor relationships. Gaps in safety protocols may go unaddressed, leading to recurring risks and non-compliance, while missed learning opportunities result in repeated mistakes and stagnant safety performance. A lack of accountability makes it difficult to identify underperforming contractors, and inconsistent safety standards across different contractors can further compound risks.

To address these issues, organizations can implement a structured contract lifecycle management framework, with evaluations focused on safety outcomes. This includes establishing clear evaluation criteria, conducting 360-degree feedback sessions, and tracking key performance metrics such as incident rates, near-miss reporting, and safety compliance. Post-project debriefing sessions and root cause analyses help capture lessons learned, translating them into actionable insights that inform updated protocols, enhanced training, and the standardization of best practices across future projects.

A formalized framework with post-project templates, scheduled evaluations, and performance tracking systems ensures consistency, while fostering a culture of continuous improvement where feedback is treated as a growth opportunity. Leadership actively participates in reviews, and improvement efforts are recognized and rewarded. Additionally, maintaining a centralized repository of contractor safety performance data allows organizations to make informed decisions when selecting contractors for future projects, promoting long-term partnerships with those who demonstrate a strong safety commitment.

By embedding these practices, organizations not only strengthen safety culture but also build a resilient, high-performing ecosystem where every project contributes to the organization's collective safety intelligence driving long-term safety excellence across the entire operational landscape.

4.1.4.3 Research Question Three

For the third research question, "What are the key factors to enable excellence in contractor safety management?", two interview questions were identified to gather insights addressing this topic. The first question explored the best practices participants would recommend for organizations seeking to improve contractor safety management, while the second question examined how collaboration between O&G companies and regulators can enhance CSMSs, along with practical strategies proven effective in the industry.

Participants unanimously agreed that, while significant progress has been made in CSM, achieving excellence remains an ongoing journey. They emphasized that sustained success requires continuous improvement, proactive risk management, and close collaboration among all stakeholders. Notably, the responses validated the insights gathered from the first two research questions, reinforcing the idea that addressing key challenges is essential for building a resilient and high-performing CSMS.

The following sections summarize the key themes, ideas, and strategies shared by participants during the interviews, highlighting actionable insights for organizations striving to elevate their CSMSs to the highest standards.

4.1.4.3.1 Joint Leadership Commitment and Accountability

A strong joint leadership commitment from both client's side and contractors is the foundation of a successful safety culture, where leaders consistently demonstrate personal dedication to safety by emphasizing its significance during meetings and site visits. Leadership must take full accountability for safety outcomes, actively promoting safety as a core value and leading by example. This includes establishing clear safety expectations, defining safety requirements in contracts, and thoroughly communicating them during onboarding. To reinforce accountability,

leaders should develop a robust CSMS that outlines roles, responsibilities, and procedures, ensuring all parties understand their obligations. A zero-tolerance policy for non-compliance should be enforced, with leaders owning the responsibility for monitoring adherence and addressing violations. Additionally, leadership should oversee the regular review and updating of policies and standards to align with evolving regulations and industry best practices. By embracing accountability and fostering a proactive safety environment, leadership can drive continuous improvement, build trust, and ensure safety remains an unwavering organizational priority.

4.1.4.3.2 Training and Awareness

To enhance safety and ensure a well-prepared contractor workforce, participants emphasized the development and implementation of a robust training program tailored to contractors' specific tasks and work environments. Daily toolbox talks should be held to reinforce safe practices and foster a culture of continuous safety awareness. Additionally, sharing lessons learned from past incidents and near-misses will help improve training and prevent future risks. Emergency preparedness plans must be developed and regularly practiced through drills and simulations, ensuring contractors are equipped for effective emergency response when needed. This comprehensive approach will help create a safer and more resilient work environment.

4.1.4.3.3 Monitoring and Evaluation

Monitoring and evaluation of contractor safety performance is essential to ensuring that safety standards are consistently met throughout the lifecycle of a project. It begins with conducting pre-qualification assessments to evaluate contractors' safety records before engagement, ensuring that only those with a strong safety history are considered. Once contractors are on board, it is crucial to monitor Key Performance Indicators (KPIs) that includes both lagging and leading measures to assess ongoing safety performance and identify areas for improvement. In addition, regular safety

audits and inspections must be conducted to ensure continuous compliance with safety standards, enabling prompt identification and resolution of any potential safety issues. To enhance the effectiveness of monitoring, digital tools and technology should be leveraged for tracking and monitoring safety practices in real time, offering greater visibility and allowing for timely interventions when safety risks arise. By combining these methods, organizations can create a robust system for evaluating contractor safety and ensuring that safety remains a top priority throughout project execution.

4.1.4.3.4 Engagement and Collaboration

Engagement and collaboration are fundamental to creating a strong safety culture that involves both contractors and employees working together towards common safety goals. To foster this culture, it is important to build teamwork and alignment between contractors and employees, ensuring that all parties understand their shared responsibility for maintaining safety on-site. A key element of this collaboration is integrating contractors into safety committees, allowing them to contribute to decision-making processes and enhancing mutual accountability. Conducting joint risk assessments is another crucial aspect, where contractors are actively involved in identifying and mitigating potential risks, ensuring that all perspectives are considered in safety planning. Furthermore, providing regular feedback and support is essential for reinforcing safety expectations and fostering continuous improvement. By engaging contractors in constructive discussions about safety practices, organizations can create a dynamic and proactive approach to safety, ultimately strengthening the safety culture across all levels of the workforce.

4.1.4.3.5 Recognition and Continuous Improvement

Recognition and continuous improvement play a vital role in cultivating a safety-focused culture where both contractors and employees are motivated to prioritize safety. One key strategy is to

recognize and reward good safety performance through incentive programs that motivate contractors to adhere to safety practices and exceed expectations. In addition, benchmarking against industry leaders allows organizations to learn from the best in the field, adopting proven safety practices that can be integrated into their own operations. To maintain a culture of openness, fostering clear communication is essential, encouraging contractors to report hazards and share safety suggestions without fear of retribution. This transparency fosters trust and helps identify potential risks before they become serious issues. Furthermore, continuously updating policies and standards is critical for adapting to new safety challenges and incorporating innovations in safety practices. By embracing a mindset of ongoing improvement, organizations can ensure that safety performance not only meets but consistently exceeds expectations, driving long-term success in safety management.

4.1.4.3.6 Collaboration Between Companies, Contractors and Regulators

Collaboration between companies, contractors, and regulators is crucial for ensuring that all parties involved in high-risk operations, particularly in industries like O&G, work towards common safety objectives. Safety is a shared responsibility, and to achieve consistent and effective safety outcomes, it is essential that all stakeholders, whether employees, contractors, or regulatory bodies align on safety standards, protocols, and expectations. This alignment between safety requirements ensures that everyone adheres to consistent guidelines and practices, which reduces confusion, minimizes risks, and enhances overall safety performance.

4.1.4.3.7 Alignment Between Safety Standards

The alignment of safety standards across all parties involved is one of the cornerstones of creating a safe and compliant work environment. When safety standards are aligned, organizations can ensure that all parties are on the same page regarding safety practices. This is especially important

in industries with complex, high-risk operations like O&G, where multiple contractors, regulatory bodies, and internal teams may be involved in the same project.

By aligning safety standards, companies can ensure that everyone follows the same protocols, guidelines, and best practices. This alignment not only helps in reducing potential confusion or discrepancies but also ensures that all stakeholders understand the same safety requirements, minimizing risks across the board. Additionally, aligned safety standards help to simplify the compliance process. When safety requirements are clearly defined and universally understood, the process of ensuring compliance becomes more streamlined, saving time, resources, and effort.

Moreover, alignment between safety standards promotes a cohesive safety culture. A unified approach to safety expectations ensures that both employees and contractors feel equally responsible for maintaining a high standard of safety. This sense of shared responsibility fosters a culture where safety is not just an isolated objective but is integrated into every aspect of the operational activities. Companies that invest in aligning safety standards with their contractors and regulatory partners are taking proactive steps to reduce workplace hazards, enhance risk mitigation, and improve overall safety outcomes.

4.1.4.3.8 Unified Training, Certification, and Knowledge Sharing

Training and certification are essential to building a consistent and effective safety culture across industries. One of the best ways to ensure that all stakeholders are equally equipped to handle safety challenges is through unified training programs. Collaboration between companies and regulatory bodies to develop joint training programs can ensure that all parties, including contractors, are receiving the same level of safety education and are up to date with the latest best practices. These programs should be designed to cover the full spectrum of safety topics and should be endorsed by both companies and regulators to ensure consistency and credibility.

A key advantage of these joint training programs is that they provide standardized knowledge and protocols, which help to minimize the risk of discrepancies in safety practices. Contractors, often coming from diverse backgrounds, may have varying levels of safety knowledge, and providing them with the same fundamental understanding of safety protocols promotes consistency. This helps to reduce risks and improve safety performance across the workforce. Moreover, providing contractors with standardized training demonstrates the company's commitment to safety and ensures that everyone is on the same page regarding safety expectations.

In addition to training, a unified certification process is essential for simplifying compliance. By establishing a standardized certification process that is endorsed by both companies and regulatory bodies, contractors are better equipped to meet safety requirements. This streamlined approach ensures that contractors are aware of the necessary certifications, making it easier for them to prove their adherence to safety standards. Furthermore, it enables companies to track the progress of safety compliance among contractors more effectively.

To further support the ongoing safety culture, regular safety workshops, leadership summits, and public safety campaigns should be organized. These events encourage continuous learning and provide an opportunity for all stakeholders to stay informed on emerging risks, safety best practices, and technological advancements. In a rapidly changing industry like O&G, where new challenges and hazards regularly arise, it is crucial to maintain a culture of learning and improvement. By offering platforms for knowledge-sharing, companies and contractors can stay ahead of the curve and effectively address new safety concerns.

Policy advocacy groups and regulatory bodies also play a significant role in shaping practical, real-world policies that address specific challenges faced in high-risk environments. Contractors' input in regulatory discussions ensures that the policies created are grounded in operational realities.

This collaborative approach allows for the creation of safety regulations that are not only effective but also feasible, ensuring that contractors can implement them without unnecessary complexity or undue burden.

4.1.4.3.9 Proactive Policy Evolution and Regulatory Support

A dynamic and evolving regulatory environment is essential for staying ahead of emerging safety challenges, especially in industries like O&G, where risks can change rapidly due to technological advancements, new industry practices, or shifts in environmental conditions. To maintain a forward-thinking approach to safety, companies and regulators must regularly review and update policies to ensure they remain relevant, effective, and adaptable to new challenges. Proactive policy updates allow organizations to stay ahead of emerging risks, providing the framework needed to respond effectively to new safety concerns.

Regular policy reviews and proactive updates are essential to ensure that safety regulations continue to address current risks and industry changes. These reviews help identify gaps in existing policies and regulations and provide an opportunity to introduce new safety measures that are better aligned with the evolving nature of industry practices. As industry progresses and new risks are introduced, it is vital that safety standards are updated to address these changes.

Clear, practical regulatory guidance plays a crucial role in helping companies implement effective CSMSs. Regulatory bodies must provide clear guidance on how companies can design systems that align with safety regulations and ensure compliance. This clarity helps eliminate confusion, ensures that safety standards are met, and simplifies the overall compliance process for both companies and contractors.

Dedicated liaison officers between regulatory bodies and companies also serve an important role in bridging any communication gaps that may exist. By fostering a smooth exchange of

information between the two parties, liaison officers help ensure that both sides are aligned and that safety expectations are clearly communicated. This collaboration between regulators, companies, and contractors can help prevent misunderstandings and ensure that safety goals are achieved effectively.

4.1.4.3.10 Emergency Response, Incident Management and Investigation

Effective emergency response and incident management are essential for minimizing the impact of major incidents and ensuring the safety of workers, assets and environment. In high-risk environments, swift and coordinated action can be the difference between successfully managing an incident or escalating its consequences. To achieve this, it is important to develop unified emergency response protocols that ensure companies, contractors, and regulators can act quickly and cohesively in the event of an emergency.

Standardized incident reporting formats are a critical component of incident management. These formats help ensure that incidents' data is collected quickly and accurately, allowing for a faster response time and more informed decision-making. Having a consistent format for reporting incidents also ensures that all parties involved understand the key details of the incident, enabling them to take appropriate actions without unnecessary delays.

Additionally, comprehensive investigation should be carried out to determine the root causes and contributing factors and the findings and key lessons learned will be shared with all stakeholders, including contractors, other companies, and regulatory authorities. Shared incident databases centralize valuable information related to past incidents, making it easier for companies, contractors, and regulators to access and analyze the data. This centralized approach helps identify trends, root causes, and areas for improvement, which can then be used to enhance future emergency preparedness. By sharing this information, organizations can collaborate to improve

response strategies and reduce response times, ensuring that the organization is better prepared to handle future incidents.

Developing and maintaining robust emergency response protocols, along with the use of standardized reporting and shared databases, strengthen overall preparedness. A proactive, collaborative approach to emergency management can significantly reduce the time it takes to respond to incidents, ultimately improving safety outcomes and reducing operational disruptions. This collaboration ensures that all parties involved are aligned, acting quickly and cohesively to safeguard lives and protect assets.

4.1.4.3.11 Accountability, Transparency, and Performance Monitoring

Accountability, transparency, and performance monitoring are critical components of a successful safety culture. To achieve this, companies and contractors must work together to ensure that both parties are equally accountable for safety outcomes. Mutual accountability is key to fostering an environment where safety is a shared responsibility, and all parties are committed to ensuring the well-being of everyone involved.

A key strategy for promoting mutual accountability is the co-development of contractor safety scorecards. These scorecards track contractor performance and publicly report safety metrics, fostering transparency and motivating continuous improvement. By regularly reviewing contractor performance, companies can identify areas for improvement and take necessary actions to address any safety concerns. Publicly reporting safety metrics holds contractors accountable for their performance and reinforces the importance of maintaining high safety standards.

Regular safety audits, combined with the adoption of technology, further enhance the ability to track and monitor safety performance. Technology, such as real-time monitoring tools and data analytics platforms, enables companies to track safety metrics more effectively and identify

potential risks before they escalate into incidents. Cross-sector committees also play an important role in driving innovation and balancing safety with operational feasibility. These committees help to ensure that safety advancements do not hinder productivity, finding ways to enhance safety while maintaining operational efficiency.

Finally, by treating contractors as safety partners rather than external entities, companies and regulators foster a culture of trust and shared responsibility. This collaborative approach encourages both parties to work together to achieve long-term safety leadership, creating a strong foundation for sustainable safety outcomes. When companies and contractors view each other as partners in safety, it promotes a culture of transparency, trust, and continuous improvement that benefits everyone involved.

4.3 Conclusion

A total of 20 O&G professionals were interviewed, representing diverse geographical areas and various industry segments. The findings capture the most critical elements influencing contractor safety, derived from insights shared by industry professionals. These themes provide a comprehensive view of the practices and principles essential to fostering a robust safety culture, minimizing risks, and ensuring effective collaboration with contractors. Each element identified through the interviews is discussed in detail to highlight its significance and the practical steps organizations can take to strengthen safety performance.

