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Examining the Nuances of Safety Management System, Safety Motivation and Safety Knowledge to Improve Safety Performance among Contract Mineworkers in Ghana

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Abstract

The current study looked at how a safety management system (SMS) affected contract mineworkers' safety performance, through safety knowledge and motivation. Using 363 valid responses from frontline contract mineworkers in Ghana, the study's paths were analysed using hierarchical regression analysis in SPSS version 27. The findings showed that six SMS variables (promotion and training-PT, documentation and commands-DC, executive management commitment-EMC, safety rules and procedure-SRP, safety management policy-SMP and safety committees-SC) significantly influenced safety compliance. Emergency preparedness and response plan (EPRP) had an insignificant effect on safety compliance. Surprisingly, only four SMS variables (PT, EMC, EPRP, and SC) significantly influenced safety participation. DC, SRP, and SMP did not significantly affect safety participation. The five SMS variables (PT, DC, EMC, SMP, and SC) and compliance were found to be significantly mediated by safety motivation. The relationship between four SMS variables (PT, EMC, EPRP, and SC) and safety participation was further significantly

mediated by safety motivation. On the other hand, the indirect route from EPRP and SRP to safety compliance could not be substantially mediated by safety motivation. Also, safety motivation insignificantly mediated the indirect path from DC, SRP and SMP to safety participation. Similarly, safety knowledge significantly mediated the relationship between four SMS variables (PT, DC, SMP, and SC) and safety compliance, and between two SMS variables (PT and SC) and safety participation. Unfortunately, safety knowledge insignificantly mediated the indirect paths from EMC, EPRP, and SRP to safety compliance. Similarly, safety knowledge did not mediate the paths from DC, EMC, EPRP, SRP, and SMP to safety participation to a significant extent.

Keywords: Safety management system; safety motivation; safety knowledge; safety performance

1. Introduction

The mining industry is among the highest-paying jobs globally, yet it is the most hazardous place one can work (Zhu et al., 2020). Incident rates are high despite several interventions by mine regulators and investments by mine owners to improve safety (Quansah et al., 2023). The case is even worse for contract mineworkers compared to owner mineworkers. For instance, Pappas and Mark (2011) reviewed the mine incidents from 1992 to 1999. They found that contract mineworkers had injury rates 16.6 times higher than owner mineworkers. The mortality rate between contract and owner mining enterprises was also investigated by Muzaffar et al. (2013). They concluded that contract miners are responsible for almost 2.8 times as many deaths as mine owners. Also, Buessing and Boden (2016) compared injuries with owner and contract miners. They concluded that, compared with owner-mining businesses, contract miners are responsible for over 55% of injuries. The terms of the contract and the measures that owner-mining companies use to reevaluate their contracts may contribute to this high incident rate among contract mineworkers (Quansah et al., 2023). This could be upsetting and stressful, leading to incidents (Quansah et al., 2023). Despite this worry, some scholars hope the mine site can be made a safe place for all to work if mine management invests in interrelated activities that improve workplace safety. Some scholars (e.g., Kobylianskyi and Mykhalchenko (2020), Bao et al. (2017), Haas and Yorio (2016), Chen and Chen (2012)) propose that companies should implement safety management system (SMS) to increase safety and lower mishaps

SMS is a methodical framework intended to support occupational health and safety management, according to the Health and Safety Executive (HSE, 2008). Though there is a financial cost associated with safety management system, the advantages greatly exceed the drawbacks. However, accidents negatively impact productivity and quality, as well as the company's internal atmosphere and public image. As a result, an effective safety management system can improve competitiveness factors such as safety motivation and safety knowledge, in addition to enhancing safety performance. Therefore, organisations have a great chance to embrace the challenge and implement a safety management system.

According to Park and Kim (2013) and Sunindijo and Zou (2013), SMS might not be sufficient on its own to promote good safety performance. They contend that when SMS is combined with other management initiatives, it may fully improve performance. Despite this, Yiu et al. (2019) note that safety performance will still be negatively impacted if there are weak connections between SMS and other management programmes. In light of this, Poon et al. (2008) qualitatively suggested motivational elements to supplement SMS's impact on safety performance. However, there was no empirical backing for their findings. According to Yiu et al. (2019), it would be preferable to use empirical data to conduct a quantitative analysis of the connection between SMS and safety performance. Additionally, the current study proposes quantitatively demonstrating how safety motivation enhances SMS's benefits for safety performance.

Furthermore, Heinrich's Domino Theory of accident occurrence (Heinrich, 1932) serves as the foundation to combine SMS, safety motivation, safety knowledge, and safety

performance. The Domino Theorists (e.g., Sabet et al. (2021), Rahiman and Mahat (2018), Rad (2013)) believe that poor safety performance is a sequential event. These sequential events that lead to accidents can be broken with contemporary SMS that supports knowledge development and motivates employees to be desirous of acting safely at the workplace (Chi & Han, 2013). Thus, the study's objectives are to: (a) investigate how SMS affects safety performance; and (b) investigate how safety motivation and safety knowledge mediate the relationship between SMS and safety performance.

