Enhancing SCT in High-Risk Work Environments: A Comprehensive Framework for Effective Communication

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Abstract

This paper emphasizes the imperative of measuring SCT on oil and gas platforms for enhanced safety, environmental protection, and global energy sustainability. This study addresses the unique challenges of high-risk platforms, emphasizing the pivotal role of SC and CS in fostering a robust safety culture, focusing on technical, structural, and process safety dimensions. The research explores their impact on personnel SCT, which is crucial in environments where incidents can be fatal. The proposed framework incorporates indicators for key personnel management variables, outlining the interdependence of SC, CS, and SCT. It also explores the creation of perceptions regarding management commitment to safety by positioning it as a leadership construct using a multidimensional commitment framework. The research examines worker SCT from affective, normative, and calculative perspectives. The research will employ a mixed-methods design (Quantitative + Qualitative) with interviews (n=10) and surveys (n=250). The study will investigate the theoretical conceptualization of SCT among workers. The study offers a predictive framework considering diverse demographics and communicative events, aiming to lower incident rates and near misses, emphasizing the correlation between SC, commitment, and incidents. This research provides a holistic perspective for managing critical personnel resources on oil and gas platforms.

Keywords: Safety communication; CS; safety management system; High-risk work environment; SCT; Oil and gas industry.

1. Introduction

The genesis of numerous catastrophic accidents within global industries, both historical and contemporary, often stems from the deficiency or inadequate implementation of SC within occupational health and safety management systems (OSHMS). Despite the widespread understanding of OSHMS principles, organizations across various sectors consistently incur substantial losses and inefficiencies due to increased work-related illnesses and injuries. Emphasizing safety communication (SC) as a pivotal variable is crucial for addressing these challenges. A 2022 report from the International Labour Organization (ILO) on "employees' health and safety" underscores the imperative for heightened efforts in enhancing SC to improve employees' health and safety. The report highlights that, globally, over 2.3 million occupational accidents occur annually, contributing to an estimated daily death toll of over 6000 employees (Moon, 2022; Safety, 2014).

Furthermore, the ILO approximates that globally, one worker succumbs to occupational injuries every 15 seconds, and approximately 160 workers contract work-related illnesses

(Demba, Ceesay, & Mendy, 2013; Moon, 2022; Safety, 2014). In addition to causing occupational injuries and diseases, workplace accidents have far-reaching financial implications for organizations (Kheni, Dainty, & Gibb, 2008; Nwankwo, Arewa, Theophilus, & Esenowo, 2022). Numerous studies within the domain of behavior-based safety posit that hazardous incidents are primarily instigated by unsafe or inappropriate actions of workers, prompting extensive research on behaviours fostering safety and injury prevention (Takala et al., 2014). It is imperative to note, however, that workplace safety is not exclusively attributable to human error, as various other factors may also significantly contribute to safety outcomes (Berglund, 2020; Zheng, Xiang, Song, & Wang, 2010).

In industrial safety, the impact of organizational dynamics, particularly the influence of managerial decisions and behaviour, is unequivocal (Oppong, 2014; Sugiono, Ali, & Miranda, 2020). Within this framework, the nexus of SC, communication satisfaction (CS), and safety commitment (SCT) emerges as pivotal for cultivating a robust safety culture within organizations. As a linchpin organizational factor, leadership plays a pivotal role in shaping safety performance (Amponsah-Tawiah & Dartey-Baah, 2011; Oppong, 2014). The strategic implementation of SC, led by adept leaders and managers, becomes paramount in articulating safety expectations, goals, and values to all workforce levels. A well-crafted SC strategy contributes to cultivating a positive safety climate, a factor consistently associated with promoting safe behaviours (Abad, Lafuente, & Vilajosana, 2013; Neal, Griffin, & Hart, 2000). Whereas, CS, reflecting an individual's positive assessment of organisational communication, dovetails seamlessly with SC. When employees perceive that safety-related information is communicated effectively, it enhances their satisfaction with overall communication processes (ABDİEN, 2019). This positive synergy fosters a conducive environment for understanding and adhering to safety protocols.

Furthermore, direct managers and supervisors exemplify SCT as a foundation in effective OHSM (Jalalkamali, Ali, Hyun, & Nikbin, 2016; Jaupi & Llaci, 2015). Leaders who articulate and demonstrate an unwavering commitment to safety principles instil a sense of responsibility and dedication among employees toward maintaining a safe work environment, fostering a resilient safety culture. Establishing robust SC channels, ensuring CS, and nurturing a pervasive culture of SCT among leadership, collectively contribute significantly to promoting safe behaviours and mitigating the risk of workplace injuries (Zahiri Harsini et al., 2020).