Strong leadership commitment and alignment between both the contractor and the operator is the foundation of an effective contractor safety management system. Regular communication and joint safety planning ensure that both parties share the same vision, goals, and expectations, fostering a unified approach to safety. Leaders must set a clear vision for safety, allocate necessary resources, and develop actionable safety plans. Their visibility on-site, willingness to engage with workers,

and demonstration of safety-first behaviors establish a strong safety culture. When leaders serve as role models, reinforcing safety expectations and recognizing positive safety performance, it encourages contractors to prioritize safety in all operations. A robust pre-qualification process ensures that only competent and safety-conscious contractors are selected. This involves defining a clear SoW, reviewing historical safety performance, and considering factors beyond just cost avoiding the tendency to select the lowest bidder without evaluating safety capabilities. By implementing rigorous pre-qualification criteria, organizations can proactively mitigate risks and ensure contractors align with the company's safety standards and expectations.

Qualified and experienced supervision is critical to maintaining safety on-site. Supervisors should have the necessary technical knowledge and safety training to oversee operations effectively. Their role includes ensuring workers follow safety procedures, providing guidance on the permit-to-work system, and facilitating immediate support when issues arise. Adequate supervision ensures that safety protocols are consistently enforced, and workers have someone to turn to for safety concerns or clarifications. Managing contractor safety through a risk-based approach allows organizations to focus resources on the most hazardous activities and contractors with higher risk profiles. This involves thorough hazard identification, risk assessments, and prioritizing controls for high-risk tasks. A continuous risk review process, paired with frequent communication of identified risks to contractors, ensure that safety measures evolve alongside changing work conditions and emerging threats.

Ongoing performance management and regular audits help ensure that safety remains a dynamic and continuously improving process. Setting clear goals, objectives, and key performance indicators (KPIs) allows organizations to measure contractor safety performance objectively. Field inspections and audits, combined with structured feedback mechanisms and lessons-learned

sessions, create opportunities to correct unsafe practices, share best practices, and drive continuous safety improvements across all contractor activities. Building strong, collaborative relationships with contractors fosters a culture of shared responsibility for safety. Encouraging two-way communication and regular feedback creates an environment where contractors feel heard and valued. Fairness and transparency in decision-making build trust, making contractors more likely to proactively report hazards, suggest improvements, and fully commit to safety initiatives. Positive relationships ensure safety is treated as a joint priority rather than an imposed requirement. Ensuring contractors are properly trained and competent is vital for safe operations. A comprehensive training framework should cover onboarding, job-specific safety training, and regular refreshers. Toolbox talks, safety drills, and ongoing competency assessments reinforce knowledge and keep safety at the forefront of workers' minds. By systematically verifying competency, organizations can be confident that contractors not only understand safety protocols but can also apply them effectively in practice.

4.2 Quantitative Analysis

4.2.1 Descriptive analysis

Out of the 500 O&G professionals invited to participate in the study, 142 responded positively representing a response rate of 28%. The survey showed a clear regional distribution, with the Middle East leading at 41% of responses, followed by North America at 31%. Africa contributes 14% of the responses, while Europe and Asia/Australia/New Zealand account for 9% and 5%, respectively. The high response rate from the Middle East reflects the region’s significant O&G operations, where contractor safety is a major focus due to the scale and complexity of projects. North America’s strong response is attributed to its mature safety culture, heavily regulated by agencies like OSHA. Africa’s response suggests emerging markets that may still be developing

comprehensive safety frameworks, while Europe's smaller share could be due to its shift towards renewable energy, though it maintains high safety standards. Asia/Australia/New Zealand's response rate, although the lowest, highlights the diversity within the region, where countries like Australia likely have advanced safety practices compared to other parts of Asia. This data suggests that contractor safety practices are most mature in regions with significant O&G infrastructure and regulatory frameworks, while emerging markets like Africa may require more emphasis on safety education and practices. Further research could explore the relationship between response volume and safety incident rates, as well as the role of safety training and technological tools in improving contractor safety across these regions (See Figure.4.1).

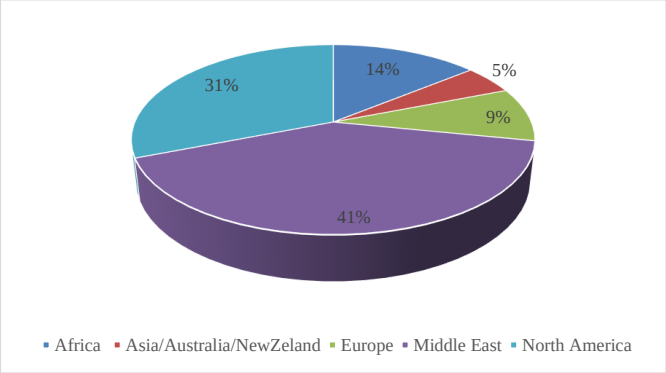

Figure 4.1: Survey Participants Geographical Zone
Source: Author's compilation

For the demographic analysis, the respondent group comprised a diverse and well-balanced mix of roles and disciplines, making it a representative sample for the study. The highest proportion of participants were Senior Manager Executives (26.8%), followed by Intermediate Leaders (22.5%), Frontline Leaders (19.7%), Frontline Employees (19.0%), and Others (12.0%). In terms of discipline, Health, Safety, and Environment (HSE) professionals constituted the largest group (39.4%), followed by Operations (18.3%), Engineering (17.6%), Maintenance/Turnaround &

Inspection (T&I) (9.2%), Other disciplines (8.5%), and Project Management (7.0%). The majority of respondents (85.9%) had more than 10 years of professional experience, while 8.5% had between 5 and 10 years, and only 5.6% had less than 5 years. This distribution reflects a strong and experienced respondent base. However, a noted limitation is the relatively low percentage of participants with less than five years of experience, which may result in a slight underrepresentation of early-career perspectives in the findings (See Table 4.7).

Table 4.7. Demographic Analysis

Category	Subcategory	Frequency	Percentage
Position	Frontline Employee	27	19.0%
	Frontline Leader	28	19.7%
	Intermediate Leader	32	22.5%
	Other	17	12.0%
	Senior Manager Executive	38	26.8%
Discipline	Engineering	25	17.6%
	HSE	56	39.4%
	Maintenance/Turn Around & Inspection (T&I)	13	9.2%
	Operations	26	18.3%
	Other (Please specify)	12	8.5%
	Project Management	10	7.0%
Experience	0-5 years	8	5.6%
	5-10 years	12	8.5%
	More than 10 years	122	85.9%
	Total	142	100.0%

Commented [MS2]: Add percentage sign

Survey Question One: "What is your position in the organizational hierarchy?"

The survey revealed that 27% of respondents were senior managers/executives, 22% intermediate leaders, 20% frontline leaders, 19% frontline employees, and 13% held other roles such as safety

officers or technical staff. The significant representation from leadership (69%) highlights a strong commitment to safety at both strategic and operational levels, while the balanced input from frontline leaders and workers provides valuable insight into day-to-day safety practices. This distribution ensures a comprehensive understanding of safety culture across all organizational levels, capturing both high-level policy direction and on-the-ground realities (See Figure 4.2).

Figure 4.2: Survey Question One
Source: Author's compilation

Survey Question Two: ''What is your discipline?"

The survey participants represented a diverse range of disciplines, reflecting the industry's multifaceted expertise. HSE (Health, Safety, and Environment) dominated the representation with 39% of participants, underscoring the industry's strong emphasis on safety, risk management, and regulatory compliance. Meanwhile, Engineering and Operations each comprised 18% of the participants, highlighting the critical role of technical expertise in design, execution, and operational efficiency. Maintenance/Turn Around & Inspection (T&I) accounted for 9% of the participants, highlighting the importance of asset integrity, preventive maintenance, and periodic

shutdowns to ensure equipment reliability. Project Management represented 7%, reflecting the need for structured planning, coordination, and execution in large-scale projects. The other category accounted for 9% of the participants, including specialized roles such as Process Safety, Emergency Response, Fire Department, Sales and Service, Operations Commercial, and Change Leadership. These roles play a crucial part in bridging technical, business, and emergency preparedness functions. The overall distribution of participants demonstrates a well-balanced representation of safety, engineering, operations, and management disciplines, ensuring a holistic approach to operational excellence and business sustainability (See Figure 4.3).

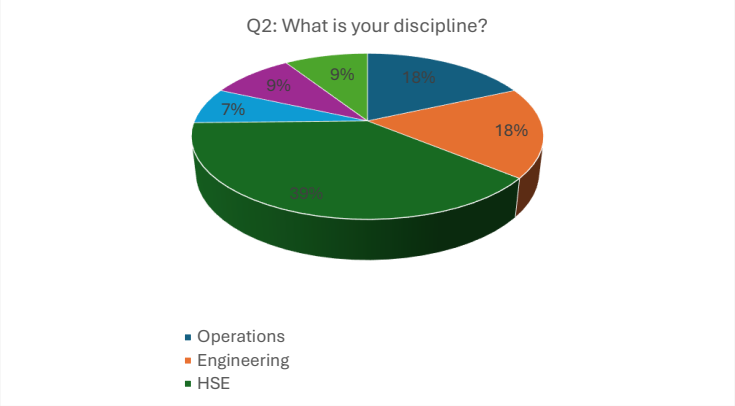

Figure 4.3: Survey Question Two
Source: Author's compilation

Survey Question Three: "How many years of experience do you have?"

This survey's question highlighted the participants' years of experience. It revealed that 86% of respondents had over 10 years of experience, indicating that the majority of those surveyed were highly experienced professionals who likely possess in-depth knowledge of CSM in the O&G industry. This extensive experience ensured that the feedback gathered is rooted in years of practical expertise and familiarity with safety protocols. Meanwhile, 8% of respondents had 5-10

years of experience, representing professionals who are still relatively seasoned but may have more recent exposure to evolving safety practices. Lastly, 6% of respondents had less than 5 years of experience, providing valuable insights from newer professionals by shedding light on how safety practices are perceived by those who are just starting their careers. Overall, the overwhelming representation of experienced professionals suggests that the survey results will likely align with the well-established industry norms and best practices in contractor safety (See Figure 4.4).

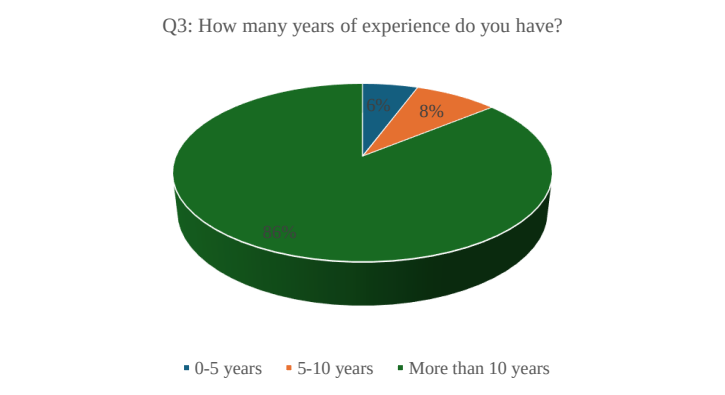

Figure 4.4: Survey Question Three
Source: Author's compilation

Survey Question Four: "The safety culture at our organization promotes a strong focus on contractor safety?"

Survey question four examined whether the organisation's safety culture prioritizes contractors' safety. The survey results showed that 85% of respondents agreed or strongly agreed that their organization prioritized contractor safety, reflecting generally a positive safety culture. However, the 15% of respondents who disagreed, strongly disagreed, or remained neutral offered valuable insights. Within this group, 60% are frontline employees or leaders, and 80% have more than 10 years of experience, suggesting that seasoned personnel closest to daily operations may be noticing

gaps in safety practices. Additionally, 45% of these respondents are from maintenance and operations, teams typically exposed to the highest safety risks due to hands-on, high-hazard tasks. Their concerns may point to practical safety challenges such as inadequate contractor supervision, procedural drift, or gaps in hazard mitigation. Another 40% are from HSE, indicating that even safety specialists see room for improvement, which is significant since they are responsible for driving safety culture. These reservations could suggest issues with policy implementation, field compliance, or communication breakdowns. Auditors are also represented in the 15%, suggesting that those responsible for evaluating safety processes are identifying inconsistencies or gaps during their reviews. This data suggests that the disconnect may stem from how safety policies are translated into field practices, with frontline and safety teams feeling that safety initiatives are not fully effective or consistently applied in high-risk areas like maintenance and operations. Addressing these concerns through targeted listening sessions, focused audits, or enhanced frontline leadership engagement could help bridge the gap and further strengthen the safety culture (See Figure 4.5).

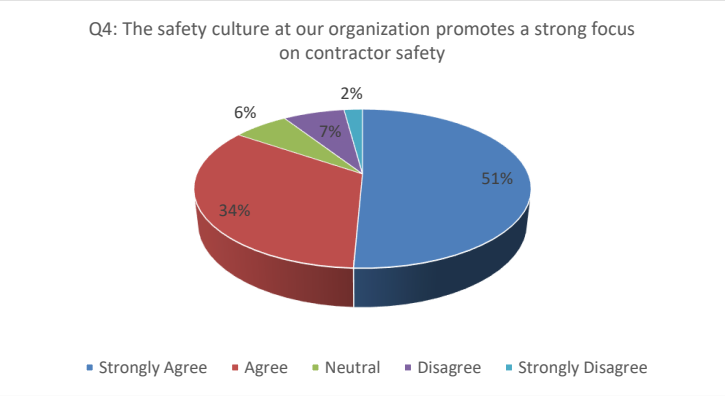

Figure 4.5: Survey Question Four
Source: Author's compilation

Survey Question Five: "Contractor management system is available and implemented effectively so that contracted work is completed safely?"

Survey Question Five assessed whether the CMS is available and implemented effectively to ensure that the contracted work is completed safely. The results showed that 79% of participants agreed or strongly agreed that the CMS is effective in ensuring safety during contracted work, while 21% were either neutral, disagreed, or strongly disagreed. Among the participants, 73% had over 10 years of experience, 8% had 5-10 years of experience, and 6% had less than 5 years of experience. In terms of disciplines, 46% were from safety, 23% from operations, and 20% from turnaround and maintenance. Regarding organizational hierarchy, 50% were senior managers and executives, 43% were intermediate leaders, and 7% were frontline employees or frontline leaders. These results suggest that while the majority recognized the effectiveness of the CMS in promoting safety, there may be gaps in perception across experience levels and organizational roles that could be addressed to further improve its implementation. To enhance the effectiveness of the CMS, several recommendations can be considered: provide enhanced training for frontline and mid-level leaders to improve their understanding and implementation of safety protocols; establish regular feedback loops from frontline employees and contractors to identify safety gaps; increase senior leadership engagement through active participation in safety audits, site visits, and performance reviews; address experience gaps by establishing mentorship programs to share safety best practices; tailor communication for different organizational levels to ensure relevant safety information is provided; implement routine safety audits to evaluate the system's effectiveness and make adjustments as needed; ensure all safety protocols and management system guidelines are clearly documented and accessible to all stakeholders; and regularly reinforce safety culture

through leadership visibility, internal campaigns, and recognition of safety milestones, ensuring that safety is prioritized at all levels of the organization (See Figure 4.6).