2. Literature Review and Hypotheses Development

2.1 Theoretical Foundation

Workplace safety is essential to protecting lives, maintaining equipment, and preserving the environment. Hence, scholars in the field of safety have proposed several theories to help organizations achieve significant safety improvements. Some of these theories include safety management system theory (Hale et al., 1997), adjustment stress theory (Kerr, 1957), human error theory (Choudhry & Fang, 2008), Swiss Cheese theory (Reason, 1990), health belief theory (Rosenstock, 1974; Rosenstock et al., 1988), etc. One theory that encapsulates the nitty-gritty of how incidents occur and what can be done to mitigate or eliminate them is Heinrich's Domino theory of accident occurrence. The domino theory (Heinrich, 1931) is also known as Heinrich's Law. It is the first scientific approach to workplace safety. The domino theory provides a framework for understanding how poor safety performance (e.g., incidents) occurs and offers strategies for preventing them by addressing their root causes.

The domino theory offers a solid basis for connecting the safety management system (SMS) to safety performance through the mediating effects of safety motivation and knowledge. The rationale is that safety performance is not isolated. An organization's safety performance may be determined by a number of processes (such as safety motivation and knowledge) and factors such as SMS.

For instance, the SMS contains number of safety actions that interact to affect safety performance (Khalid et al., 2021). Documentation and commands, executive management commitment, training and promotion, emergency preparedness and response plan, and safety management policy are some of the activities that fall within the safety management system (Chen & Chen, 2012). Other important elements of the safety management system include safety committees (Flin et al., 2000) are also key components of the SMS and safety rules and procedures (Vinodkumar & Bhasi, 2010). Domino theorists believe that SMS has a dynamic capability to systematically manage an organisation's risk to achieve a positive safety record (Vaiagae, 2020). Achieving positive safety records indicates an improvement in an organisation's safety performance (Yeboah et al., 2025).

Furthermore, the domino theory suggests that organisations create a system that motivates employees to work safely (Chi & Han, 2013). According to Bunner et al. (2018), safety motivation encourages workers to take an active role in safety processes and adhere to safety protocols.. This act enhances safety performance by leading to fewer incidents (Vatankhah, 2021).

In addition, domino theorists such as Chee (2017) highlight that over-complacency can contribute to poor workplace safety and, consequently, lead to a high incident rate. However, organisations that can create a system to equip employees with relevant safety knowledge may become more safety-conscious and help improve safety performance. Hence, based on the domino theory of incident occurrence, the study proposes that SMS may affect safety motivation and safety knowledge, which will then affect safety performance (See Figure 1 below).

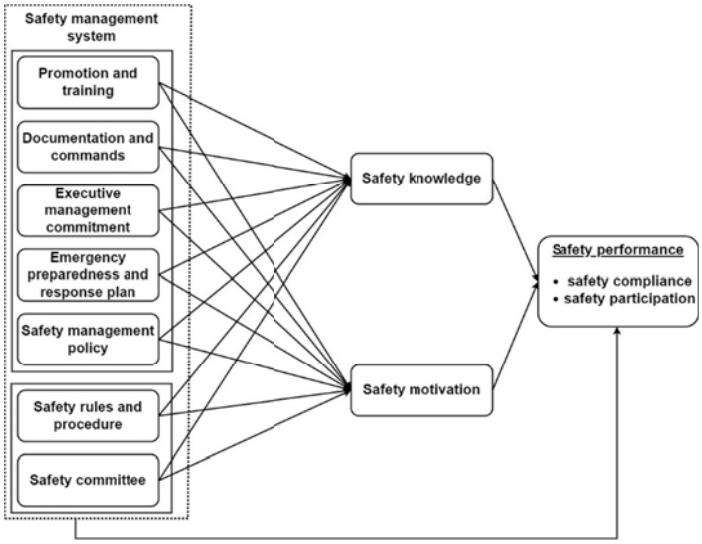

Figure 1. Relationship among safety management system, safety motivation, safety knowledge, and safety performance

2.2 Safety Performance

One particular facet of an organization's overall success is its safety performance. Nevertheless, some prior research has compared safety performance to other work-related behaviours that comprise job performance. This enables the application of performance models to workplace safety performance. Task performance and contextual performance, according to Borman and Motowidlo (1997), make up performance model. Borman and Motowidlo (1997) claim that performance components account for the behaviours people exhibit at work. Griffin and Neal (2000) suggested that safety performance can be utilized to distinguish between different workplace safety practices based on the performance idea of Borman and Motowidlo (1997).