This study aims to present a specialised conceptual framework tailored for the oil and gas industry, focusing on dimensions crucial to safety and communication. Specifically, it delves into SC and CS, recognising their significance in ensuring a comprehensive and effective strategy within the industry. The theoretical discussion highlights the role of communication strategies, particularly SC, in conveying crucial information during various stages. The proposed conceptual framework, designed for the oil and gas sector, explicitly integrates SC and CS as crucial dimensions. It emphasises their importance in creating a conducive environment for successful and safe operations, providing valuable insights for practitioners and policymakers.

a. Background

Mitigating accidents on a site becomes achievable through meticulous safety planning, adept management procedures, and establishing a safety-centric culture. A pivotal aspect of accident prevention lies in the early identification of risks before operational activities commence.

While the causes of accidents may vary across sectors, they invariably align with accident causation theories (Hosseinian & Torghabeh, 2012). Notably, in the late 1920s (Heinrich, Petersen, & Roos, 1980) conducted a comprehensive study on industrial accidents, revealing that a staggering 88% of 75,000 accidents were linked to risky workers' behaviour. These stats underscore the significance of addressing human errors in accident prevention. The Human Factor Theory, accident/incident theory, Behaviour-Based Safety (BBS), Turner's model, and the Swiss cheese model all echo this sentiment (Andersson, 2012). Human errors are a predominant factor, placing the responsibility for accident prevention squarely on the shoulders of both management and employees, necessitating a collaborative effort.

Integrating SC and CS emerges as crucial components in this context. Effective SC becomes the conduit for conveying risk-related information, fostering an environment where employees are well-informed and engaged in accident prevention measures. Simultaneously, promoting CS enhances the receptiveness and understanding of safety protocols, establishing a culture where employees feel heard and valued. As management endeavours to develop safety systems for enhancing job safety, employees need to comprehend these systems and adhere to safety rules, compliance, and active participation. While both employees and management share responsibility, the organisation plays a central role in supporting its workforce through training and education to enhance SC (Abad et al., 2013; Vinodkumar & Bhasi, 2010; Zerguine, Tamrin, & Jalaludin, 2018). SC influences optimal safety outcomes (Alcantara, Whetten, & Alcantara, 2021; Griffin & Neal, 2000).

While prior research has delved into various safety-related concerns, such as exploring the mediating role of CS in safety management and behaviour (Griffin & Neal, 2000; Zerguine et al., 2018), there has been a notable gap in studies about SC and OHSMS within the Malaysian oil and gas sector. Notably, there is a dearth of research focused on work-related accidents and injuries, a critical aspect in this high-risk industry (Achaw & Boateng, 2012; Acheampong & Akumperigya, 2018; Toseafa, Bata, & Toseafa, 2018). The scarcity of such studies is noteworthy, especially considering that previous research has highlighted significant deficiencies in applying OHSMS and policies within this sector. Despite the burgeoning nature of Malaysia's oil and gas sector, a substantial body of literature documents severe catastrophes and critical workplace accidents prevalent in the global oil and gas industry (Hayes, 2012; Hopkins, 2008; Oppong, 2014).

In the context of this study, it is anticipated that the growing occurrence of occupational accidents and work-related injuries in developing countries, such as Malaysia, stems not only from the ineffective implementation of safety management systems but also from insufficient SC and CS or lack of effective communication among workers. Therefore, investigating such aspects in a high-risk industry holds significant relevance for managers, safety practitioners, and policymakers. This study addresses this gap by offering insights into the mediating role of CS in the relationship between SC and SCT. The framework encompasses the impact of SC on SCT within each oil and gas organisation considered in the study, as outlined in the discussion section.

b. Significance of the Study

The significance of this study is two-fold. Firstly, it contributes significantly to organisational behavioural studies and communication domains. A deep dive into the nuanced dynamics of SC advances the comprehension of how effective communication can mould safety culture and

commitment, especially within high-risk work environments such as offshore oil and gas platforms. Secondly, this research bears substantial practical importance, furnishing valuable knowledge to steer organisations in nurturing the well-being and advancement of their employees amid challenging circumstances. It aims to pinpoint the crucial elements of organisational culture and employee engagement while investigating the pivotal role organisations can play in this dynamic.

In thriving organisations where robust organizational communication is pivotal for cultivating a resilient safety culture, this study aligns with the pressing necessity for organisations to empower employees to actively contribute to safety, quality, and overall success not merely out of obligation but through genuine commitment. Essentially, this research furnishes actionable insights that can assist organisations in ameliorating safety, elevating employee well-being, and instilling a culture of safety and excellence in high-hazard settings like offshore oil and gas platforms. Examining communication variables such as SC, communication climate, and CS provides a guide for organisations navigating the complexities of fostering a robust safety culture and ensuring the dedication of their personnel.

2. Safety and Health Communication Nexus

In occupational safety, an accident is commonly defined as an unplanned event resulting in injury, damage, or loss. Historically, work-related accidents were considered inevitable and viewed as a natural part of the work cycle. Early perceptions, clouded by insufficient evidence or biased perspectives, often attributed accidents to random acts of nature. The emergence of the 'accident proneness theory' in the early modern era suggested a predisposition for specific individuals to be more accident-prone, a notion widely contested by contemporary researchers.