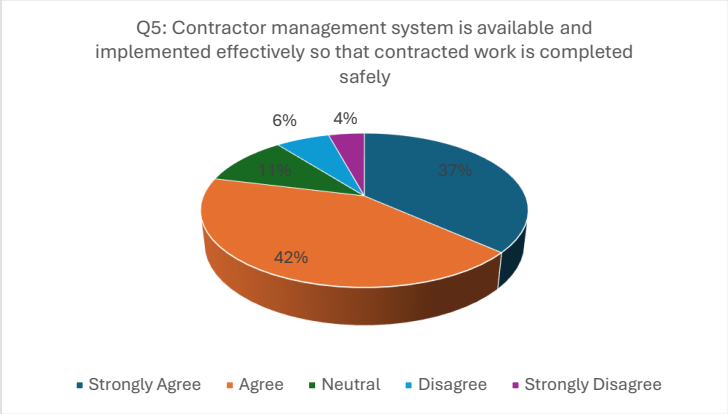

Figure 4.6: Survey Question Five
Source: Author's compilation

Survey Question Six: "Contractor historical Safety performance is considered as a go/no-go criterion in the contractor selection process?"

The survey revealed that 85% of participants agreed or strongly agreed that historical safety performance is considered as a go/no-go criterion in contractor selection, while 15% were neutral, disagreed, or strongly disagreed. Notably, 72% of those who disagreed had over 10 years of experience, 14% had between 5 to 10 years, and 14% had less than 5 years of experience. In terms of disciplines, 45% were from HSE, 23% from Operations, and 27% from Turnaround and Maintenance. Regarding organizational hierarchy, 40% were senior managers or executives, while 55% were frontline employees or frontline leaders. This data suggests that while the majority recognized the importance of safety performance in contractor selection, the mixed responses across experience levels and frontline roles indicate a need to ensure the criteria are consistently

applied and well-communicated across all levels of the organization. To strengthen this, safety performance should be incorporated as a mandatory go/no-go criterion in the contractor selection process before any financial decisions are made, ensuring safety is prioritized from the outset. All relevant safety performance data, including historical safety records and incident history, should be clearly documented and accessible to decision-makers and communicated consistently across the organization. Safety performance should be integrated into the contractor vetting process alongside cost, technical expertise, and capacity, making it a fundamental factor in contractor evaluation. Senior leaders must be held accountable for ensuring contractor safety data is reviewed prior to financial decisions, reinforcing that safety is a primary consideration (See Figure 4.7).

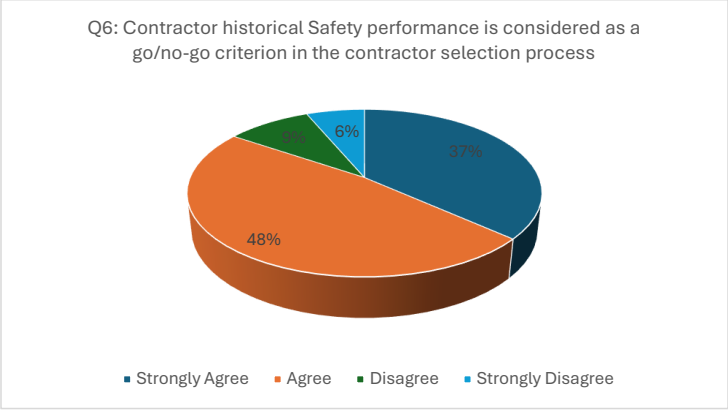

Figure 4.7: Survey Question Six
Source: .Author's compilation

Survey Question Seven: "Leadership is committed and accountable for Contractor Safety?"

The survey showed that 85% of participants recognized leadership's commitment to contractor safety, with 80% agreeing or strongly agreeing, while 20% were neutral, disagreed, or strongly disagreed. Among those who disagreed, 76% had over 10 years of experience, suggesting that

seasoned professionals may perceive gaps between leadership intent and on-the-ground execution. In terms of disciplines, 45% were from HSE, 21% from Operations, and 24% from Turnaround and Maintenance, indicating that teams working closely with contractors during high-risk tasks may experience the impact of leadership accountability most acutely. Additionally, 52% of those who disagreed were frontline employees or leaders, emphasizing the need for leadership commitment to be consistently visible at the worksite level. While overall sentiment is positive, the data suggests an opportunity to further strengthen leadership accountability by enhancing direct engagement with frontline teams, conducting frequent site visits, and reinforcing safety expectations through continuous dialogue and real-time safety leadership. Strengthening this connection can help close perception gaps, foster mutual accountability, and drive safety excellence across all operational levels (See Figure 4.8).

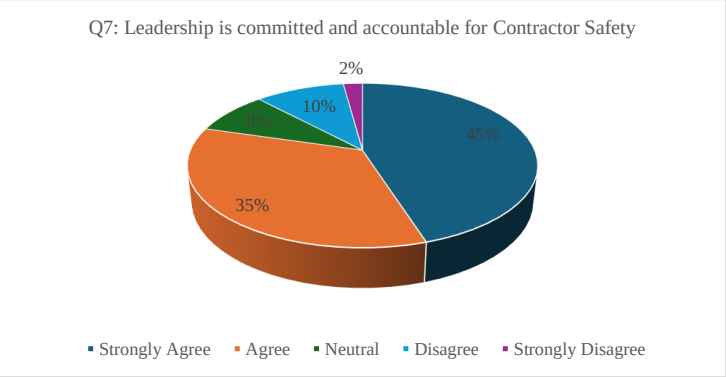

Figure 4.8: Survey Question Seven
Source: Author's compilation

Survey Question Eight: "Leadership effectively communicates HSE expectations to contractors prior to start of contract work and during the work execution?"

The survey revealed that 80% of participants strongly agreed or agreed that leadership effectively communicates HSE expectations to contractors before and during work execution, while 19% were neutral, disagreed, or strongly disagreed. Among those who disagreed, 74% had over 10 years of experience, suggesting that seasoned professionals may be more aware of communication gaps or inconsistencies. Discipline-wise, 44% were from HSE, 18% from Operations, and 26% from Turnaround and Maintenance, indicating that teams engaged in high-risk, dynamic activities may feel communication needs to be more responsive to evolving hazards. Additionally, 56% of those who disagreed were frontline employees or leaders, highlighting that top-down safety messages may not always reach those closest to the work. While leadership communication is generally effective, this data suggests that frontline teams and less experienced workers may benefit from more consistent, practical, and ongoing communication efforts. Opportunities for improvement include mandatory pre-work HSE kickoff meetings, regular safety huddles and site walkthroughs with leaders, structured feedback mechanisms, and increased leadership presence on-site. Strengthening these communication loops can reinforce safety expectations, promote continuous learning, and ultimately enhance safety culture across all levels of the organization (See Figure 4.9).

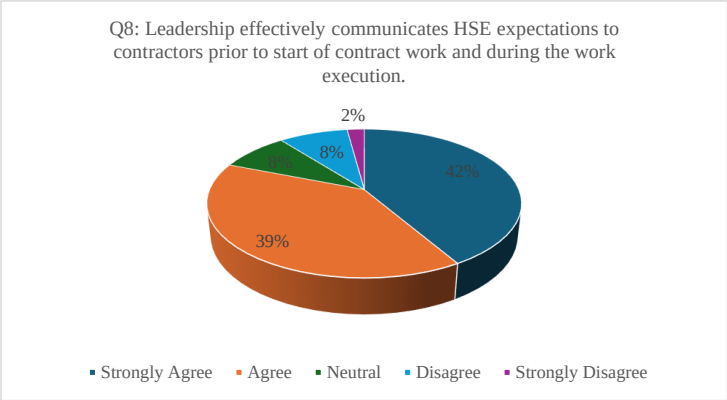

Figure 4.9: Survey Question Eight
Source: Author's compilation

Survey Question Nine: "The contractors' safety management plans effectively address known risks and hazards of assigned Scopes of Work (SoW)?"

This question asked about the effectiveness of contractors' safety management plans in addressing known risks and hazards for assigned SoW. The survey indicated that 77% of participants agreed or strongly agreed that contractors' safety management plans effectively address these risks, while 23% were neutral, disagreed, or strongly disagreed, highlighting potential gaps in safety plan effectiveness. Key insights included that 78% of those who disagreed have over 10 years of experience, suggesting seasoned professionals generally trust the plans, but their expertise might make them more aware of subtle safety gaps. The data also showed that 41% of participants were from HSE, 13% from Operations, and 25% from Turnaround and Maintenance, implying that operations and maintenance teams often closer to field hazards may see more room for improvement. Additionally, while 47% of respondents were senior managers or executives, 41% were frontline employees or leaders, whose feedback is invaluable as they directly apply safety measures on the ground. Opportunities for improvement include strengthening risk assessments to ensure thoroughness, enhancing hazard controls to be realistic and easy to implement, providing more discipline-specific training with real-life scenarios, creating regular feedback loops for frontline workers to share safety concerns, and pairing less experienced workers with seasoned professionals through mentorship programs to bridge experience gaps and foster stronger safety practices (See Figure 4.10).

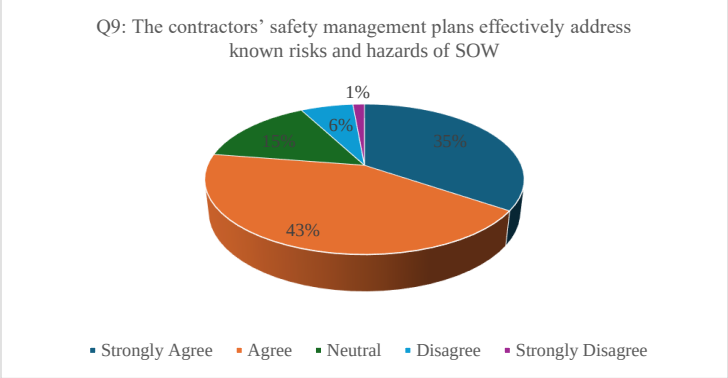

Figure 4.10: Survey Question Nine
Source: Author's compilation

Survey Question Ten: "Contractors receive adequate safety training and records are verified before starting SoW?"

This question focused on whether contractors receive adequate safety training and if records are verified before starting their SoW. The survey results, showed that a significant majority (74% of participants) had a positive view regarding the effectiveness of contractors' safety management plans in addressing known risks and hazards. However, 26% were either neutral, disagreed, or strongly disagreed, indicating room for improvement. Notably, 80% of those who disagreed had over 10 years of experience, suggesting a disconnect between seasoned professionals and the current safety management approach or differences in how risks and hazards are identified and managed. This could reflect concerns about the adequacy or comprehensiveness of the safety training or the clarity of safety plans. The distribution across disciplines (41% from HSE, 24% from Operations, and 19% from Turnaround and Maintenance) indicated that safety training may need to be tailored more effectively across different operational areas, ensuring that contractors' safety plans are specific to the context of each discipline. The breakdown by organizational

hierarchy (38% senior managers/executives, 46% frontline employees/leaders) showed that leadership alignment with safety practices is crucial. Frontline leaders and employees may benefit from clearer communication regarding how safety training is delivered and verified. To address these concerns, the organization might consider reviewing safety training programs to ensure comprehensiveness, especially for high-risk areas; gathering feedback from more experienced individuals to better understand their concerns; and tailoring safety management plans to different disciplines while ensuring effective communication to both senior management and frontline workers (See Figure 4.11).

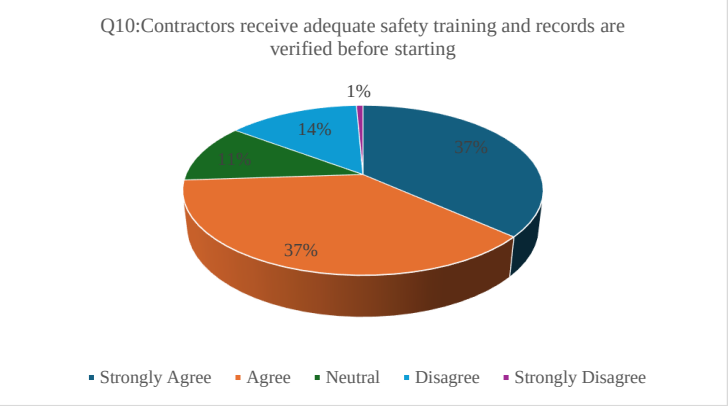

Figure 4.11: Survey Question Ten
Source: Author's compilation

Survey Question Eleven: "Contractors can easily report safety incidents or concerns without fear of repercussions?"

This question assessed whether contractors can easily report safety incidents or concerns without fear of repercussions. The survey revealed that 75% of participants strongly agreed or agreed that contractors feel safe reporting incidents, reflecting a positive safety culture that encourages open communication. However, 25% of respondents disagreed or strongly disagreed, highlighting an

area for improvement. Among those who disagreed, 65% had over 10 years of experience, suggesting that seasoned professionals may have witnessed situations where fear of consequences hindered incident reporting. In terms of discipline, 49% were from HSE, 19% from Operations, and 16% from Turnaround and Maintenance teams often facing high-risk tasks where incident reporting is critical for safety improvements. Additionally, 38% of respondents were senior managers or executives, while 35% were frontline employees or leaders, indicating that concerns span across all organizational levels.

This data suggests that while the overall sentiment is positive, strengthening psychological safety through leadership visibility, anonymous reporting channels, and reinforcing non-punitive reporting policies could further empower contractors to report safety concerns. Promoting a no-blame culture where incident reports are treated as learning opportunities rather than fault-finding exercises is essential to building trust and encouraging proactive hazard identification. This approach not only drives continuous safety improvements but also reinforces the idea that safety is a collective responsibility shared by all (See Figure 4.12).

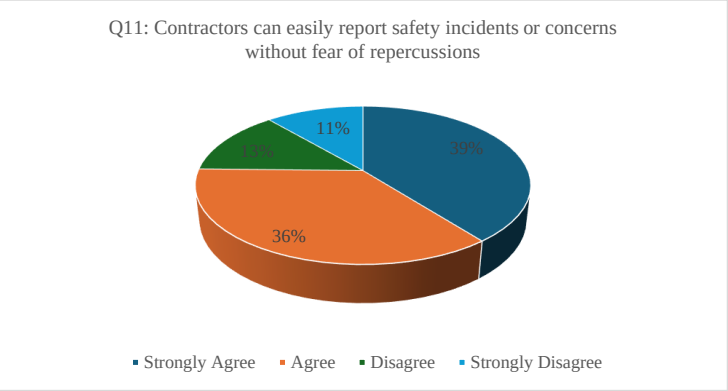

Figure 4.12: Survey Question Eleven
Source: Author's compilation

Survey Question Twelve: "Contractor HSE performance is regularly evaluated and tracked and used to guide continuous improvement in safety management practices?"

This question assessed whether contractor HSE performance is regularly evaluated and tracked and used to guide continuous improvement in safety management practices. The survey revealed that 72% of participants strongly agreed or agreed that contractor HSE performance is effectively tracked and utilized to improve safety practices. However, 25% of respondents disagreed or strongly disagreed, suggesting room for enhancement in this area. Among those who disagreed, 83% had over 10 years of experience, which could indicate that seasoned professionals, who are likely to have a broader view of past performance, perceive gaps in the evaluation or tracking of contractor safety. In terms of discipline, 38% were from HSE, 18% from Operations, and 20% from Turnaround and Maintenance, all of whom are closely involved with safety management and may be seeing opportunities for more robust tracking and performance evaluation. Regarding organizational hierarchy, 48% were senior managers or executives, while 45% were frontline employees or frontline leaders, signaling that concerns span across different levels of the organization.