They proposed the terms "safety compliance" and "participation" for task and contextual performance, respectively. According to Griffin and Neal's (2000) study, employees must fulfill mandatory safety obligations in order to preserve workplace safety, making safety compliance crucial. An example includes following lockout and tagout protocols. They also characterize safety participation as employees' voluntary safety behaviours that promote workplace safety. Attending safety meetings or taking part in voluntary safety initiatives are two examples. Although it may not immediately increase workplace safety, safety participation contributes to the creation of a safe atmosphere.

2.3 Safety Management System and Safety Performance

A safety policy is the cornerstone of a robust Safety Management System (SMS). It demonstrates senior management's commitment to safety and ongoing development and describes the protocols, organizational structure, and techniques needed to accomplish safety goals. Establishing a culture of safety and making sure that all employees understand and follow safety protocols are the responsibilities of management. If proper compliance is maintained throughout the workplace, there is a greater chance that the likelihood of accidents and injuries will be greatly reduced.

Researchers such as Vinodkumar and Bhasi (2010), Arocena and Nunez (2010) and Hamidi et al. (2012) have examined the efficacy of SMS. The operation of a SMS has received full or partial support from the majority. The Australian Transportation Safety Bureau has studied the effectiveness of SMS and discovered that they have a major impact on safety behaviour (Thomas, 2012). The rail, maritime, and aviation sectors in Australia have lately adopted SMS. The purpose of the study was to assess the efficacy of SMS deployment utilizing research data. The results of the study suggest that well-executed SMS could enhance safety performance.

Nonetheless, the evaluation shows that safety management systems in mining domains are not well studied. Despite the fact that many academics and companies have linked SMS to safety results, Gallagher et al. (2003) and Jazayeri and Dadi (2017) contended that the linkage is ambiguous and false. The current study argues that, with the right components in the SMS, organizations can significantly influence safety performance.

For instance, when SMS includes promotion and training, firms can convey safety as a fundamental priority and equip employees with the skills needed to work safely (Tong et al., 2023). Also, documentation and commands are crucial for proving compliance with regulatory bodies such as the Occupational Safety and Health Administration (OSHA) and for standardizing. Executive management commitment ensures that the established guidelines are required actions rather than mere recommendations, giving safety precautions the resources and authority they need. Again, an SMS with an emergency preparedness and response plan (EPRP) serves as the foundation for safety compliance by outlining precise protocols, roles, and duties for emergency circumstances. EPRP ensures that companies are equipped to manage emergencies effectively and safeguard their personnel and resources. Being able to do this directly improves safety performance. An SMS with a firm safety management policy can convert management's dedication into practical procedures that systematically reduce risks, transforming intangible objectives into quantifiable safety outcomes and thereby improving safety performance. Safety rules and procedures provide the framework, information, and standards required for safe behaviour at work. They improve safety performance by educating workers about potential hazards and how to mitigate them. An effective SMS will need the safety committee to function correctly (Flin et al., 2000). A safety committee can serve as a link, ensuring that issues are acknowledged, cooperative solutions are developed, and safety regulations are successfully implemented, thereby enhancing appreciable safety performance. Therefore, the study proposes the following

hypotheses upon the reasons highlighted so far:

H1: Safety management system will significantly influence safety performance among contract mineworkers

H1a: Promotion and training will significantly influence safety compliance among contract mineworkers

H1aa: Promotion and training will significantly influence safety participation among contract mineworkers

H1b: Documentation and commands will significantly influence safety compliance among contract mineworkers

H1bb: Documentation and commands will significantly influence safety participation among contract mineworkers

H1c: Executive management commitment will significantly influence safety compliance among contract mineworkers

H1cc: Executive management commitment will significantly influence safety participation among contract mineworkers

H1d: Emergency preparedness and response plan will significantly influence safety compliance among contract mineworkers

H1dd: Emergency preparedness and response plan will significantly influence safety participation among contract mineworkers

H1e: Safety management policy will significantly influence safety compliance among contract mineworkers

H1ee: Safety management policy will significantly influence safety participation among contract mineworkers

H1f: Safety rules and procedure will significantly influence safety compliance among contract mineworkers

H1ff: Safety rules and procedure will significantly influence safety participation among contract mineworkers

H1g: Safety committee will significantly influence safety compliance among contract mineworkers

H1gg: Safety committee will significantly influence safety participation among contract mineworkers

2.4 Safety Management System, and Safety Motivation

The foundation for increasing employee safety motivation is established by a safety management system (SMS). SMS accomplishes this through a series of related actions. Some of these associated actions include promotion and training (PT), documentation and

command (DC), executive management commitment (EMC), an emergency preparedness and response plan (EPRP), a safety management policy (SMP), safety rules and procedures (SRP), and a safety committee (SC).