Today, the prevailing view acknowledges that accidents result from a complex interplay of factors rather than individual predispositions. Various accident causation models aim to unravel the intricate web of contributory elements, encompassing both unsafe working conditions (such as lack of effective communication, inadequate safeguards, suboptimal tools, etc.) and unsafe acts (instances where safety rules are disregarded, potentially involving chemical handling without proper protection, or working under the influence). In the context of post-COVID-19 world, where the significance of Occupational Safety and Health (OSH) is heightened, new labour market demands, such as teleworking and the diligent use of protective measures, underscore the need for innovative approaches to health and safety. education emerges as a pivotal strategy to instil a proactive safety culture, empowering future generations with the skills and knowledge needed to navigate OSH challenges.

In this dynamic landscape, SC, CS, and SCT become linchpins for fostering a safety culture. Effective communication ensures workers are well-informed about safety protocols, which increases CS. Concurrently, a strong commitment to safety, embedded in organisational practices and employee mindset, further strengthens the preventive approach to OSH issues. This proactive stance aligns with the broader goals of inclusive and equitable education, as outlined in SDG 4, emphasising the importance of relevant skills for employment and entrepreneurship.

3. Literature Review
a. Safety Communication (SC)

In the contemporary business landscape, increasing numbers of enterprises place SC at the forefront of their core values. This heightened focus on a secure workplace boosts employee

morale and proves advantageous for the overall business trajectory. As per the "Liberty Mutual Workplace Safety Index (Insurance, 2020)," an investment of $1 in workplace safety can yield an impressive $4 return on investment. SC emerges as a pivotal tool across all business facets, and the workplace is no exception.

Effectively communicating safety hazards, regulations, goals, warnings, area guidelines, rules, and progress reports to employees through various media channels is essential for establishing a truly protected workplace (Alcantara et al., 2021). The broader context of SC encompasses organizational safety culture, leadership, and group climates (Paolucci, Sangiorgi, & Mariani, 2021). Incorporating researcher-based evaluation and feedback mechanisms for operational and production workers significantly enhances daily oral SC, resulting in elevated levels of safety performance in the workplace environment (Mambwe, Mwanaumo, Thwala, & Aigbavboa, 2021; Rasool, Samma, Wang, Zhao, & Zhang, 2019).

Several scholars, in their conceptualizations and evaluations of safety culture across various industries, have underscored the importance of SC (Cigularov, Chen, & Rosecrance, 2010; Kim & Scott, 2019; Pinto, Nunes, & Ribeiro, 2011). A robust safety culture entails a shared set of organizational ideals aimed at risk reduction, where individuals across the organizational hierarchy prioritize the creation of a safe workplace (Lyndon et al., 2015). Poor safety culture and communication have been implicated in notorious health and safety catastrophes, highlighting the potency of strategies to foster improved safety practices (Vecchio-Sadus, 2007).

While employee errors are not the primary source of blame, inadequate management actions, such as neglecting the establishment of effective communication channels or disregarding employee feedback, can result in substantial financial losses (Johnsen et al., 2020). Enhancing health and SC systems, including refining communication channels, recording essential information, and employing effective employee feedback mechanisms, can potentially elevate a company's safety culture. The hypothesis posits that effective SC, involving clear and informative discussions about safety procedures and hazards within an organization, is expected to correlate positively with individuals' level of SCT (Asibey, Amponsah, & Yeboah, 2019; Mashi, Subramaniam, & Johari, 2020). In essence, the belief is that improved communication on safety matters will lead to a more incredible dedication among employees to actively participate in safety protocols, adhere to guidelines, and foster a culture where safety is prioritized. This hypothesis forms the basis for investigating the empirical relationship between SC practices and the observed commitment to safety within a workplace. Thus, the first and second hypothesis of the study are:

H1: Safety communication will have a positive impact on communication satisfaction.

H2: Safety communication will have a positive impact on safety commitment.

b. Communication Satisfaction (CS)

The motivation of employees is deeply impacted by CS, as their engagement in organizational work relies on perceiving fulfilling communication. This encompasses various forms of satisfaction in communication, such as supervisory, integration, media, co-worker, corporate, and personal satisfaction, relevant in any organizational context. In organizations where communication is effective, there is a notable increase in employee satisfaction. Numerous studies underscore the connection between CS and incidents in high-risk work environments.

When employees lack confidence and satisfaction in received information, it reduces satisfaction levels, contributing to hazards (ABDİEN, 2019). As a result, this study aims to explore the impact of CS on SCT.