This data suggests that while the majority recognize the importance of tracking HSE performance for continuous improvement, there may be inconsistencies in how this is implemented or communicated. To enhance the effectiveness of contractor HSE performance evaluation, conducting regular audits and field inspections is essential to ensure that safety practices are being followed consistently. Additionally, setting SMART objectives and meaningful KPIs that are improvement-driven including both lagging and leading indicators can help drive continuous improvement. By making these KPIs more actionable and result-oriented, organizations can more effectively monitor performance and address areas needing improvement. Strengthening the

regular evaluation of contractor HSE performance, improving visibility into tracking systems, and ensuring that feedback is used effectively across all levels will help enhance safety management practices and foster a culture of continuous improvement (See Figure 4.13).

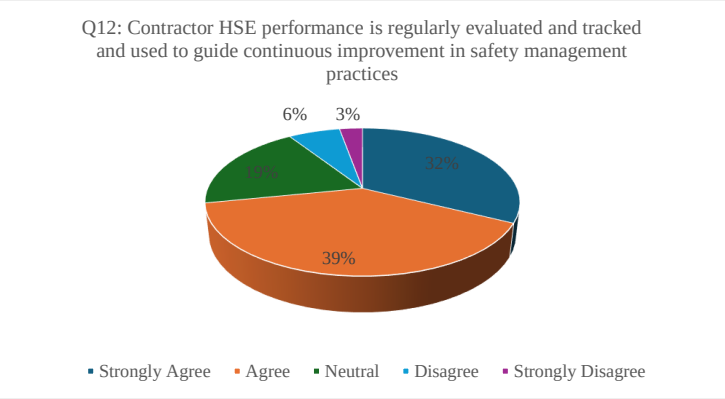

Figure 4.13: Survey Question Twelve
Source: Author's compilation

Survey Question Thirteen: "Contractors' safety management practices are integrated with project planning and execution from the start.?"

This question assessed whether contractors' safety management practices are integrated with project planning and execution from the start. The survey revealed that 67% of participants strongly agreed or agreed that contractors' safety management practices are integrated with project planning and execution from the start, while 33% were either neutral, disagreed, or strongly disagreed. Among those who disagreed or remained neutral, 74% had over 10 years of experience, 7% had between 5 to 10 years, and 7% had less than 5 years of experience. This suggests that more experienced participants may have observed gaps in the early alignment of safety practices with project phases. In terms of disciplines, 43% were from HSE, 15% from Operations, 7% from Turnaround and Maintenance, and 28% from Project, Engineering, and other disciplines

highlighting that teams directly involved in project execution and high-risk tasks might perceive misalignments between safety planning and field realities. From an organizational hierarchy perspective, 40% were senior managers and executives, 51% were frontline and frontline leaders, and 9% were in other roles, indicating that both strategic decision-makers and those closest to the worksite see opportunities for improvement. To enhance safety integration, organizations should ensure HSE representatives and contractor safety leads are actively involved in initial project planning, conduct pre-execution safety workshops, and establish defined safety integration checkpoints during project phases. Encouraging joint risk assessments between contractors and internal teams fosters shared ownership of safety outcomes, while regular site visits, safety walks, and real-time feedback loops help verify safety measures are effectively implemented. These steps can help bridge gaps, reduce risk exposure, and drive safety excellence throughout the project lifecycle (See Figure 4.14).

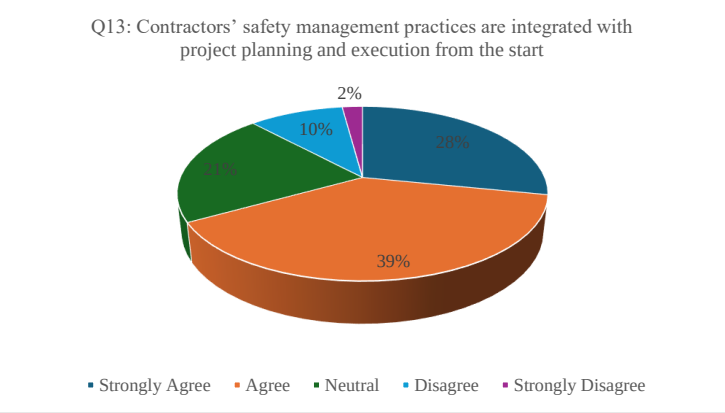

Figure 4.14: Survey Question Thirteen
Source: Author's compilation

Survey Question Fourteen: "Contractors receive the necessary support and supervision to improve safety practices from internal teams?"

The survey results revealed that 72% of participants strongly agreed or agreed that contractors received the necessary support and supervision from internal teams to enhance safety practices, while 28% were neutral, disagreed, or strongly disagreed. Among those who disagreed or remained neutral, 83% had over 10 years of experience, 5% had between 5 to 10 years, and 7% had less than 5 years of experience. In terms of disciplines, 45% were from HSE, 18% from Operations, 18% from Turnaround and Maintenance, and 20% from Project, Engineering, and other disciplines showing that teams directly involved in high-risk and project activities may be most aware of gaps in contractor support. From an organizational hierarchy perspective, 43% were senior managers and executives, 48% were frontline and frontline leaders, and 10% held other roles, emphasizing that both decision-makers and those closest to the worksite see room for improvement. To strengthen contractor support, organizations should promote a more collaborative environment by assigning dedicated safety liaisons to contractors, conducting regular safety coaching sessions, and facilitating knowledge-sharing workshops. Increasing internal team presence through frequent site visits, real-time safety observations, and interactive toolbox talks can enhance safety awareness and bridge communication gaps. Additionally, establishing structured mentorship programs and joint incident reviews can help contractors learn from internal teams' experiences, accelerating safety improvements and fostering continuous learning (See Figure 4.15).

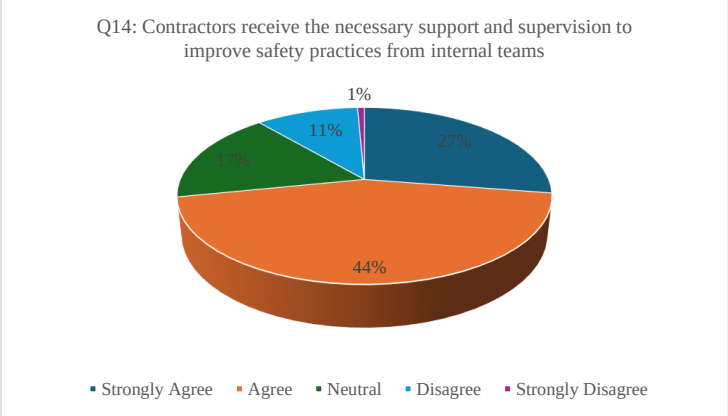

Figure 4.15: Survey Question Fourteen
Source: Author's compilation

Survey Question Fifteen: "Contractors are audited, and compliance assured during the execution of the SoW?"

The survey results revealed that 73% of participants strongly agreed or agreed that contractors are audited, and compliance is ensured during the execution of SoW, while 27% were neutral, disagreed, or strongly disagreed. Among those who expressed concerns, 77% had over 10 years of experience, 8% had between 5 to 10 years, and 7% had less than 5 years of experience. In terms of disciplines, 33% were from HSE, 15% from Operations, 21% from Turnaround and Maintenance, and 31% from Project, Engineering, and other disciplines highlighting that teams with direct oversight of high-risk tasks and project execution may be most aware of potential compliance gaps. From an organizational hierarchy perspective, 44% were senior managers and executives, 46% were frontline and frontline leaders, and 10% held other roles, demonstrating that both leadership and field-level personnel recognized the need for strengthened compliance assurance. To enhance contractor compliance and safety performance, organizations should conduct more frequent audits and unannounced inspections, develop digital compliance tracking

systems, and implement real-time reporting mechanisms. Setting SMART compliance objectives with both lagging and leading KPIs can help track progress, while post-audit debriefs, and corrective action reviews can drive continuous improvement. Strengthening contractor training on site-specific safety requirements and fostering an open feedback culture where contractors can raise compliance concerns without fear of repercussions will also contribute to sustained safety excellence (See Figure 4.16).

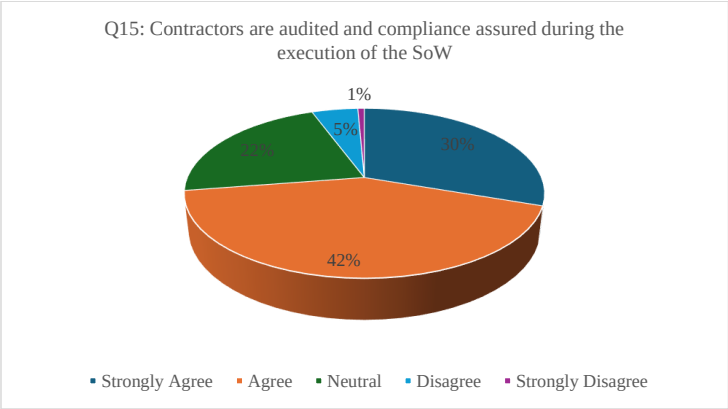

Figure 4.16: Survey Question Fifteen
Source: Author's compilation

Survey Question Sixteen: "Cost considerations take precedence over safety performance when managing contractors?"

The survey revealed that 40% of participants strongly agreed or agreed that cost considerations take precedence over safety performance when managing contractors, indicating a significant concern about the prioritization of financial factors over safety. Among those who disagreed or were neutral, 84% had over 10 years of experience, 9% had between 5 to 10 years, and 7% had less than five years of experience. In terms of disciplines, 44% were from HSE, 21% from Operations, 16% from Turnaround and Maintenance, and 19% from Project, Engineering, and

other disciplines. From an organizational hierarchy perspective, 46% were senior managers and executives, 44% were frontline employees and frontline leaders, and 10% held other roles. This data suggests that while most participants recognize the importance of safety, a sizable portion still perceives cost as a dominant factor, which could undermine a strong safety culture.

To address this issue, organizations should integrate contractor safety performance as a critical go/no-go criterion in procurement and contract award processes, ensuring that safety track records are given equal or greater weight than cost considerations. Leadership must reinforce this by embedding safety expectations in contract terms, enforcing prequalification requirements based on safety history, and ensuring that budget allocations account for necessary safety measures. Additionally, financial decisions should be aligned with long-term risk mitigation strategies, demonstrating that prioritizing safety ultimately leads to cost savings by reducing incidents, downtime, and liabilities. Strengthening internal governance through cross-functional reviews involving HSE, operations, and procurement teams can help maintain a balance between cost efficiency and safety excellence, ensuring that contractor selection and management practices consistently uphold the organization's safety values (See Figure 4.17).

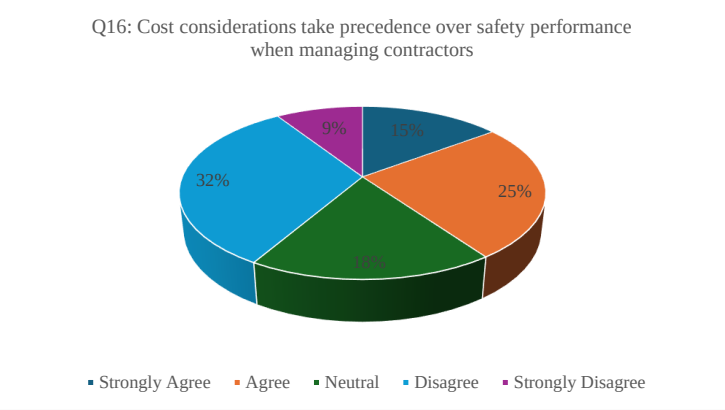

Figure 4.17: Survey Question Sixteen

Source: Author's compilation

Survey Question Seventeen: "Contractors are treated fairly and actively involved in the decision-making process related to safety?"

The survey revealed that 63% of participants strongly agreed or agreed that contractors are treated fairly and actively involved in safety-related decision-making, while 37% were neutral, disagreed, or strongly disagreed. Among those who expressed concerns, 81% had over 10 years of experience, 8% had between 5 to 10 years, and 11% had less than 5 years of experience. In terms of disciplines, 53% were from HSE, 17% from Operations, 15% from Turnaround and Maintenance, and 15% from Project, Engineering, and other disciplines. Regarding organizational hierarchy, 47% were senior managers and executives, 43% were frontline employees and frontline leaders, and 10% held other roles. This data suggests that while a majority believe in fair treatment and contractor involvement in safety, a notable percentage especially those with extensive experience feel that contractors may not always have an equitable voice in safety-related decisions.

To enhance contractor engagement in safety decision-making, organizations should establish structured communication channels, such as contractor safety forums and joint safety committees, to ensure their input is valued and incorporated into operational safety strategies. Leadership should reinforce a collaborative approach by involving contractors in pre-job safety planning, hazard assessments, and incident reviews, fostering a sense of shared responsibility. Additionally, promoting a just and no-blame culture will encourage contractors to report safety concerns and provide feedback without fear of repercussions. Implementing transparent decision-making processes, where contractor perspectives are actively considered in policy and procedural updates, can further bridge the gap and strengthen trust. Finally, conducting periodic surveys and engagement sessions focused on contractor experiences will help identify specific areas for

improvement, ensuring that safety management remains an inclusive and continuously evolving process (See Figure 4.18).

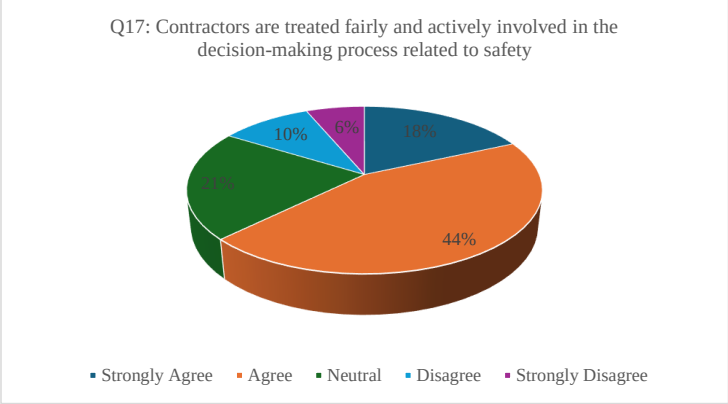

Figure 4.18: Survey Question Seventeen
Source: Author's compilation

Survey Question Eighteen: "The Sope of Work (SoW) is clearly defined, with well-communicated expectations, milestones, and deliverables?"

The survey results indicated that 73% of participants strongly agreed or agreed that SoW is clearly defined, with well-communicated expectations, milestones, and deliverables, while 27% were neutral, disagreed, or strongly disagreed. Among those who expressed concerns, 84% had over 10 years of experience, which may reflect a deeper awareness of how ambiguities in SoW definitions can affect safety and performance. In terms of disciplines, 29% were from HSE, 18% from operations, 18% from turnaround and maintenance, and 8% from project, engineering, and other disciplines. Regarding organizational hierarchy, 47% were senior managers and executives, 53% were frontline employees and frontline leaders, and 9% held other roles. The significant proportion of experienced professionals who raised concerns suggests a perceived gap in contractor workforce competency, which could impact safety, efficiency, and overall project execution. To address these

concerns, organizations should implement structured pre-mobilization alignment workshops that include contractors, project teams, and HSE representatives. These sessions should focus on clarifying SoW expectations, verifying contractor understanding, and identifying training or competency gaps before work begins ensuring alignment from planning through execution (See Figure 4.19).