For instance, PT increases employee value by equipping them with additional knowledge, skills, and abilities to work (Chan et al., 2023). Equipped employees express their inner feelings (motivation) through higher levels of engagement, job satisfaction, and commitment. Similarly, DC influences safety motivation by convincing staff that management is committed to a strict, well-documented safety system (e.g., by providing updated procedures and training records). Motivated employees will have a better impression of the organization's commitment to safety (Fraboni et al., 2023). They may be more inclined to participate in safe activities as a result of this apparent support and open communication. EMC ensures businesses display appropriate behavioural indicators that workers can interpret as encouraging and acceptable (Peker et al., 2022). Employee motivation will suffer if management claims to be committed yet permits production pressure to take precedence over safety (Quansah et al., 2022). Once more, a robust EPRP can boost employee safety motivation and show an organization's unwavering commitment to worker well-being (Andreassen et al., 2025). When workers are aware that a clear plan is in place, they are more likely to be encouraged to participate in safety programs and exercises with a solid EPRP (Bruyelle et al., 2014; Domgue K et al., 2025). SMP serves as an official declaration that safety is important. This may motivate employees both internally and externally (Shi & Mohamed Zainal, 2022). Additionally, when workers feel that the safety policy is sincere and that their health is a top priority, SMP can increase their motivation (Khun-anod et al., 2024; Yeboah et al., 2025).

Furthermore, workers frequently act in accordance with their interpretations of their perceptions. SRPs must therefore work to persuade workers that they are beneficial and efficient for their actual safety (Nnaji et al., 2022). Employees may be more motivated to follow them if this is accomplished. On the other hand, motiv ation declines when regulations are seen as merely "ticking boxes" or are overly complicated and ineffective (Caesens & Brison, 2023). Another important component of the SMS is the safety committees. With safety committees, employees can discuss safety-related matters with managers. This approach promotes open communication, empowerment, and a sense of collective accountability. By involving employees in safety decision-making, the committee elevates safety from a top-down requirement to a fundamental organizational value. According to the current study, this strategy can have a big impact on safety motivation. Therefore, the researcher proposes the following hypotheses:

H2: Safety management system will significantly influence safety motivation among contract mineworkers

H2a: Promotion and training will significantly influence safety motivation

H2b: Documentation and commands will significantly influence safety motivation

H2c: Executive management commitment will significantly influence safety motivation

H2d: Emergency preparedness and response plan will significantly influence safety motivation

H2e: Safety management policy will significantly influence safety motivation

H2f: Safety rules and procedures will significantly influence safety motivation

H2g: Safety committee will significantly influence safety motivation

2.5 Safety Management System and Safety Knowledge

To proactively manage risks, promote ongoing improvement, and integrate safety into a company's culture, the safety management system (SMS) should leverage and extend safety expertise. This enables the company to translate theoretical understanding into practical, effective action to improve safety performance. For example, employees" knowledge can be enhanced in areas such as risk assessment and hazard identification when promotion and training programmes are well-designed and delivered. Employees with training will know how to use best practices to complete their tasks safely. Also, the availability and enforcement of appropriate task execution criteria are guaranteed by documentation and command (DC). On the blind side, the DC encourages employees to take responsibility for developing, sharing, and implementing the established safety protocols. Strong DC ensures that the established guidelines are required actions rather than mere recommendations, giving safety precautions the resources and authority they need. Doing these helps DC develop a safety culture that promotes safety knowledge, which can be shared rather than hoarded.

Similarly, the development of safety knowledge across an organization is directly and significantly influenced by executive management commitment (EMC) (Mashi et al., 2020). Employees are encouraged to seek out, learn, and use safety knowledge and procedures when leaders demonstrate a clear, sincere commitment to safety (Fruhen et al., 2014). This responsibility may make EMC essentially turn safety knowledge into an active, deeply embedded part of the organization's everyday operations and culture, rather than just information found in a policy document. Another aspect of the SMS that influences safety knowledge is the emergency preparedness and response plan (EPRP). By converting abstract knowledge into specific, doable actions, EPRP operationalizes and immediately implements safety knowledge (Knuth et al., 2017). Using this information, the EPRP develops a workable, written strategy that guarantees people and organizations know how to use that safety knowledge in an emergency (Knuth et al., 2017). Safety management policy (SMP) can also influence safety knowledge. SMP explains the organization's policy to its staff. The commitments, rules, and required training transfers established by these policies will improve personnel's safety knowledge (Park et al., 2010; Vinodkumar & Bhasi, 2010). With enhanced safety knowledge, these employees will follow procedures, avoid hazards, and improve performance (Subramaniam et al., 2016). Safety rules and procedures (SRPs) provide workers with clear guidance and real-world applications (Vinodkumar & Bhasi, 2010). Employers who offer these procedures to staff through safety meetings, training, and communication help employees become more knowledgeable about safety (Bayram et al., 2022; Weichbrodt, 2015). By converting an abstract understanding of dangers into practical

actions to prevent accidents, protect people, ensure compliance, and maintain a safe work environment, employees demonstrate this safety knowledge. Again, it has been discovered that safety committees have a big impact on an organization's knowledge development (Farouk, 2017). The committee plans and directs safety training sessions, distributes safety information, and ensures staff members understand potential risks and proper protocols. This directly expands workers' knowledge of safety (McGuire et al., 2020). The present study puts forth the following hypotheses in light of the problems that have been brought up so far:

H3: Safety management system will significantly influence safety knowledge among contract mineworkers

H3a: Promotion and training will significantly influence safety knowledge

H3b: Documentation and commands will significantly influence safety knowledge

H3c: Executive management commitment will significantly influence safety knowledge

H3d: Emergency preparedness and response will significantly influence safety knowledge

H3e: Safety management policy will significantly influence safety knowledge

H3f: Safety rules and procedures will significantly influence safety knowledge

H3g: Safety committee will significantly influence safety knowledge

2.6 Safety Motivation, Safety Knowledge and Safety Performance

Employers want excellent safety performance from their staff. By assuring safety compliance and participation behaviors, employees can exhibit great safety performance. For instance, employees must wear personal protection equipment (PPE), use the proper safety tools, and follow safety rules and procedures in order to comply with safety laws (Griffin & Neal, 2000). Safety motivation can enhance this compliance behaviour if it rewards workers or keeps them out of trouble (Ansori & Widyanti, 2021; Griffin & Hu, 2013). Also, it can improve one's desire to stay safe through consistent behaviour, such as adhering to safety protocols and standards before performing any task (Tahapary & Laksono, 2025; Zohar et al., 2015). Again, when motivation makes employees feel internal pressure or prompts them to want to see colleagues feel good about themselves, their actions are may follow safety regulations (Jiang & Tetrick, 2016).

Additionally, safety participation in organizations refers to voluntary actions that improve safety. A work environment that promotes worker and group safety, promotes proactive workplace safety management, and mostly avoids accidents and near-misses is created via participation in safety programs. Zhang (2014) ssssasserts that intrinsic motivation has a major impact on safety participation in coal mining businesses. Jiang and Tetrick (2016) found a positive correlation between autonomous motivation and safety engagement. Furthermore, Griffin and Neal (2000) discovered that safety motivation had a stronger correlation with safety engagement than safety knowledge. Furthermore, Wang et al. (2023) discovered that employees who are driven by safety are more passionate and engage in safety-related activities than those who are not. Thus, the following theories are put forth by

the current study:

H4: Safety motivation will significantly influence safety performance

H4a: Safety motivation will significantly influence safety compliance

H4b: Safety motivation will significantly influence safety participation

Furthermore, previous studies show that safety knowledge significantly influences safety performance. According to studies like Neal and Griffin (2006), Vinodkumar and Bhasi (2010), and Yu et al. (2021), for example, safety knowledge is the foundation of safety compliance. Workers that are knowledgeable about safety are better able to comprehend procedures, risks, and equipment operation. Employees who possess safety knowledge become more proficient in their work and cognizant of the safety procedures that apply to their jobs (Yu et al., 2021).

Additionally, Jiang and Probst (2016) show a significant relationship between safety knowledge and safety participation. Employees who are knowledgeable about safety are better equipped to be proactive in the workplace (Yu et al., 2021). It gives workers the tools they need to understand the importance of protecting others and themselves. Jiang and Probst (2016) assert that workers who appear unconcerned about others' safety tend to exhibit empathy. Because every workplace safety issue has the potential to stop operations, which could affect bonuses completely (Peron et al., 2022). Increased knowledge boosts motivation for both safety participation (going above and beyond the rules) and compliance (following the rules) (Neal & Griffin, 2006; Putra et al., 2022). These reasons makes the study propose that:

H5: Safety knowledge will significantly influence safety performance

H5a: Safety knowledge will significantly influence safety compliance

H5b: Safety knowledge will significantly influence safety participation

2.7 Safety Motivation as Mediators

The study relies on the domino theory of accident occurrence to suggest that SMS can affect safety motivation. This affect will in turn, influence safety performance (SMS→SM →SP). This claim holds because the domino theory emphasizes the importance of identifying and removing the underlying causes of mishaps rather than focusing solely on the immediate physical failures, which serves as the conceptual basis for the contemporary safety management system (SMS) approach.

For instance, promotion and training, key components of SMS, can be used to remove bottlenecks that prevent employees from working safely. Removing these bottlenecks may motivates employees to foster a consistent workplace culture and achieve higher safety performance. Once more, employees' perception of the organization's support for safety can be improved when documentation and commands (DC) are used to demonstrate management's dedication to a strict, well-established DC system (e.g., by providing current procedures and training records). This action drives employee motivation (Shi & Mohamed

Zainal, 2022), which, in turn, may lead them to strive for high safety performance. Also, when organizations, through executive management commitment (EMC), care for employees' well-being, safety motivation can be improved (Ye et al., 2020). This act can, in turn, motivate employees to follow safe procedures and take safety precautions seriously, thereby improving safety performance. By integrating employees, an emergency preparedness and response plan (EPRP) promotes a sense of responsibility and ownership for safety. It also demonstrates a company's genuine dedication to worker welfare. Businesses can increase employee safety motivation by implementing these EPRP goals (Andreassen et al., 2025). When workers are aware that a clear strategy is in place, they are more likely to be motivated to adhere to safety regulations and participate in safety programs and exercises.