Several researchers have characterized CS as an individual's contentment with various facets of communication in interpersonal, group, and organisational settings (Downs & Hazen, 1977; Jalalkamali et al., 2016). According to (Verčič & Špoljarić, 2020), CS is generally perceived as an emotional response resulting from the fulfilment of expectations during information exchange, indicating a gratifying experience. A satisfying communication environment, characterised by clarity, openness, and effectiveness, is expected to enhance employees' acquisition and understanding of safety-related information. This hypothesis suggests that CS mediates the relationship between SC and SCT. In other words, the impact of SC on SCT is not direct but operates through the satisfaction individuals derive from communication processes. It implies that effective SC influences CS, and, in turn, this satisfaction contributes to a higher level of commitment to safety. This hypothesis reflects that the quality of CS acts as a bridge, explaining how and why SC practices can influence individuals' commitment to safety in a workplace or organisational setting (Musah, Zulkipli, & Ahmad, 2017; Trippas, Spina, Cavedon, & Sanderson, 2017). However, the third hypothesis of the study is;

H3: Communication satisfaction mediates the relationship between safety communication and safety commitment.

c. Safety Commitment (SCT)

According to (Kucherov, McDonald, Ivanov, & Rose, 2015), enhanced SCT arises when front-line individuals improve their behaviours. However, these behaviours are likely to change only under the guidance of influential leaders who foster a sense of belonging within the team. Recognising this, oil and gas companies increasingly invest in safety leadership training programs. The objective is to empower leaders to establish a personal and organisational commitment to safety, transcending daily personnel behaviour. This involves equipping leaders to drive cultural and behavioural changes on the front line and ensuring the sustainability of safety leadership within the organisation (Naji et al., 2020).

Effective communication is pivotal in aligning people, processes, tasks, and systems to achieve health, safety, and environmental (HSE) goals purposefully and cooperatively. How security is communicated significantly influences whether individuals accept and engage in safety processes, with language as an indicator of acceptance (Kalteh, Mortazavi, Mohammadi, & Salesi, 2019). This hypothesis posits that individuals who are content and satisfied with communication processes within an organisational context are likely to exhibit a higher level of commitment to safety. In simpler terms, when employees find the communication within the organisation fulfilling, clear, and compelling, it is expected to contribute positively to their commitment to safety practices (Tripathi & Agarwal, 2017). The hypothesis suggests a correlation between the satisfaction individuals derive from communication and their dedication to maintaining a safe environment. A positive communication experience may foster a more substantial commitment to safety measures and protocols. The fourth hypothesis of the study is;

H4: Communication satisfaction will have a positive impact on safety commitment.

d. High-Risk Workplace Environment

A high-risk workplace environment is characterised as involving work or processes with a high level of inherent dangers, capable of causing physical injury, mental illness, psychological impact, and exposure to biological hazards (Chau et al., 2014; Dahl & Kongsvik, 2018; Dembe, Delbos, & Erickson, 2008; Olivares, Rivera, & Mc Leod, 2014; Zara, Nordin, & Isha, 2023). Figure 1 presents the factors that can contribute to improve the safety at high-risk workplaces. Industries falling under this classification encompass construction, mining, manufacturing, and oil and gas. It pertains to workplaces where the nature of the work is associated with high-risk activities, including those in construction, mining, manufacturing, oil and gas, or related sectors. Certain businesses are also considered high risk when potential outcomes can lead to systemic failures, evidenced by statistics of poor compliance with work health and safety regulations (Chau et al., 2014).

The high-risk work environment significantly impacts the health and safety of millions of employees daily, characterised by stress, overtime, extended shifts, and task performances, thereby increasing the risk of injury (Lindøe, Baram, & Paterson, 2013; Liu, Nkrumah, Akoto, Gyabeng, & Nkrumah, 2020). It can also be defined as a workplace with a risk of psychological and physical damage, including the potential harm to co-workers or the distribution of risk exposure in group work experiences (Fan et al., 2016; Liu et al., 2020). Essentially, any work involving hazardous, flammable, or explosive materials that pose a threat to the worker's health, life, and overall well-being, whether physically or mentally, falls under the category of a high-risk workplace environment (Dembe et al., 2008; Sommer, Ness, & Borg, 2018).

Due to its numerous hazards, the oil and gas industry is considered a particularly high-risk work environment. Some studies define this risk in the oil and gas industry as work or processes that could lead to fatal outcomes in the case of miscommunication or a simple mistake involving multiple hazards like fire, explosion, dangerous emissions, electrical or structural damage, and potential loss of life (Tang, Leiliabadi, & Olugu, 2017; Zara et al., 2023). Another definition highlights workplaces with highly flammable materials, such as heavy hydrocarbons, naphtha B, and bitumen, where even minor miscommunication, mishandling, or maladministration can result in a significant accident (Chettouh, Hamzi, & Benaroua, 2016).

4. Communication Model

Significant efforts contribute to creating the general method for improving safety, and it is perceived that cultural and behavioural issues need to be addressed to achieve this enhancement. Although this is the best way to diversify the safety in the organisation, it might constrain its usefulness. Effective safety processes must improvise different techniques or installations during the early stages of developing their safety measures. Thus, a model has been designed to determine an organisation's safety procedures and identify and recognise actions required to improve workplace safety.

Few studies proposed a communication model that involves improving communication elements during multiple stages in work practice (Bambang Sulistyo P, Fatma Lestari, & Puji Lestari, 2022). This model is anticipated to reduce miscommunication in the overall management system. Lack of an effective communication climate and horizontal and vertical communication between leaders and followers, creating misunderstandings during operational duties. Therefore, the communication gap between supervisors and workers remains a concern. This model tends to emphasise broader contributing factors that significantly impact accidental

causes. This model demonstrated that an effective management system needs to manage major risks and must depend on measuring the work performance of the system to control hazards to ensure they are working as intended.