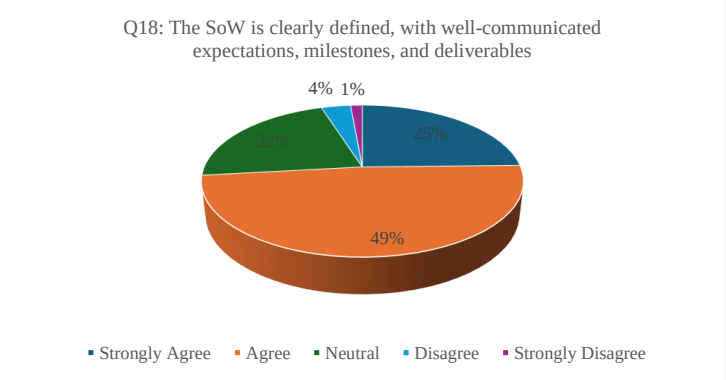

Figure 4.19: Survey Question Eighteen
Source: Author's compilation

Survey Question Nineteen: "The contractors' workforce is competent and adequately skilled to meet the SoW requirements?"

The survey results revealed that 61% of participants strongly agreed or agreed that the contractors' workforce is competent and adequately skilled to meet the SoW requirements, while 39% were neutral, disagreed, or strongly disagreed. Among those who expressed concerns, 80% had over 10 years of experience, 8% had between 5 to 10 years, and 12% had less than 5 years. In terms of disciplines, 50% were from HSE, 14% from Operations, 16% from Turnaround and Maintenance, and 20% from Project, Engineering, and other disciplines. Regarding organizational hierarchy, 48% were senior managers and executives, 43% were frontline employees and frontline leaders,

and 9% held other roles. The significant proportion of experienced professionals who raised concerns suggests a perceived gap in contractor workforce competency, which may impact safety, efficiency, and overall project execution.

To address these concerns, organizations should implement a robust contractor pre-qualification process that includes competency verification, certifications, and practical skill assessments before contract award. Strengthening contractor training programs with targeted upskilling initiatives, on-the-job mentorship, and competency-based evaluations will help bridge existing skill gaps. Additionally, organizations should establish a structured onboarding process for contractors, ensuring that workforce competency aligns with SoW requirements through continuous training, refresher courses, and hands-on safety drills. Conducting periodic field competency assessments and tracking workforce performance through key performance indicators (KPIs) will enable proactive identification of areas needing improvement. Finally, fostering a knowledge-sharing culture by integrating experienced personnel into contractor training and mentorship programs will help elevate overall workforce capabilities and ensure a consistently high standard of execution (See Figure 4.20).

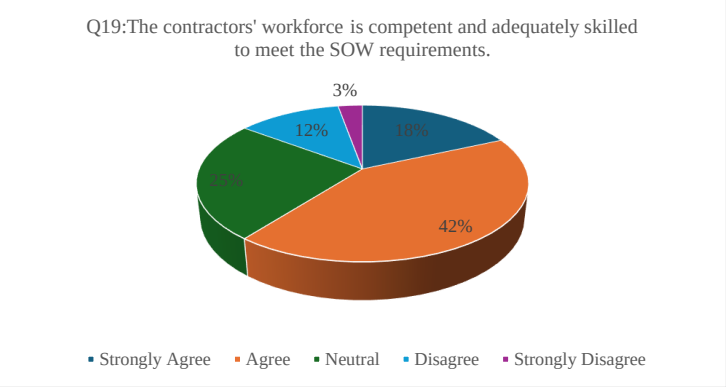

Figure 4.20: Survey Question Nineteen
Source: Author's compilation

Survey Question Twenty: "Effective processes and procedures are in place to monitor contractor compliance with HSE protocols?"

The survey revealed that 73% of participants strongly agreed or agreed that effective processes and procedures are in place to monitor contractor compliance with HSE protocols, while 27% were neutral, disagreed, or strongly disagreed. Among those who expressed concerns, 76% had over 10 years of experience, 8% had between 5 to 10 years, and 16% had less than 5 years. In terms of disciplines, 47% were from HSE, 18% from Operations, 16% from Turnaround and Maintenance, and 18% from Project, Engineering, and other disciplines. Regarding organizational hierarchy, 45% were senior managers and executives, 45% were frontline employees and frontline leaders, and 9% held other roles. The relatively high percentage of experienced professionals and HSE personnel raising concerns suggests that while monitoring systems exist, gaps may remain in field compliance, procedural adherence, or the real-time effectiveness of safety oversight mechanisms. To enhance monitoring and ensure sustained compliance, organizations should implement digital HSE platforms for live tracking of contractor activities, incident reporting, and protocol adherence. Regular and unannounced audits, coupled with field inspections, can help verify that safety practices are consistently followed, while also identifying areas for improvement. Strengthening contractor onboarding with detailed HSE training and clear expectations around compliance can bridge knowledge gaps early on. Establishing real-time feedback loops between contractors and internal safety teams will allow immediate corrective actions and promote continuous improvement. Additionally, setting SMART objectives and meaningful KPIs that include both leading and lagging safety indicators will provide measurable insights into contractor performance. Finally, promoting a culture of shared accountability where contractors feel empowered to report

non-compliance without fear of repercussions will help drive safety ownership across all levels of the organization (See Figure 4.21).

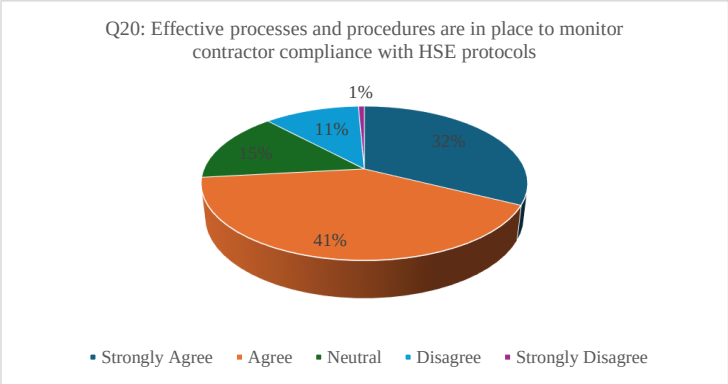

Figure 4.21: Survey Question Twenty
Source: Author's compilation

Survey Question Twenty-One:" Effective communication and collaboration processes are available to ensure successful HSE management?"

The survey results showed that 78% of participants strongly agreed or agreed that effective communication and collaboration processes support successful HSE management, while 22% were neutral, disagreed, or strongly disagreed. Of those expressing concerns, 74% had over 10 years of experience, 13% had between 5 to 10 years, and 13% had less than 5 years. In terms of disciplines, 52% were from HSE, 19% from Operations, 23% from Turnaround and Maintenance, and 3% from Project, Engineering, and other disciplines. Hierarchically, 35% were senior managers and executives, 55% were frontline employees and frontline leaders, and 10% held other roles. The concerns raised by experienced personnel and frontline workers who are directly exposed to daily risks suggest potential breakdowns in information flow, delayed safety communication, or inconsistent collaboration between internal teams and contractors.

To enhance communication and collaboration, organizations should establish regular safety briefings, toolbox talks, and cross-functional safety huddles to ensure real-time sharing of safety updates and hazard alerts. Implementing digital communication platforms with centralized HSE dashboards can streamline information flow, keeping all teams informed and aligned. Encouraging two-way communication, where contractors feel safe to raise concerns or suggest improvements without fear of blame, is vital for fostering trust and proactive safety management. Embedding communication protocols into project planning such as structured handover meetings, joint safety reviews, and shared safety KPIs can strengthen collaboration from the outset. Finally, leadership should promote visible safety engagement through frequent site visits and active participation in safety discussions to reinforce the message that safety is a shared priority across all levels of the organization (See Figure 4.22).

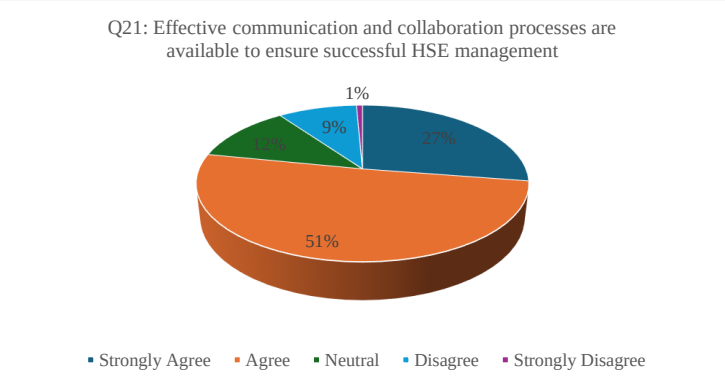

Figure 4.22: Survey Question Twenty-One
Source: Author's compilation

Survey Question Twenty-Two: "Time and budget constraints often hinder the implementation of necessary safety measures?"

The survey results indicated that 49% of participants strongly agreed or agreed that time and budget constraints hinder the implementation of necessary safety measures, while 51% were neutral, disagreed, or strongly disagreed. Among those with concerns, 89% had over 10 years of experience, 8% had between 5 to 10 years, and 3% had less than 5 years. Regarding disciplines, 40% were from HSE, 13% from Operations, 23% from Turnaround and Maintenance, and 42% from Project, Engineering, and other disciplines. Hierarchically, 58% were senior managers and executives, 40% were frontline employees and frontline leaders, and 2% held other roles. The high percentage of experienced personnel and leadership raising concerns suggests that operational pressures may be and budget constraints leading to safety trade-offs, particularly in high-risk environments such as maintenance, turnaround, and project execution.

To address these challenges, organizations should prioritize safety as a non-negotiable investment rather than a cost, ensuring that safety budgets are integrated into project planning from the outset. Implementing risk-based decision-making frameworks can help balance safety requirements with time and financial constraints, ensuring that high-priority risks receive immediate attention. Additionally, fostering a culture where safety is embedded in all business decisions rather than being seen as an obstacle can help align leadership and frontline teams. Setting clear, measurable safety objectives and KPIs, including both lagging and leading indicators, can drive accountability and continuous improvement. Regular audits and field inspections should be conducted to identify potential gaps early and ensure that safety measures remain a priority throughout project execution. By embedding safety into the core of operational planning and decision-making, organizations can mitigate the impact of constraints while maintaining a strong safety performance (See Figure 4.23).

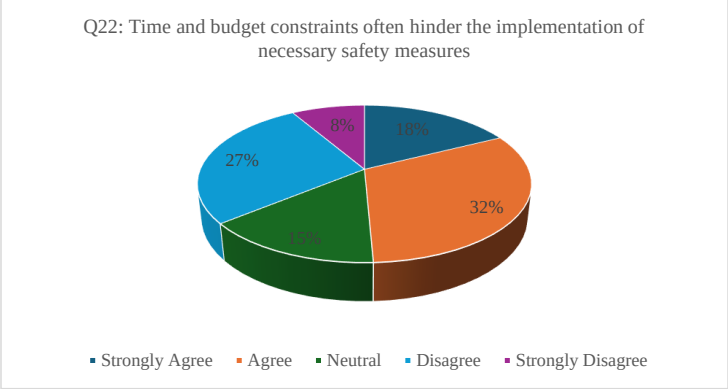

Figure 4.23: Survey Question Twenty-Two
Source: Author's compilation

Survey Question Twenty-Three: "Adequate time and resources are allocated to ensure contractor HSE measures are implemented?"

The survey results indicated that 65% of participants strongly agreed or agreed that adequate time and resources are allocated to contractor HSE measures, while 35% were neutral, disagreed, or strongly disagreed. Among those with concerns, 82% had over 10 years of experience, 6% had between 5 to 10 years, and 12% had less than 5 years. Regarding disciplines, 49% were from HSE, 20% from Operations, 14% from Turnaround and Maintenance, and 18% from Project, Engineering, and other disciplines. Hierarchically, 45% were senior managers and executives, 53% were frontline employees and frontline leaders, and 2% held other roles. The fact that a significant portion of experienced professionals and frontline workers perceive gaps in resource allocation suggests that despite existing efforts, there may be inconsistencies in ensuring HSE measures are fully integrated into contractor management.

To enhance contractor HSE effectiveness, organizations should ensure that resource allocation is risk-based, prioritizing high-hazard activities and critical phases of project execution. Leadership should reinforce the importance of safety through dedicated safety budgets, workforce training,

and proactive engagement with contractors. Implementing structured planning processes that align contractor HSE requirements with project timelines can help mitigate last-minute safety compromises due to scheduling or budget pressures. Additionally, continuous monitoring through audits, inspections, and safety performance tracking can help identify areas where additional resources are needed. Establishing clear accountability for contractor HSE performance, coupled with strong collaboration between internal teams and contractors, will further strengthen safety implementation and drive continuous improvement (See Figure 4.24).

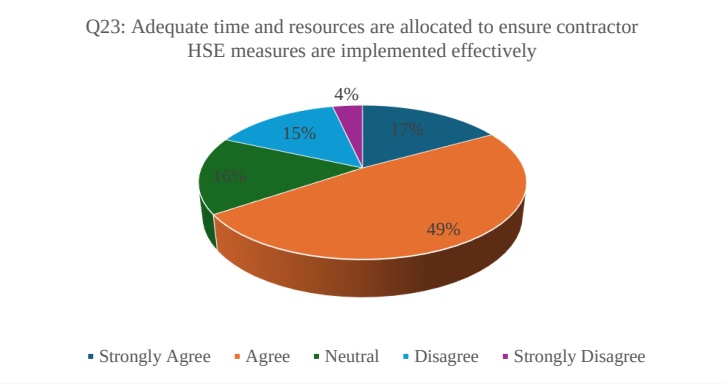

Figure 4.24: Survey Question Twenty-Three
Source: Author's compilation

Survey Question Twenty-Four: "Contractors are actively involved in identifying and managing risks associated with their work?"

The survey results showed that 75% of participants agreed or strongly agreed that contractors are actively involved in identifying and managing risks associated with their work, while 25% were neutral, disagreed, or strongly disagreed, indicating that there is still room to enhance contractor engagement in risk management processes. Among those with concerns, 75% had over 10 years of experience, suggesting that seasoned professionals may have higher expectations or have

observed inconsistencies in contractor risk ownership. From a discipline standpoint, 47% were from HSE, 11% from Operations, 22% from Turnaround and Maintenance, and 19% from Project, Engineering, and other areas highlighting that frontline and support functions alike see opportunities for stronger contractor involvement. In terms of hierarchy, 53% of those with concerns were frontline employees or leaders, while 44% were senior managers, pointing to a shared perception across organizational levels. These insights suggest a need to deepen contractor participation in risk identification through proactive engagement in hazard assessments, inclusion in pre-job risk reviews, and more structured involvement during job planning and execution phases. Enhancing contractor empowerment and accountability in risk management can drive a more collaborative safety culture and ensure that hazards are effectively controlled at the source (See Figure 4.25).

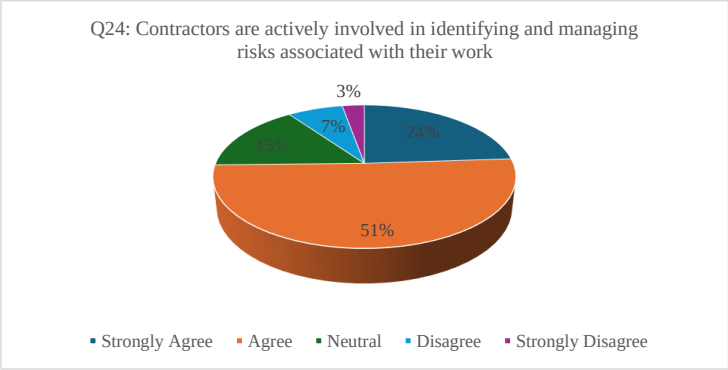

Figure 4.25: Survey Question Twenty-Four
Source: Author's compilation

Survey Question Twenty-Five: "The organization uses technology and data analytics to monitor and improve contractor safety performance?"