Furthermore, organizations use a safety management policy (SMP) to establish a clear safety standard for monitoring and evaluating employees' behaviour. When these standards are well communicated, they foster employee safety motivation. These motivated employees will, in turn, exhibit high levels of safety compliance and participation (Zohar et al., 2015). There are standards for performing work duties, thanks to safety rules and regulations (SRP). The mere existence of these rules, however, might not guarantee compliance and participation. These rules must motivate employees to perform safely, encouraging them to put forth effort to improve safety performance. To enhance safety performance, organizations establish safety committees. Nonetheless, the safety committee needs to drive a culture of safety. By incorporating, empowering, and educating staff members, this promotes safety motivation and improves adherence to policies and procedures. Safety committee-induced safety motivation can also increase safety participation, such as assisting colleagues in performing their jobs safely. Therefore, the study hypothesizes that:

H6: Safety motivation will significantly mediate the relationship between safety management system and safety performance (compliance and participation)

H6a: Safety motivation will significantly mediate the relationship between promotion and training and safety compliance

H6aa: Safety motivation will significantly mediate the relationship between promotion and training, and safety participation

H6b: Safety motivation will significantly mediate the relationship between documentation and commands and safety compliance

H6bb: Safety motivation will significantly mediate the relationship between documentation and commands and safety participation

H6c: Safety motivation will significantly mediate the relationship between executive management commitment and safety compliance

H6cc: Safety motivation will significantly mediate the relationship between executive management commitment and safety participation

H6d: Safety motivation will significantly mediate the relationship between emergency preparedness and response plan and safety compliance

H6dd: Safety motivation will significantly mediate the relationship between emergency preparedness and response plan and safety participation

H6e: Safety motivation will significantly mediate the relationship between safety management policy and safety compliance

H6ee: Safety motivation will significantly mediate the relationship between safety management policy and safety participation

H6f: Safety motivation will significantly mediate the relationship between safety rules and procedure and safety compliance

H6ff: Safety motivation will significantly mediate the relationship between safety rules and procedure and safety participation

H6g: Safety motivation will significantly mediate the relationship between safety committee and safety compliance

H6gg: Safety motivation will significantly mediate the relationship between safety committee and safety participation.

2.8 Safety Knowledge as Mediators

Relying on the domino theory of accident occurrence, the study establishes that SMS may influence safety performance (SP) through safety knowledge (SK). The reason is that the fundamental tenet of contemporary SMS is the Domino Theory of accident (Saxena, 2017), which holds that accidents result from a series of consecutive events and can be avoided by severing any one link. This concept emphasizes the importance of safety knowledge for identifying and addressing the underlying causes of problems. For instance, SMS components such as promotion and training enhance one's safety knowledge ((Gressgård, 2014). Employees who receive training gain a thorough awareness of safety protocols and the risks associated with their jobs. Without sufficient knowledge, workers might not understand the need for specific procedures, leading to inadvertent infractions or a lack of desire to comply with regulations (Tong et al., 2023). Therefore, organizations that improve training and promotion will affect safety knowledge ((Mohammed et al., 2021), which in turn will affect safety performance (Putra et al., 2022). Also, documentation and commands (DC) ensure that employees acquire safety knowledge through training materials and manuals.

As is well known, employees' comprehension of risks, protocols, and the appropriate use of safety equipment is referred to as safety knowledge. The main way this knowledge is acquired is through training, which primarily depends on accessible, clear DC. Hence, making employees knowledgeable about safety, which in turn influences their safety performance. Once more, safety performance may improve if executive management commitment turns safety knowledge from policy manual content into an active, embedded part of the company's everyday operations and culture. In addition, an emergency preparedness and response plan (EPRP) is an essential part of an all-encompassing SMS, not merely an insurance policy. The EPRP relies on safety knowledge to directly raise awareness. This strategy, in turn, affects safety performance by ensuring the company is equipped to

manage emergencies effectively, safeguarding its personnel and resources. Similarly, ensuring that both inadvertent and deliberate infractions are eradicated in organizations falls to the safety management policy (SMP). SMP can accomplish this by increasing workers' knowledge of safety risks and how to mitigate them without causing harm. This knowledge then influences their decisions to work safely. Again, to effectively define and convey to workers what they need to know to develop safety knowledge, safety rules and procedures must be clear and consistent. Safety knowledge helps employees understand and follow rules and procedures, thereby making it a prerequisite for improved safety performance. The safety committee serves as the catalyst, transforming employee input and management commitment into implementable programmes. These practical programmes improve safety knowledge. According to Yu et al. (2021), a self-reinforcing cycle of continual improvement in safety performance can be established via increased safety knowledge. Therefore, the study proposes the following hypotheses:

H7: Safety knowledge will significantly mediate the relationship between safety management system and safety performance (compliance and participation)

H7a: Safety knowledge will significantly mediate the relationship between promotion and training, and safety compliance

H7aa: Safety knowledge will significantly mediate the relationship between promotion and training, and safety participation

H7b: Safety knowledge will significantly mediate the relationship between documentation and commands and safety compliance

H7bb: Safety knowledge will significantly mediate the relationship between documentation and commands and safety participation

H7c: Safety knowledge will significantly mediate the relationship between executive management commitment and safety compliance

H7cc: Safety knowledge will significantly mediate the relationship between executive management commitment and safety participation

H7d: Safety knowledge will significantly mediate the relationship between emergency preparedness and response plan and safety compliance

H7dd: Safety knowledge will significantly mediate the relationship between emergency preparedness and response plan and safety participation

H7e: Safety knowledge will significantly mediate the relationship between safety management policy and safety compliance

H7ee: Safety knowledge will significantly mediate the relationship between safety management policy and safety participation

H7f: Safety knowledge will significantly mediate the relationship between safety rules and procedure and safety compliance

H7ff: Safety knowledge will significantly mediate the relationship between safety rules and procedure and safety participation

H7g: Safety knowledge will significantly mediate the relationship between safety committee and safety compliance

H7gg: Safety knowledge will significantly mediate the relationship between safety committee and safety participation

3. Method

The researcher adapted the survey instruments from already reliable and validated scales. The psychometric properties of these scales been met in previous studies. The current did slight modifications to the scales to reflect the organizational settings of contract mining companies. A 5-point Likert scale was used to measure each item. These modifications did not affect the instruments' contextual meaning. Details of the scales are provided in the Appendix.

3.1 Survey Instruments

3.1.1 Safety Performance

Six questions from Neal and Griffin (2006). safety performance measure were employed by the researcher. The two components of the scale are safety compliance and safety participation. There are three items on the safety compliance scale. "I ensure the highest levels of safety when carrying out my job" is an example item. The safety compliance scale's Cronbach's alpha is 0.789. Three items are also used to measure the safety participation scale. "I support the mines' safety program" is an example. The Cronbach's alpha for the safety participation scale is 0.943.

3.1.2 Safety Management System (SMS)

The SMS was assessed with seven dimensions: Promotion and training (PT), documentation and commands (DC), executive management commitment (EMC), emergency preparedness and response plan (EPRP), Safety management policy (SMP), safety rules and procedures (SRP), and safety committee (SC). PT, DC, EMC, EPRP, and SMP were measured with 7, 7, 4, 4, and 3 items, respectively, adapted from Chen and Chen (2012). The Cronbach's alpha coefficient values for PT, DC, EMC, EPRP and SMP are 0.931, 0.919, 0.931, 0.883, and 0.838, respectively. The SRP was assessed with a four-item scale from Vinodkumar and Bhasi (2010) and its Cronbach's alpha is 0.831. The safety committee was assessed with a four-item scale by Flin et al. (2000), and its Cronbach's alpha is 0.846.

3.1.3 Safety Motivation

Four items taken from Vinodkumar and Bhasi (2010) were used to gauge safety motivation. "I feel that it is important to maintain safety at all times, and I believe that safety in the mines is a very important issue" is one example. The safety motivation scale has a Cronbach's alpha of 0.867.

3.1.4 Safety Knowledge

Five items taken from Vinodkumar and Bhasi (2010) were used to assess safety knowledge. "I know how to perform my job safely, and I know how to use safety equipment and standard work procedures" is one example. The safety knowledge scale has a Cronbach's alpha of 0.921.

3.1.5 Control Variables

The study used gender, age, educational level, length of service, marital status, and job title as control variables in the safety performance construct. These factors serve as effective controls in mediation and moderation models (Ye et al., 2020).

3.2 Participation

Before administering the questionnaire, the researchers met with the authorities at the participants' companies and obtained their permission to use their premises for data collection. They were informed of the study's goals, and permission to administer the survey was granted The researchers also met with employee representatives and explained the study's motivation. The researchers promised them that every participant's privacy would be protected. They were also promised optimal confidentiality. They were informed that the survey was for an academic exercise and that the results would not be used to penalise any employee. Instead, it will help shape work systems and make the workplace safer. Additionally, the volunteers were urged to remind the participants that they might withdraw at any moment and that participation was entirely voluntary. These representatives volunteered and helped explain the study's objectives to the participants. They also help distribute the questionnaires to the frontline contract mineworkers who participated in the study. With the help of the volunteers, boxes were placed at the various participation departments. The completed questionnaires were then dropped into these data collection boxes by the participants—employees who participated in the survey provided written informed consent. In all, due to the nature of mining operations, the researchers distributed approximately 1000 questionnaires to the frontline contract mineworkers. The questionnaire was administered between May 2025 and August 2025. Of the 1000 questionnaires distributed to participants, 517 were returned. 363 (70.21%) of the 517 completed surveys that were returned were error-free. As a result, it shows the overall valid answer rate.