The communication model (also presented and briefed in Figure 2) focuses on ten significant dimensions of safety, such as safety procedure, individual safety practice, interpersonal communication with co-workers and supervisors, training and motivation, supervisory structure, self-learning, personal growth, leadership style, and employee commitment. These dimensions were also addressed in previous studies regarding workplace safety and identified factors used in other major frameworks in the different industries grounded in empirical research (Chau et al., 2014; Frazier, Ludwig, Whitaker, & Roberts, 2013; Vinodkumar & Bhasi, 2010). Based on the abovementioned dimensions, the proposed framework also considers exploring the four communication dimensions: CS, communication climate, SC, and SCT.

SC is considered a significant predictor of employee performance. The communication model demonstrates this concept clearly, which perceives communication as one of the proximal components that affect work performance. It's a common assumption that supervisors don't understand how to convey information more quickly during operation duties so subordinates can easily understand it. On the other hand, employees feel afraid to share their opinions and advise the management. Lack of effective communication is the primary cause of accidents in the oil and gas industry. However, due to miscommunication, workers and management could not complete the project on time, negatively impacting the organisation's business. Many organisations have uncleared and inappropriate safety procedures and supervisory structures that cause hazards and incidents in the workplace. The oil and gas industry needs an appropriate communication model in which solid interpersonal communication develops between supervisors and workers. There is a need to propose a new communication model to improve safety practices for implementing SC. The communication model applies to encoding, interpreting, decoding, transmitting, receiving feedback, and sharing information frequently. Communication elements such as communication climate, satisfaction, and SC play a significant role in solving problems using communication media across the organization. The communication model helps the industry identify the existing safety issues and effectively achieve desirable results to improve safety in the workplace.

5. Conceptual Framework

This study has established a framework based on the hypothesis (H1 to H4) to elucidate the interconnectedness of good SC, CS, and SCT (also depicted in Figure 3). The proposed framework will prove the developed hypothesis will have a significant impact on SCT. The framework highlights three key variables: SC, CS, and SCT. In this study, SC is posited as an independent variable assumed to influence SCT, the dependent variable. The interconnection between SC and SCT is proposed to be mediated through CS. This research scrutinizes the significance of CS in mediating the relationship between SC and SCT within the Malaysian petrochemical and oil and gas industries. The study explores diverse risk reduction and accident prevention avenues by validating the framework components in the Malaysian setting.

The findings of this study aspire to contribute to an enhanced understanding of the factors influencing employee SCT and strategies for promoting positive safety behaviors. Consequently, the developed model of employee SC is anticipated to foster improvements in worker productivity, well-being, and overall safety in the workplace. The study employs

questionnaires based on "social exchange theory" (SET) to assess the efficiency of exchanges in the realms of communication, CS, and SCT (Acheampong & Akumperigya, 2018; Nwankwo et al., 2022).

a. Theory Of Planned Behaviour

Safety attitude, in addition to individual elements, plays a role in influencing risk-taking behavior (Ulleberg & Rundmo, 2003). The impact of attitude on behavior is expounded in Ajzen's theory of planned behavior (1991). One can delve into social psychology research to grasp the nuances of perspectives, particularly in persuasion (Fazio & Olson, 2014; Guldenmund, 2000). In essence, an attitude is a psychological construct involving an evaluation of an object, resulting in a positive or negative outcome, ranging from weak to vigorous (Battaglia, Frey, & Passetti, 2014; Demba et al., 2013). This evaluation can manifest as preferences such as like or dislike, good or bad, desirable or undesirable, approach or avoid, pleasant or unpleasant, and harmful or beneficial (Fugas, Silva, & Meliá, 2012; Gardner, 2003)

Attitudes encompass three classic components: cognitive, affective, and behavioral (Guldenmund, 2000; Purdham, 1980), commonly known as the tripartite (Fazio & Olson, 2007). These components correspond to what people think (cognitive), feel (affective), and do (behavioral) concerning the object (Fazio & Olson, 2007; Purdham, 1980), which in safety terms could be safety rules, injuries, hazards, personal protective equipment, safety management, or activities like phoning while driving. Attitudes evolve through a process involving a pre-formed perspective in memory and newly assessed experiences. Ajzen's theory (1991) adds that subjective norms, perceived behavioral control, and attitude shape a person's intention to behave. Figure 4 illustrates that perceived behavioral control can directly influence behavior, emphasizing its importance in determining behavioral intention. Notably, the theory of planned behavior pertains to planned behavior, while safety behavior often involves non-intentional actions.