The survey results indicated that 55% of participants strongly agreed or agreed that the organization effectively uses technology and data analytics to monitor and improve contractor safety performance, while 45% were neutral, disagreed, or strongly disagreed. Among those with concerns, 80% had over 10 years of experience, 6% had between 5 to 10 years, and 14% had less than 5 years of experience. Regarding disciplines, 52% were from HSE, 13% from Operations, 13% from Turnaround and Maintenance, and 22% from Project, Engineering, and other disciplines. Hierarchically, 48% were senior managers and executives, 50% were frontline employees and frontline leaders, and 2% held other roles. The significant proportion of experienced professionals and HSE specialists among those expressing concerns suggests that there may be gaps in the effective implementation, accessibility, or integration of technology into daily CSM practices.

To address these concerns, the organization should prioritize the seamless integration of digital safety tools into contractor management processes. This includes enhancing the use of real-time monitoring systems, predictive analytics, and AI-driven risk assessments to identify safety trends and prevent incidents proactively. Expanding the adoption of digital safety dashboards, wearable technology, and IoT-enabled devices can further improve compliance tracking and hazard identification. Additionally, providing targeted training to contractors and internal teams on utilizing safety technologies effectively, combined with regular system audits and feedback loops, will drive continuous improvement. Ensuring that digital solutions align with practical field safety needs and embedding them into decision-making processes will enhance contractor safety performance and promote a more data-driven safety culture (See Figure 4.26).

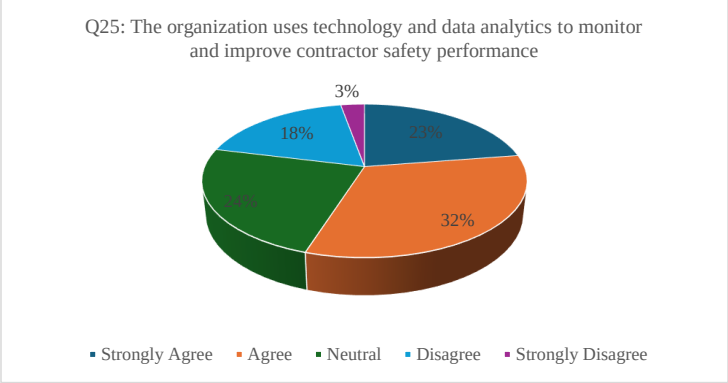

Figure 4.26: Survey Question Twenty-Five
Source: Author's compilation

Survey Question Twenty-Six: "Contractors are adequately supervised during the execution of the SoW?"

The survey results revealed that 68% of participants strongly agreed or agreed that contractors receive adequate supervision during the execution of their SoW, while 32% were neutral, disagreed, or strongly disagreed. Among those expressing concerns, 80% had over 10 years of experience, 9% had between 5 to 10 years, and 11% had less than 5 years of experience. Regarding disciplines, 50% were from HSE, 22% from Operations, 13% from Turnaround and Maintenance, and 15% from Project, Engineering, and other disciplines. In terms of organizational hierarchy, 35% were senior managers and executives, 63% were frontline employees and frontline leaders, and 2% held other roles. The high proportion of frontline leaders and HSE professionals among those raising concerns suggests that gaps in supervision may impact safety performance and compliance.

To strengthen contractor supervision, organizations should enhance field oversight by ensuring a sufficient number of competent supervisors are actively engaged in monitoring contractor

activities. Implementing structured site inspections, real-time digital reporting tools, and AI-driven safety analytics can improve visibility into contractor compliance and performance. Additionally, fostering a proactive approach by establishing clear supervision protocols, conducting regular safety walkdowns, and ensuring that supervisors have the authority to intervene in unsafe situations will reinforce a culture of accountability. Providing leadership training for frontline supervisors to effectively coach contractors on safety expectations and performance can also drive continuous improvement and alignment with organizational safety objectives (See Figure 4.27).

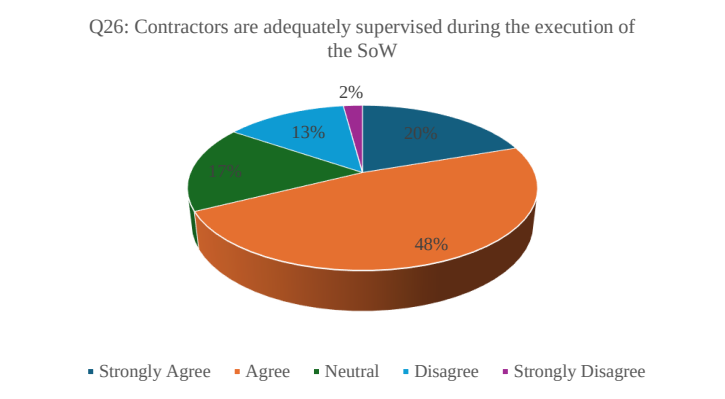

Figure 4.27: Survey Question Twenty-Six
Source: Author's compilation

Survey Question Twenty-Seven: "What are the key factors to enable excellence in contractor safety management?"

The survey results provided valuable insights into the factors that participants consider most crucial for contractor safety within the context of O&G operations. The findings suggested that certain elements, such as effective communication, training, supervision, leadership commitment, and accountability, are seen as fundamental to ensuring the safety and well-being of contractors working on-site. These factors are viewed as essential components of a broader safety framework

that, when properly implemented, can significantly reduce risks and improve overall safety performance. However, other factors such as digitalization, data analytics, incentivizing, and collaboration, while still recognized as important, are considered secondary to foundational safety measures. This analysis will explore the survey results in greater detail, offering insights into each factor's relative importance and identifying potential areas for improvement (See Figure 4.28).

Effective Communication (89%)

At the top of the list is Effective Communication, which was identified as the most important factor for contractor safety, with 89% of participants emphasizing its significance. The importance of communication in safety cannot be overstated, as it ensures that all safety expectations, protocols, and risks are clearly conveyed to all stakeholders involved. Effective communication fosters a culture of transparency and collaboration, where everyone, from management to contractors, understands their roles and responsibilities in ensuring safety. This factor is often seen as the bedrock of a successful SMS, as it enables teams to share critical information, respond quickly to potential hazards, and mitigate risks in real-time. In high-risk environments like the O&G industry, where operational hazards are prevalent, the ability to communicate effectively is crucial in preventing accidents and incidents.

Communication is also essential for ensuring that safety policies and procedures are consistently applied across different contractors and teams. The clarity of communication channels can significantly impact the speed at which safety concerns are addressed. With 89% of participants recognizing its importance, it is clear that effective communication is not only a tool for day-to-day operations but also an overarching factor that underpins the entire safety culture of the organization.

Training and Competency Assurance (87%)

Training and Competency Assurance follows closely behind with 87% of participants acknowledging its importance. The ability to ensure that contractors are adequately trained and competent to carry out their work safely is a key factor in preventing accidents and maintaining a high standard of safety. Competency assurance programs typically involve a mix of formal training, on-the-job experience, and competency assessments to ensure that workers are equipped with the necessary skills and knowledge to identify and manage risks effectively.

Training programs that are tailored to the specific hazards and risks of the workplace are essential in enabling contractors to respond appropriately to emergencies. Moreover, ongoing training and refresher courses help to ensure that safety standards evolve in response to new risks, regulations, and technological advancements. This factor's high ranking reflects a shared understanding among participants that well-trained workers are better prepared to prevent incidents and maintain a safe working environment. In many ways, training and competency assurance are seen as an investment in long-term safety and performance.

Effective Supervision (84%)

The third most important factor is Effective Supervision, with 84% of participants indicating that it plays a critical role in contractor safety. Supervision ensures that contractors adhere to safety procedures and regulations while performing their tasks. Supervisors are responsible for monitoring work processes, identifying hazards, and taking corrective actions as needed. Effective supervision also involves providing guidance, support, and training to contractors on-site, helping to reinforce safety messages and ensuring that workers are following established protocols.

This factor is closely linked to accountability, as supervisors are often the ones who hold workers accountable for their actions. Their role in providing feedback, conducting safety observations, and addressing any unsafe practices is vital for creating a culture of safety. Effective supervision

not only helps in maintaining safety standards but also fosters a sense of responsibility among contractors, ensuring that safety is prioritized throughout the workday.

Joint Leadership Commitment and Accountability (78% & 72%)

Joint Leadership Commitment, with 78% of participants considering it important, emphasizes the role of leadership in driving safety culture. It reflects the understanding that safety is a shared responsibility between the company's leadership and the contractors they engage. Leaders must demonstrate a commitment to safety by providing resources, support, and clear direction to ensure that safety standards are consistently met. This includes ensuring that safety is a core element of the organization's strategic objectives and embedding safety into every aspect of operations.

Closely tied to leadership commitment is Accountability (72%), which ensures that individuals take responsibility for their actions and adhere to safety standards. When accountability is embedded in the safety culture, it reinforces the importance of compliance with safety procedures. Contractors, supervisors, and managers must all be held accountable for maintaining a safe working environment. Leadership must set the example by ensuring that safety violations are addressed consistently and fairly.

Contractor Audits, Compliance Assurance, Performance Management, and Incentivizing (77%, 65%, & 48%)

Contractor Audits and Compliance Assurance (77%), Performance Management (65%), and Incentivizing (48%) collectively contribute to ensuring that contractors adhere to safety standards, regulations, and continuous improvement practices. Audits provide a structured mechanism for monitoring contractor performance, identifying areas for improvement, and ensuring that safety standards are met. Regular audits help maintain compliance with regulatory requirements and contractual obligations, reinforcing a culture of safety.

Performance management is an essential aspect of contractor oversight, as it involves assessing contractor safety performance, providing feedback, and implementing corrective actions where necessary. The integration of incentives into performance management can further enhance safety outcomes by encouraging proactive safety behaviors and rewarding compliance with best practices. Incentivizing contractors for strong safety performance fosters a competitive yet cooperative environment where contractors are motivated to exceed minimum safety requirements. Collectively, these factors promote a proactive approach to safety management, ensuring that contractors are continuously improving their safety performance. A strong audit and performance management system, coupled with effective incentivization, helps drive higher safety engagement and accountability across all levels of contractor operations.

Digitalization and Data Analytics (34% & 54%)

Although Digitalization (34%) and Data Analytics to Improve Contractor Safety (54%) received lower rankings, they still hold potential for improving safety performance. Digital tools, such as real-time safety tracking systems, wearable technology, and automated reporting platforms, can enhance safety management. However, their lower ranking suggests that participants may see them as supplementary tools rather than core safety drivers.

Data analytics can help identify trends, predict potential hazards, and improve decision-making in CSM. Despite its potential, the relatively low ranking suggests that organizations may still be in the early stages of fully integrating data-driven safety solutions. Encouraging greater adoption of digital tools and analytics could help improve contractor safety by providing more precise risk assessments and proactive safety interventions.

Collaboration and Fair Treatment (46%)

The factor Collaboration & Fair Treatment (46%) suggests that while it has some relevance, it is not seen as central to contractor safety. Collaboration ensures that contractors are engaged and motivated to follow safety procedures, while fair treatment fosters a sense of trust and commitment. However, this factor may be perceived as a cultural enhancement rather than a core safety strategy.

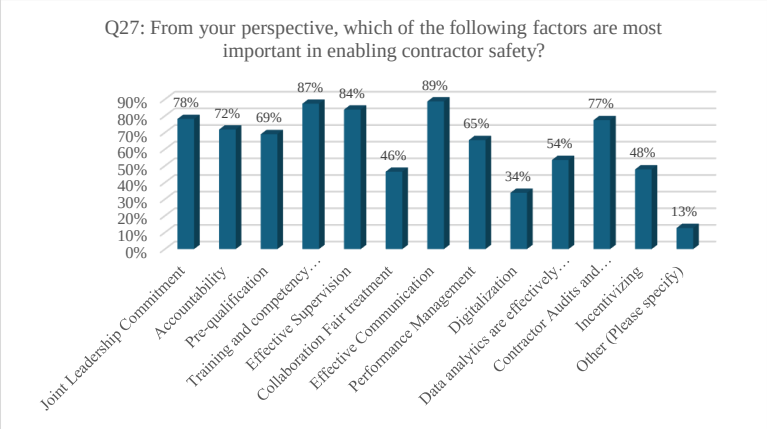

Figure 4.28: Survey Question Twenty-Seven
Source: Author's compilation

Conclusion

The survey identified Effective Communication, Training and Competency Assurance, and Effective Supervision as the top contributors to contractor safety. Leadership Commitment, Accountability, Compliance Assurance, Performance Management, and Incentivization are also highly valued, highlighting the need for a comprehensive approach. While factors such as Digitalization and Incentivizing are recognized, they are viewed as secondary to more direct safety measures. These results can help organizations prioritize safety initiatives and ensure that contractors are equipped to work safely in high-risk environments.

4.2.2 PLS Model Analysis

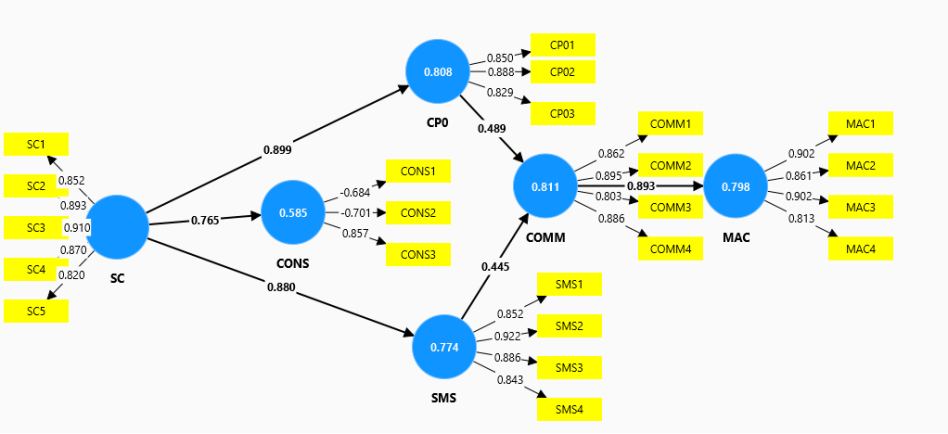

Figure 4.29.: PLS Run 1

Source: Author's compilation

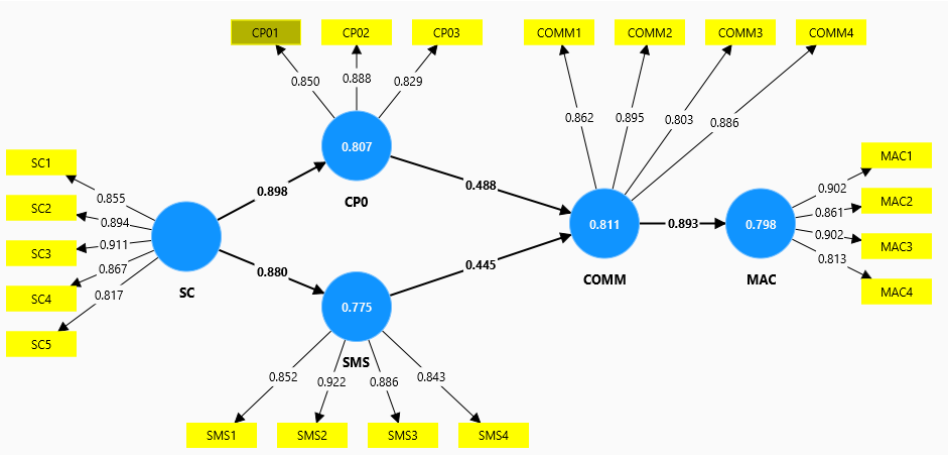

Figure 4.30.: PLS Run 2 (Deleted construct cons, as the outer loadings were less than 0.6)

Source: Author's compilation

4.2.1.1 Measurement of Outer Model

Reliability Analysis: The Cronbach's Alpha (α) measures internal consistency (how well items in a construct measure the same concept). All values are above 0.70, indicating good reliability. Composite Reliability measures the overall reliability of the latent construct, accounting for loadings. All values are above the 0.70 threshold, indicating strong construct reliability.

Average Variance Extracted (AVE) measures convergent validity, indicating how much variance the construct captures compared to measurement error. All AVE values are above 0.50, confirming good convergent validity. Factor loading/ Outer loading was greater than 0.6, (only for Con was less than 0.6, hence deleted). The outerloadings were more than 0.6 (Refer Figure 4.1, Hair et al., 2012) Hence acceptable. Most of factor loadings are above 0.70, which indicates that the items strongly contribute to their respective constructs.

Thus, all constructs demonstrate strong reliability and validity. No concerns regarding internal consistency, composite reliability, or convergent validity. Model results suggest that the constructs are well-measured, making them suitable for further analysis (e.g., structural model evaluation).

Table 4.8. Outer Loadings

	COMM	CP0	MAC	SC	SMS
COMM1	0.862				
COMM2	0.895				
COMM3	0.803				
COMM4	0.886				
CP01		0.850			

CP02		0.888			
CP03		0.829			
MAC1			0.902		
MAC2			0.861		
MAC3			0.902		
MAC4			0.813		
SC1				0.855	
SC2				0.894	
SC3				0.911	
SC4				0.867	
SC5				0.817	
SMS1					0.852
SMS2					0.922
SMS3					0.886
SMS4					0.843

Table 4.9. Reliability and Validity

	Cronbach's alpha	Composite reliability (rho_c)	Average variance extracted (AVE)
COMM	0.884	0.920	0.743
CP0	0.817	0.892	0.733

MAC	0.893	0.926	0.757
SC	0.919	0.939	0.756
SMS	0.899	0.930	0.768

Discriminant validity was measured using Fornell-Larcker Criterion and Cross Loadings. Fornell-Larcker criterion assesses **discriminant validity** by comparing the square root of the **Average Variance Extracted (AVE)** with the correlations between latent constructs. The square root of the AVE (diagonal values) should be **greater than** the correlations between constructs (off-diagonal values) to establish discriminant validity. As per Forner Larcker, all diagonal values were found to be higher than values on the left, hence Discrimant validity was established

Table 4.10. AVE

	COMM	CP0	MAC	SC	SMS
COMM	0.862				
CP0	0.812	0.856			
MAC	0.813	0.816	0.870		
SC	0.835	0.818	0.823	0.869	
SMS	0.866	0.862	0.838	0.810	0.876

Cross loadings- All items have higher loadings on their respective constructs compared to other constructs, satisfying the cross-loadings criterion. No significant cross-loading issues were detected, indicating acceptable discriminant validity.

Table 4.11. Cross Loadings

	COMM	CP0	MAC	SC	SMS
COMM1	0.862	0.757	0.813	0.719	0.796
COMM2	0.895	0.799	0.833	0.771	0.780
COMM3	0.803	0.688	0.669	0.706	0.704
COMM4	0.886	0.756	0.753	0.681	0.699
CP01	0.660	0.850	0.645	0.799	0.721
CP02	0.795	0.888	0.740	0.796	0.745
CP03	0.780	0.829	0.708	0.712	0.749
MAC1	0.803	0.773	0.902	0.789	0.793
MAC2	0.776	0.687	0.861	0.650	0.683
MAC3	0.842	0.778	0.902	0.756	0.793
MAC4	0.676	0.585	0.813	0.663	0.634
SC1	0.708	0.734	0.730	0.855	0.792
SC2	0.693	0.769	0.700	0.894	0.758
SC3	0.746	0.819	0.767	0.911	0.822
SC4	0.713	0.810	0.699	0.867	0.710
SC5	0.770	0.770	0.679	0.817	0.741
SMS1	0.730	0.737	0.715	0.793	0.852
SMS2	0.774	0.800	0.732	0.796	0.922
SMS3	0.779	0.774	0.779	0.768	0.886
SMS4	0.750	0.708	0.708	0.726	0.843

4.2.1.2 Measurement of Inner Model

The study tested five hypothesis (Refer Table 4.12). First hypothesis was supported (H1, B=0.893, t =55.373, p=0.000, reflecting effective communication on (COMM) significantly impacts Continuous Improvement. The second hypothesis H2, was supported (H2, B=0.488, t=6.577, p=0.000 reflecting Contractor onboarding significantly impacts Communication Effectiveness. H3 (B=0.898, t= 45.409, p= 0.000) was supported reflecting effectiveness of Leadership Commitment significantly impacts contractor Prequalification. H4 (B=0.880, t= 35.503, p=0.000) was confirmed suggesting that Safety Culture significantly impacts Safety Management System. H5 was supported (B=0.445, t= 5.942, p=0.000) reflecting Effective Safety Management Systems Significantly Impacts Communication.

Table 4.12 Hypothesis Results

	Original sample (O)	T statistics (|O/STDEV|)	P values	Result
COMM -> MAC	0.893	55.373	0.000	Supported
CP0 -> COMM	0.488	6.577	0.000	Supported
SC -> CP0	0.898	45.409	0.000	Supported
SC -> SMS	0.880	35.503	0.000	Supported
SMS -> COMM	0.445	5.942	0.000	Supported

Table 4.13. Model fit R square

	R-square	R-square adjusted
COMM	0.811	0.808
CP0	0.807	0.806
MAC	0.798	0.797

SMS	0.775	0.773

Table 4.14. Model fit f square

COMM			3.952			
CP0	0.324					
MAC						
SC		4.181			3.439	
SMS	0.268					

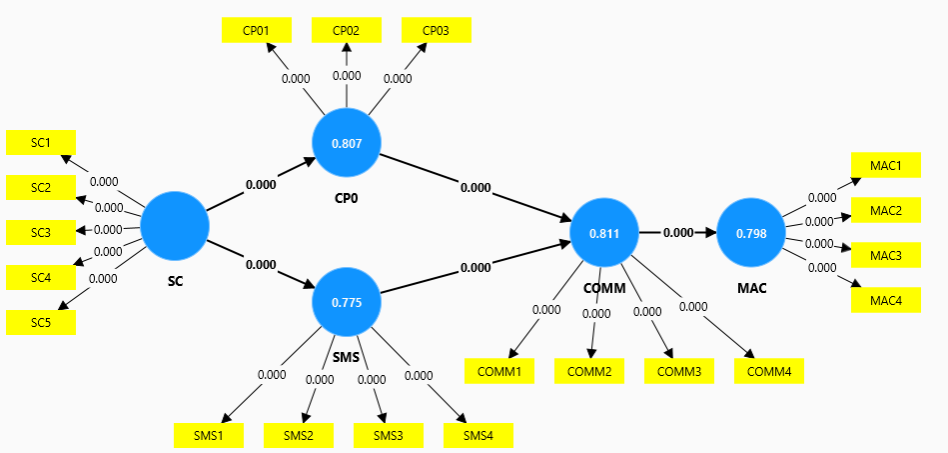

Figure 4.31.: Bootstarpping

Source: Author's compilation

CHAPTER V: DISCUSSION

5.1 Qualitative

5.1.1 Discussion of Research Question One

The study investigated the effectiveness of current safety management practices among contractors in mitigating risks and enhancing safety performance.

Participants unanimously agreed that while CSM systems in the O&G industry have made significant progress, however, they are not yet fully effective in preventing contractor-related incidents, as the industry continues to record a high number of fatalities and serious injuries annually. Key themes critical to building and sustaining an effective SMS emerged, with Leadership Commitment and Safety Culture, identified as foundational to CSMS. Leaders must set a clear safety vision aligned with strategic objectives and embed safety into every aspect of the business. This includes active participation, regular site visits, and continuous reinforcement of safety values. A robust contractor prequalification process was also highlighted, with a need for a clear scope definition, thorough vetting of past safety performance, and inclusion of safety clauses in contracts. Establishing clear roles, responsibilities, and accountability ensures all stakeholders, including contractors, are aligned and jointly accountable for safety. Participants stressed the importance of proactive risk management, through structured methods like HIRA and JSA, supported by digital tools and real-time analytics. Ongoing training, competency, and awareness programs, particularly those tailored to high-risk tasks and utilizing blended learning approaches, are critical for building safety capabilities. Effective communication and information sharing through toolbox talks, safety meetings, and real-time channels, enhance collaboration and emergency response. A win-win culture of contractor engagement and collaboration further strengthens trust and safety outcomes. Performance monitoring and auditing using SMART

objectives and KPIs enables tracking of both leading and lagging indicators, while regular audits and inspections reinforce safety standards. Transparent incident reporting and investigation, using no-blame methodologies and lessons-learned sharing, drives continuous improvement. Finally, emergency preparedness and response was deemed non-negotiable, requiring full contractor integration, regular drills, KPI tracking, and post-drill evaluations to ensure readiness and safeguard people, assets, and the environment.

5.1.2 Discussion of Research Question Two

Participants unanimously agreed that, despite efforts to strengthen safety protocols, CSMSs in the O&G industry face numerous challenges that hinder their effectiveness and limit incident prevention. A recurring theme is the lack of engagement and commitment to safety from both contractor and client leadership, which undermines safety efforts, fosters misalignment, and weakens the overall safety culture. When leadership fails to establish clear, measurable safety goals or prioritize safety over production pressures, teams operate without direction, leading to complacency and preventable incidents. Infrequent site visits, poor communication, and insufficient investment in safety resources further exacerbate this issue. Equally concerning is the reliance on a poor prequalification process and the lowest-bidder approach, which allows high-risk, underqualified contractors into critical operations, often resulting in inconsistent safety practices and long-term project risks. The lack of contractor engagement due to a “slave-master” dynamic also creates distrust, discourages safety reporting, and disrupts collaboration, all of which are essential for maintaining a high-performing safety culture. Rushed onboarding processes and weak competency management exacerbate risks, as inadequately prepared contractors may be unaware of protocols, site-specific hazards, or safe practices, putting both people and operations at risk. Ineffective communication especially in multilingual environments common in the Middle

East introduces misunderstandings, fear of retaliation, and cultural barriers, further weakening hazard awareness and incident prevention. Additionally, inconsistent safety standards across clients create confusion and raise the potential for non-compliance as contractors transition between projects with differing requirements. Budget constraints remain a critical issue, driving contractors to cut corners on training, equipment, and safety programs, while fatigue and repetitive tasks common during Turnaround and Inspection (T&I) periods contribute to human error, reduced alertness, and injuries. Inadequate supervision and safety oversight, often due to understaffing or inexperience, prevent timely intervention and weaken safety leadership on-site. Finally, high contractor turnover disrupts knowledge continuity, leads to repeated training cycles, and reduces engagement. Addressing these complex, interrelated challenges requires a unified approach: embedding safety into leadership strategies, enhancing contractor integration, standardizing onboarding and training, improving communication, and using technology and proactive oversight to foster a strong, consistent, and resilient safety culture across all levels of the workforce.

5.1.3 Discussion of Research Question Three

Participants unanimously agreed that although CSM has advanced, excellence remains a continuous journey requiring sustained improvement, proactive risk management, and stakeholder collaboration. The responses reinforced earlier research findings, emphasizing that addressing foundational challenges is essential for a resilient and high-performing CSM. Key themes emerged from the interviews. Firstly, joint leadership commitment and accountability were identified as the bedrock of safety culture, where leadership not only sets clear expectations and contractual requirements but also leads by example, owns outcomes, and drives continuous policy refinement. Secondly, comprehensive training and awareness programs tailored to contractors' tasks, supplemented by toolbox talks and emergency drills, were seen as critical for preparedness and

cultivating a safety-conscious workforce. Monitoring and evaluation practices including pre-qualification, KPI tracking, audits, and leveraging digital tools were highlighted as essential to ensuring ongoing compliance and improvement. Engagement and collaboration between employees and contractors were seen as pivotal to shared responsibility, with joint risk assessments, safety committee participation, and open feedback loops reinforcing accountability. Recognition and continuous improvement strategies, such as incentives, benchmarking, transparent communication, and regular policy updates, were cited as effective in reinforcing a proactive safety mindset. Participants emphasized that alignment between companies, contractors, and regulators is crucial, particularly through shared standards, joint training and certification programs, and policy advocacy that reflects real-world challenges. Collaboration with regulators, including the use of liaison officers and clear guidance, ensures relevance and feasibility in safety systems. Unified emergency response and incident management protocols, standardized reporting formats, and shared databases enhance preparedness and learning. Finally, fostering mutual accountability through contractor scorecards, public performance metrics, safety audits, and technological tools, coupled with cross-sector collaboration, establishes a culture of transparency and shared responsibility, framing contractors as integral safety partners. Together, these interconnected strategies offer a comprehensive roadmap to achieving excellence in CSM.

5.2 Quantitative

The study tested five hypotheses (Refer to Table 4.12.). The results provided strong support for all proposed relationships.

The first hypothesis (H1) was supported ($B = 0.893$, $t = 55.373$, $p = 0.000$), indicating that effective communication (COMM) has a significant positive impact on continuous improvement. This

suggests that improving communication channels and practices can directly enhance ongoing improvement initiatives.

The second hypothesis (H2) was also supported (B = 0.488, t = 6.577, p = 0.000), showing that contractor onboarding significantly impacts communication effectiveness. This highlights the importance of structured onboarding programs in ensuring that communication between contractors and organizations remains clear and effective.

The third hypothesis (H3) was confirmed (B = 0.898, t = 45.409, p = 0.000), reflecting that the effectiveness of leadership commitment has a significant positive impact on contractor prequalification. This finding emphasizes the crucial role leadership plays in setting standards and ensuring that only qualified contractors are selected.

The fourth hypothesis (H4) was supported (B = 0.880, t = 35.503, p = 0.000), suggesting that a strong safety culture significantly impacts the effectiveness of the SMS. Organizations fostering a culture that prioritizes safety are more likely to develop and maintain robust safety management practices.

Finally, the fifth hypothesis (H5) was confirmed (B = 0.445, t = 5.942, p = 0.000), showing that an effective SMS significantly impacts communication. This result indicates that well-established safety systems facilitate better information flow and communication processes within organizations

CHAPTER VI: SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

6. Summary

The following sections present a comprehensive summary of the theoretical and managerial implications derived from this study, highlighting how the findings contribute to existing academic literature and offering practical guidance for industry leaders and decision-makers seeking to enhance Contractor Safety Management Systems

6.1 Theoretical and Managerial Implications

6.1.1 Theoretical Contribution

This study represents a significant theoretical advancement by introducing and empirically testing the first comprehensive model that identifies and validates the key influencing factors that enhance and sustain the effectiveness of the CSMS within the O&G industry. Despite the critical role contractors play in high-risk environments, previous literature has largely addressed contractor safety in fragmented ways, often focusing on isolated elements rather than offering a holistic, integrative framework. By developing this model, the research fills a critical gap in safety management literature, offering a structured approach to understanding the multifaceted dimensions of contractor safety performance.