The 'MODE-model' or Motivation and Opportunity as Determinants of the attitude-behavior relation (ABDİEN, 2019; Fazio, 1990) and the 'strength-model of self-control' (Muraven & Baumeister, 2000) elucidate whether a spontaneous or well-thought-out behavior will be executed. According to (Newnam & Goode, 2019), motivation and ample opportunity are essential for contemplating future behavior, involving extensive cognitive work and energy. Without these, attitudes in memory may guide behavior without conscious deliberation (Fazio & Olson, 2007, 2014). The strength model of self-control posits that executing behavior misaligned with one's attitude requires self-control, acting as a limited resource subject to ego depletion (Acheampong & Akumperigya, 2018; Muraven & Baumeister, 2000). Consequently, a person might adhere to safety plans in normal circumstances but may engage in risky behavior when depleted of available resources.

6. Research Design

This study adopts a positivist design with a deductive approach, utilizing a mixed-methods (Quantitative + Qualitative) strategy for data collection. Semi-structured interviews and physical questionnaires will be employed to enhance clarity for respondents. The study is cross-sectional for efficiency in time and cost. The population consists of oil and gas workers, specifically from Malaysia's downstream sector, with a sample size of 250 selected from production and operational departments, as determined by the (Krejcie & Morgan, 1970) table. A stratified sampling approach will be used to collect data from all levels of active industry

workers, ensuring precision and minimizing biases. Respondents from the operational and production departments are chosen for their exposure to significant occupational challenges. Data analysis will employ the Partial Least Square Structural Equation Modeling (PLS-SEM) statistical tool, following the (Preacher, Rucker, & Hayes, 2007), allowing for model modifications based on the obtained results.

7. Discussion

The conceptual framework and accompanying guide introduced in this paper present a novel way of comprehending and evaluating SC. Originally crafted as a tool for regulatory bodies and practitioners in the oil and gas sector, its applicability extends to any industry navigating high-risk and dynamically evolving landscapes. This framework boasts several advantageous attributes facilitating a more comprehensive and systemic perspective on SC. In the subsequent sections, the study delineates the practical applications revolving around strategies of effective communication that the conceptual framework and guide facilitate. Subsequently, engage in a discussion regarding aspects warranting additional development and application.

Initially, the study developed the hypothesis (H1 to H4) after rigorously reviewing the literature and analyzing the issues encountered in safety practices. The hypothesis are designed considering their impact and influence on safety practices. Subsequently, the framework is developed on the foundation of these hypothesis. Afterward, the study delves into three ways such that the framework enriches the comprehension of SC within high-risk environments. Firstly, the framework systematically defines SC, elucidating its manifestation in contexts marked by uncertainty and interdependence. It incorporates a communication model that underscores the intricacies of information exchange in dynamic settings.

Secondly, acknowledging the inherent challenge of directly observing SC, the framework introduces a structured approach to evaluate enabling capital. These capitals encompass factors such as CS, emphasizing their pivotal role in fostering effective SC. The model posits that satisfaction in communication channels is integral to enhancing employee SCT.

Furthermore, the framework establishes a linkage between CS and SCT, elucidating how a positive communication environment contributes to a higher commitment to safety protocols. This connection underscores the importance of not only the quantity but also the quality of communication in cultivating a robust safety culture within high-risk work environments. The framework significantly strides by methodically incorporating SC into a comprehensive assessment guide. SC is a pivotal element in establishing and reinforcing organizational safety. However, the term 'communication' is often invoked broadly, encompassing various factors contributing to safety, making it challenging to precisely define and manage (Cox & Flin, 1998; Lee & Kim, 2021). Despite its recognition as a causal factor in accidents, its nebulous nature has hindered practical definition and management.

Historically, communication tools have assessed diverse elements, spanning individual motivations, group processes, job characteristics, organizational norms, and safety management systems. While this approach offers a thorough evaluation, it often stands alone, lacking systematic links to other framework components like communication skills within human capital or monitoring systems within organizational capital. To address this, the framework presents a more specific conceptualization of the social foundations of communication, enhancing the integration of SC assessment. (Bills & Agostini, 2009; Luo & Zhang, 2022) underscored the regulator's need to incorporate SC into broader assessments for

overseeing entry and ongoing operations in offshore facilities. By defining the content of SC in terms of social capital, the proposed framework offers conceptual clarity for regulators and operators. It establishes systematic links between SC assessment and other safety evaluation forms. This approach ensures a more interconnected and holistic understanding of safety within the organizational context.

The proposed study contributes to the existing body of knowledge on SC by illustrating that a psychosocially safe culture can mitigate psychological distress and reduce fatalities even in high-risk work environments. Limited research has explored this connection in contexts prone to accidents and deaths (Dollard & Bakker, 2010; Feng, Teo, Ling, & Low, 2014; Mirza, Isha, Memon, Azeem, & Zahid, 2022; Rasool, Wang, Zhang, & Samma, 2020). Furthermore, past studies predominantly used injuries as a gauge for workplace safety, neglecting the exploration of how SC influences SCT among workers. This research fills a notable void in occupational safety and health literature. Drawing on the SCT concept (Stemn, Bofinger, Cliff, & Hassall, 2019; Yang, Wang, Chang, Guo, & Huang, 2009), the proposed framework indicates that employees exhibit enhanced SCT and contribute to a positive safety culture when engaged in effective SC. While the assessment primarily centred on safety leadership, it underscored the necessity of tailoring safety approaches to the contextual demands of diverse businesses concerning workplace safety. The revelations of the study highlight that addressing human error is as pivotal as attending to physical factors to elevate worker safety performance, particularly in high-risk sectors like oil and gas. This study augments the occupational CS base by advocating for a holistic approach. Industries grappling with stressful working conditions, like oil and gas, should prioritize safety culture variables to augment employee safety performance. Future research on safety enhancement strategies should encompass safety management and SC considerations dimensions. The present study delved into the influence of SC on SCT, driven explicitly by CS, yielding valuable insights for the broader understanding of safety culture."