The proposed model was rigorously tested, and the findings confirm the hypothesized relationships among the core factors that drive CSMS effectiveness. Specifically, the study underscores the pivotal roles of effective communication, structured contractor onboarding, robust leadership engagement, thorough prequalification processes, proactive safety management, a strong safety culture, and streamlined process management. Each of these elements was found to significantly

contribute not only to enhancing contractor performance but also to embedding safety deeply within operational practices, thereby ensuring long-term sustainability of safety outcomes.

This research contributes to theory by offering a validated framework that integrates organizational behavior, safety science, and operational management principles into a unified model of contractor safety excellence. It highlights how interdependencies among these influencing factors collectively shape contractor safety outcomes, moving beyond compliance-oriented approaches toward a performance-driven culture. Moreover, it sets the stage for future research to further explore causal mechanisms, contextual variations, and longitudinal impacts of these factors in diverse operational settings.

6.1.2 Managerial Implications

The findings of this study have important practical implications. Organizations aiming to drive continuous improvement in CSM should develop and implement a robust and structured CSM system, considering the key factors and improvement strategies identified through both the qualitative and quantitative analyses presented in this research. Among these factors, leadership commitment and accountability emerge as the most critical, as leaders possess the authority and ability to allocate resources, influence organizational priorities, and drive the development and enhancement of business processes required for sustainable change.

A strong leadership foundation is essential to cultivating a positive safety culture, which ensures that every worker returns home safely at the end of each day. This culture serves as a backbone of an effective SMS, enhancing communication, aligning behaviors, and fostering shared responsibility across the organization. Structured and effective CMS, along with continuous communication improvement, further strengthen the system. Leaders should actively invest in

safety programs and employee engagement initiatives to foster trust, reinforce accountability, and embed safety as a core organizational value.

For future research, it would be valuable to explore how these relationships evolve over time and across different industries, as well as to examine potential moderating factors such as organizational size, geographical location, or type of contractor work

6.2 Limitations

There are a few limitation factors in this study. Despite the survey being conducted anonymously, ensuring honest and open responses from the participants was challenging, potentially impacting the accuracy and reliability of the data. Another limiting factor for this study was the difficulty to obtain consistent data due to different interpretations responders may have had with the multiple choice options. An option may represent different things to different participants. In addition, sample representation is also limited, with less than 1% of the estimated 11.9 million O&G sector employees worldwide participating (IEA, 2022). This small size sample may not be representative, and participant's varying levels of understanding of the topic and time dedication may have affected responses. Furthermore, the study may also be biaised towards more experienced professionals, with 85% of participants having over 10 years of experience. In addtion to potential overlaps as The HTMT and Fornell-Larcker results indicated some discriminant validity concerns, suggesting that further refinement of the measurement model may be required.

6.3 Recommendations for Future Research

The outcome of this study contributes to streamlining and enhancing CSM systems, ultimately reducing incidents and safeguarding contractor well-being in the high-risk O&G sector. This advancement will enable both clients and operators to achieve and sustain best-in-class safety

performance. However, considering the study's limitations, future research should focus on refining the proposed model by addressing overlapping constructs and validating it across diverse organizational contexts to improve generalizability.

A critical area for future exploration is the integration of technology into CSM systems. This includes examining the specific elements of the safety climate that significantly influence human-technology interaction and sustainable development (Masudin et al., 2024). Research should also assess best practices for implementing smart technologies such as the IoT and CPS, while leveraging advanced data analytics and machine learning to enhance predictive capabilities and risk mitigation strategies.

Furthermore, developing frameworks to strengthen safety culture maturity by SMSs with IPMs can support more effective prioritization of improvement plans and resource allocation (Iqbal et al., 2019).

In addition to technological considerations, the psychological dimensions of contractor safety require further investigation. Factors such as trust, risk perception, and personal incentives play a significant role in shaping safety behaviors (Roberts et al., 2021). Leadership is also critical; transformational leadership behaviors, including intellectual stimulation and individualized consideration, are associated with positive safety outcomes, while passive or avoidant leadership correlates with negative results (Grill et al., 2017). Comparative studies across other high-risk industries may reveal transferable best practices that can enhance CSM and support sustainable development in the O&G sector.

By addressing these research gaps and leveraging insights from across industries, the O&G sector can drive lasting improvements in CSM, ultimately benefiting all stakeholders and contributing to a safer, more resilient business.

6.4 Conclusion

This research aimed to address the complex challenges of CSM in the O&G industry where a large, diverse contractor workforce is engaged in high-risk activities. Despite advancements in safety systems, contractors continue to face a disproportionately high rate of incidents and fatalities. Using a mixed-methods approach that included qualitative and quantitative techniques, this study identified critical gaps in current practices and proposed a structured, data-informed model to drive sustained safety performance across contractor operations.

Ten interrelated elements emerged as essential for the effective implementation and long-term success of CSM in the O&G sector:

1. **Joint Leadership Commitment and Accountability**: Safety leadership must be visibly demonstrated by both client and contractor organizations. Shared accountability for safety outcomes fosters alignment, drives cultural integration, and ensures that safety is prioritized at all organizational levels.
2. **Pre-qualification**: A rigorous contractor selection process evaluating technical capability, past safety performance, and HSE systems is foundational for managing risk. Pre-qualification acts as the first filter to ensure only competent contractors are engaged.
3. **Onboarding, Training, and Competency Assurance**: Comprehensive orientation, role-specific training, and continuous competency evaluation ensure that all personnel understand safety expectations, site-specific risks, and procedures.

4. **Effective Communication**: Open, transparent, and two-way communication across all levels of the workforce promotes shared situational awareness and helps in the early identification of hazards, reducing the likelihood of incidents.

5. **Effective Supervision**: Skilled and engaged front-line supervisors play a critical role in enforcing safety standards, mentoring workers, and fostering a strong safety culture on the ground.

6. **Audits, Compliance Assurance, and Performance Management**: Regular safety audits, monitoring of key performance indicators (KPIs), and corrective action tracking reinforce accountability and continuous improvement.

7. **Digitalization and Data Analytics**: Leveraging digital tools and analytics enhances hazard identification, incident tracking, trend analysis, and decision-making. It enables predictive safety and smarter resource allocation.

8. **Collaboration and Fair Treatment**: Building a culture of mutual respect and inclusiveness between clients and contractors improves trust and morale, encouraging ownership of safety responsibilities and greater workforce engagement.

9. **Risk-Based Management Approach**: Tailoring safety strategies to the level of risk associated with specific activities ensures resource optimization and focused mitigation, particularly in dynamic, high-hazard environments.

10. **Emergency Response and Incident Management**: Robust preparedness measures, including joint drills, coordinated response protocols, and clear incident reporting systems, are critical for minimizing impact and learning from incidents.

Together, these elements form a comprehensive and integrated model that addresses not only operational and regulatory requirements but also the human and cultural dimensions of safety management.

The contributions of this study are threefold. Academically, it fills a notable gap in empirical literature on CSM and refines safety management theories by incorporating contractor-specific dynamics. Practically, it provides O&G companies and service providers with actionable guidance to develop robust CSM systems that reduce risk, enhance performance, and support continuous improvement. From a policy perspective, the study informs regulators and industry bodies in crafting more effective frameworks that reflect the complexities and realities of contractor engagement in hazardous environments.

In conclusion, achieving excellence in CSM requires more than isolated interventions. It demands a cohesive, systems-thinking approach built on leadership, collaboration, innovation, and a deep commitment to protecting human life and preventing incidents. The findings of this research offer a practical and strategic pathway for the O&G industry to transform CSM from a compliance obligation into a driver of operational excellence and sustainability.

APPENDICES

Appendix A: Survey Cover Letter

Aissam Bouadjel

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January 5, 2025

Subject: Invitation to Participate in a Research Study on Contractor Safety Excellence

Dear Survey Participant,

I hope this letter finds you well. My name is Aissam Bouadjel, and I am a doctoral candidate at Swiss School of Business & Management (SSBM). I am conducting research on enabling excellence in Contractor Safety Management, with a focus on identifying strategies to foster safer and more effective partnerships between organizations and their contractors. Your insights as an Oil & Gas professional are invaluable to this study.

It is important to note that your participation to this project is completely voluntary and you can end your participation and withdraw from the research study at any time, for any reason. Should you decide to stop participating, the answers provided up to that point will not be retained. You can also choose to be anonymous.

The data collected from the survey will be analyzed and strictly be used for this research subject. The only information required is your job title and the department where you work.

All responses used in the research will be anonymous and only the researcher will have access to the data collected. The answers of the survey will be analyzed as a collective, except for some questions that may be examined separately.

The answers provided in the survey should reflect your opinion, and not that of others. Your answers will not be judged so it is important to provide truthful and unbiased answers. Your answers will be kept safe and secure. The data collected will be stored and password protected, and any hard copy of the research will be destroyed appropriately after the end of the study.

This survey contains 25 questions and should take approximately 15-20 minutes to complete.

Please read the questions carefully. If you have any questions regarding the survey, please do not hesitate to contact Aissam Bouadjel at Aissam.Bouadjel@gmail.com or aissam@ssbm.ch.

In addition, if you have any concerns or complaints regarding the conduct of this research, please contact my supervisor Dr Mario Silic at mario@ssbm.ch

Thank you very much for your time and participation.

Aissam Bouadjel

Appendix B: Interview Guide

1. Introduction

Greetings

"Thank you for agreeing to participate in this interview. Your insights will be invaluable in understanding the best practices in contractor safety management.

Purpose of the Interview

- "The purpose of this interview is to explore effective strategies, challenges, and innovations in contractor safety management. We aim to gather insights that can help organizations improve their safety practices."

Confidentiality Assurance

- "Please rest assured that your responses will be kept confidential and used solely for research purposes."

1. Background Information Question
    - "To start, could you share a brief overview of your experience in safety management and your role in contractor safety?"
2. RQ1. First Research Question: How effective are current safety management practices among contractors in mitigating safety risks and improving overall safety performance?
    - Q1: "What specific safety management practices do you currently implement for contractors?"
    - Q2: "How do you ensure that contractors comply with safety regulations and standards?"
    - Q3: "What key performance indicators do you use to assess contractor safety performance?"

3. RQ2. Second Research Question: What are the common challenges and obstacles in achieving excellence in contractor safety management, and how can they be addressed?
    - Q4: “What are the most frequent challenges you’ve encountered when trying to align contractor safety practices with your organization’s safety standards?”
    - Q5: “Can you share examples of obstacles that hinder contractors from fully integrating into the company’s safety culture?”
    - Q6: “What key factors influence the development of a strong and sustainable safety culture that includes contractors, and how can leadership actively foster alignment between the organization's safety values and contractor practices?”
4. RQ3. Third Research Question: What are the key factors to enable excellence in contractor safety management?
    - Q7: “What best practices would you recommend for organizations looking to improve contractor safety management?”
    - Q8: “How can collaboration between oil and gas companies and regulators enhance contractor management systems, and what practical strategies have proven effective?”
5. Thank You
    - “Thank you for your valuable insights. Your contributions will greatly assist in our research on contractor safety management.”

Appendix C: Survey Questionnaire

Research Question	Survey Question	Response	
Demographic	1. What is your position in the organizational hierarchy?	☐	Frontline Employee
		☐	Frontline Leader
		☐	Intermediate Leader
		☐	Senior Manager/Executive
		☐	Other (Please specify)
	2. What is your discipline?	☐	Operations
		☐	Engineering
		☐	HSE
		☐	Project Management
		☐	Maintenance/Turn Around & Inspection(T&I)
		☐	Other (Please specify)
	3. How many years of experience do you have	☐	0-5 years
		☐	5-10 years
		☐	More than 10 years

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
How effective are current safety management practices among contractors in mitigating safety risks and improving overall safety performance?	1. The safety culture at our organization promotes a strong focus on contractor safety.	☐	☐	☐	☐	☐
	2. Contractor management system is available and implemented effectively so that contracted work is completed safely	☐	☐	☐	☐	☐
	3. Contractor historical Safety performance is considered as a go/no-go criterion in the contractor selection process	☐	☐	☐	☐	☐
	4. Leadership is committed and accountable for Contractor Safety	☐	☐	☐	☐	☐
	5. Leadership effectively communicates HSE	☐	☐	☐	☐	☐

	expectations to contractors prior to start of contract work and during the work execution.					
	6. The contractors' safety management plans effectively address known risks and hazards of assigned Scopes of Work (SoW).	☐	☐	☐	☐	☐
	7. Contractors receive adequate safety training and records are verified before starting SoW.	☐	☐	☐	☒	☐
	8. Contractors can easily report safety incidents or concerns without fear of repercussions.	☐	☐	☐	☐	☐
	9. Contractor HSE performance is regularly evaluated and tracked and used to guide continuous improvement in safety management practices.	☐	☐	☐	☐	☐
	10. Contractors' safety management practices are integrated with project planning and execution from the start.	☐	☐	☐	☐	☐
	11. Contractors receive the necessary support and supervision to improve safety practices from internal teams.	☐	☐	☐	☒	☐
	12. Contractors are audited and compliance assured during the execution of the SoW.	☐	☐	☐	☐	☐
What are the common challenges and obstacles in achieving excellence in contractor	1. Cost considerations take precedence over safety performance when managing contractors	☐	☐	☐	☐	☐
	2. Contractors are treated fairly and actively involved in the decision-	☐	☐	☐	☐	☐

safety management	making process related to safety					
	3. The SoW is clearly defined, with well-communicated expectations, milestones, and deliverables	☐	☐	☐	☐	☐
	4. The contractors' workforce is competent and adequately skilled to meet the SoW requirements.	☐	☐	☐	☐	☐
	5. Effective processes and procedures are in place to monitor contractor compliance with HSE protocols	☐	☐	☐	☐	☐
	6. Effective communication and collaboration processes are available to ensure successful HSE management	☐	☐	☐	☐	☐
	7. Time and budget constraints often hinder the implementation of necessary safety measures	☐	☐	☐	☐	☐
	8. Adequate time and resources are allocated to ensure contractor HSE measures are implemented effectively	☐	☐	☐	☐	☐
	9. Contractors are actively involved in identifying and managing risks associated with their work	☐	☐	☐	☐	☐
	10. The organization uses technology and data analytics to monitor and improve contractor safety performance	☐	☐	☐	☐	☐
	11. Contractors are adequately supervised during the execution of the SoW.	☐	☐	☐	☐	☐
What are the key factors to enable	1. From your perspective, which of the following factors are most important	☒	Joint Leadership Commitment			
		☐	Accountability			
		☐	Pre-qualification			

excellence in contractor safety management?	in enabling contractor safety? (Check all that apply)?	☐	Training and competency assurance
		☐	Effective Supervision
		☐	Collaboration air treatment
		☐	Effective Communication
		☐	Performance Management
		☐	Digitalization
		☐	Data analytics are effectively used to improve contractor safety
		☐	Contractor Audits and Compliance Assurance
		☐	Incentivizing
		☐	Other Please specify

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