8. Conclusion

This study delves deeply into SC within the oil and gas industry, focusing mainly on effective communication. The research successfully constructed four hypotheses (H1 to H4) and developed a framework based on those hypotheses to improve safety practices through effective communication. The research features its vital role in disseminating critical information, ensuring a thorough understanding of safety protocols among all individuals, and recognizing SC as a linchpin for a robust safety culture. A positive safety environment, characterized by openness and trust, is pivotal in facilitating meaningful safety discussions. Furthermore, the satisfaction derived from communication processes, reflecting personnel contentment, is intricately linked to heightened engagement in safety measures.

The proposed conceptual framework enriches academic understanding and holds practical significance. By scrutinizing the impact of crucial communication variables on SCT, this study provides organizations with actionable insights, guiding them in fostering resilient safety cultures in high-risk environments. In the unique context of oil and gas platforms, these insights contribute significantly to overarching goals of heightened safety, well-being, and excellence.

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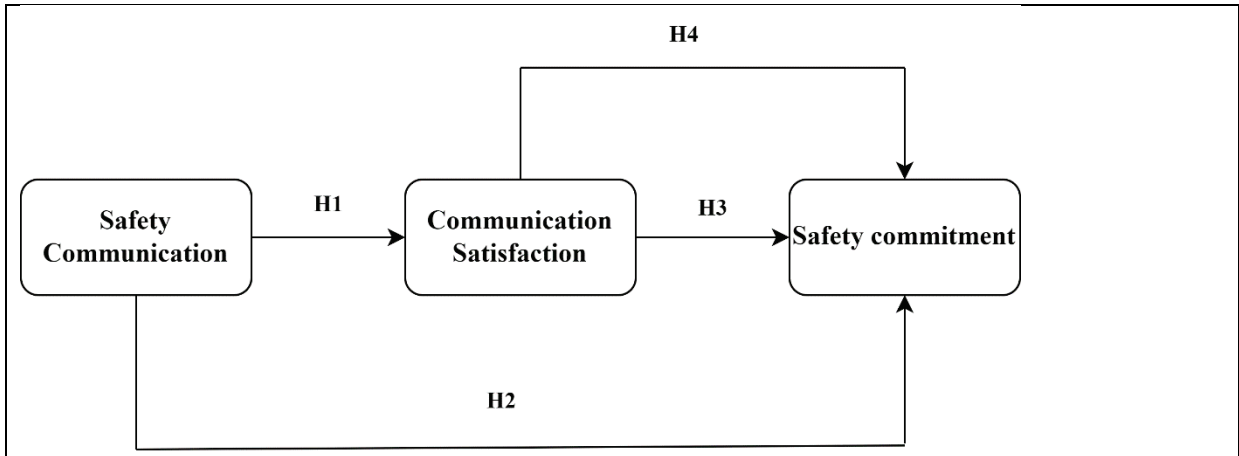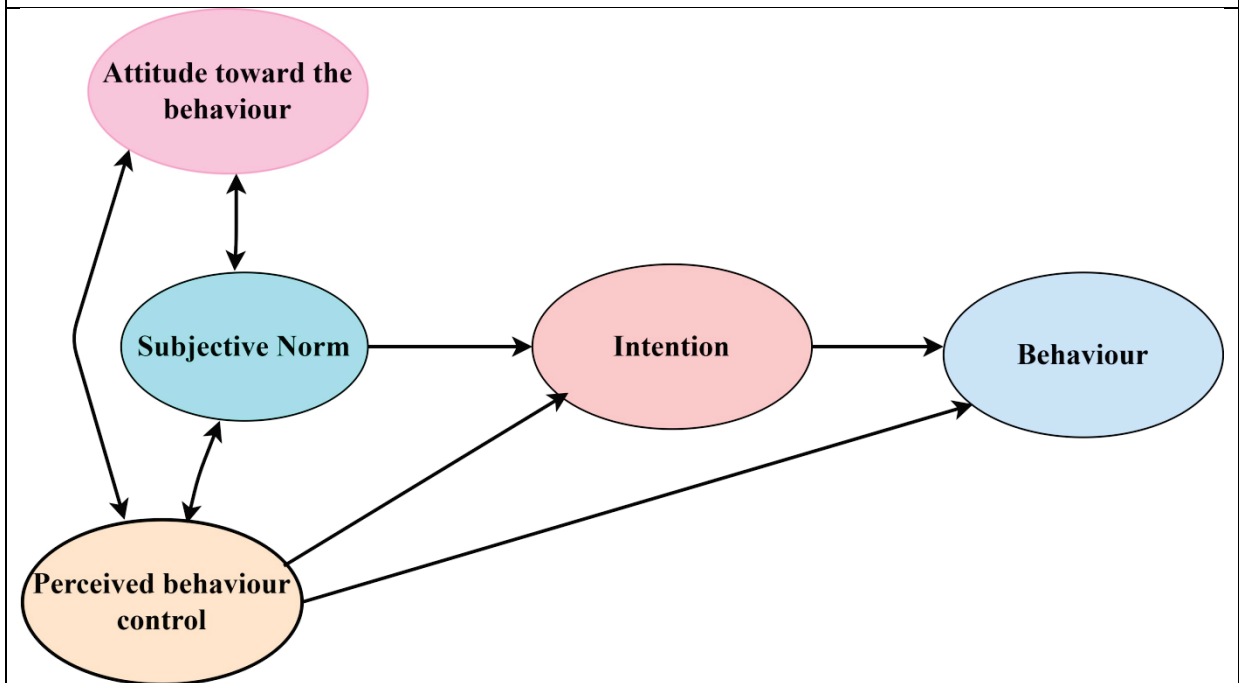
Figures:

Figure 1: High-risk Workplace Environment.
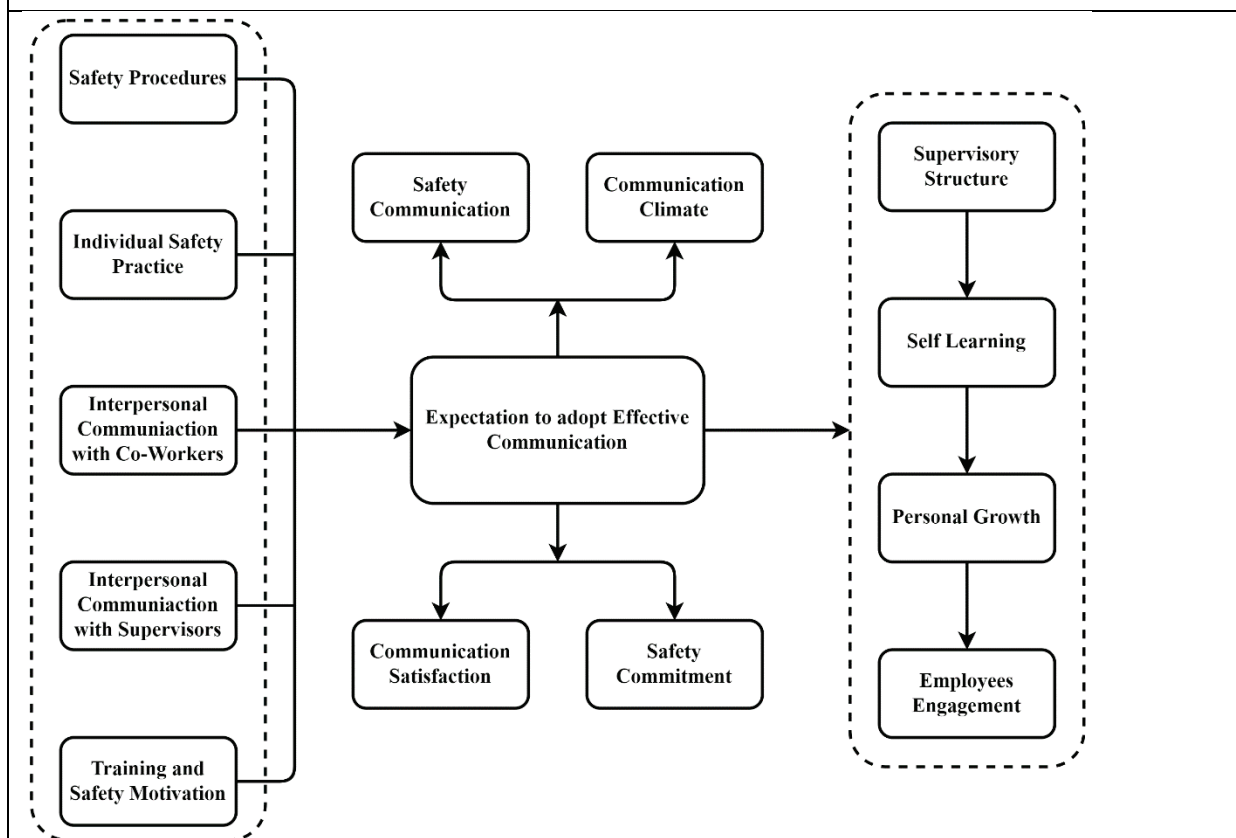
Figure 2: Communication Model.

Figure 3: Conceptual Framework.

Figure 4: Theory of Planned Behaviour.