3.3 Data Analysis

The study tested the several proposed associations using hierarchical regression analysis in SPSS version 27. Relationships. The study also used the SPSS software to perform the reliability testing analysis. The model's fitness for the data set was determined using AMOS version 26's confirmatory factor analysis.

4. Results

4.1 Preliminary Results

4.1.1 Common Method Bias/Variance

The researchers are aware of the potential biases that may arise when using questionnaires to

collect data from participants. To address common-method biases, the researchers employed both qualitative and quantitative approaches proposed by Podsakoff et al. (2003). They informed participants that participation was voluntary. Additionally, they informed the participants that they might leave the survey whenever they felt like it. In addition, participants were urged to answer the questionnaire truthfully and were guaranteed the highest level of anonymity and confidentiality. The researchers used a Harman single-factor test, where all measurement items loaded onto a single factor, to objectively address frequent technique bias. Harman's single-factor test rule of thumb states that common method bias in the dataset is present when a single factor accounts for more than 50% of the total variation. Conversely, when one factor explains less than half of the total variation, a common method bias does not occur. A single factor only explained 33.56% of the total variance in the study's single-factor test, indicating that common-method bias is not present in the data set.

4.1.2 Demographic Characteristics

The demographic in Table results showed that of the 363 respondents, 280 were males and 83 were females. The respondents' ages recorded an average of 34.88 with a standard deviation of 9.087. Two hundred fifty-three respondents had attained a tertiary education, and 78 and 27 respondents had attained senior high school and junior high school qualifications, respectively. Five respondents had no formal education. 206 respondents were married, and 157 were single. The respondents had worked for an average of 1.40 with a standard deviation of 0.688.

Table 1. Demographic characteristics

Indicators	Description	Frequency	Percent	Total
Gender	Male	280	77.1	
	Female	83	22.9	100
Highest Educational Qualification	Tertiary	253	69.7	
(HEQ)	SHS	78	21.5	
	JHS	27	7.4	
	No formal education	5	1.4	100
Marital status (M.S)	Married	206	56.7	
	Single	157	43.3	100

	Gender	Age	Length of service	HEQ	M.S
Mean	1.23	34.88	1.40	5.02	1.43
Standard deviation	0.421	9.087	0.688	4.568	0.496

4.1.3 Assessment of the Structural Model

The researcher used AMOS version 26 software to perform analysis such as the comfirmatory factor analysis (CFA). The cut-off criteria for determining model fitness (Hu & Bentler, 1999) were used. The CFA model fit results showed a Chi-square value (X^2) = 1262.696, degree of freedom (*df*) = 1025, relative CMIN or Chi-square index (X^2/df) =1.232, standardised root mean residual (SRMR) = 0.031, comparative fit index (CFI) = 0.980, root mean square error of residual (RMSEA) = 0.025, and PCLOSE = 0.994. The model fits the dataset well, according to the study's model fit results, which met all suggested standards. The researcher further performed a model fit assessment for each construct for the survey analysis; the results are shown in Table 2. The model fit results for each construct further support the conclusion that each measure's indices fit their respective datasets excellently. For instance, the comparative fit indices (CFI) ranged from 0.985 to 0.999, and the relative Chi-square

index (CMIN/DF) ranged from 0.451 to 1.249, indicating excellent model fit.

Table 2. Model fit indices for each construct

No of Variables	Variables	CMIN	DF	CMIN/ DF	CFI	SRMR	RMSEA	PClose
7-factors	Safety management system	591.931	474	1.249	0.985	0.032	0.026	0.999
1-factor	Safety motivation	1.799	2	0.899	0.993	0.011	0.001	0.666
1-factor	Safety knowledge	3.605	5	0.721	0.985	0.009	0.003	0.896
2-factors	Safety performance	3.605	8	0.451	0.997	0.009	0.001	0.991

Note: CMIN = Chi-square; DF = degree of freedom; CMIN/DF = relative Chi-square index; CFI = comparative fit index; SRMR = standardised root mean residual (SRMR); RMSEA = root mean square error of residual.

4.1.4 CFA Factor Loadings, Reliability and Validity

The researcher employed confirmatory factor analysis (CFA) to assess the factor loadings' acceptability. Additionally, the researcher performed validity and reliability analyses, the findings of which are shown in Table 3. The range of CFA factor loadings was 0.677 to 0.934. Since the loadings exceed the 0.50 threshold recommended by Hu and Bentler (1999), all the measurement items are acceptable. The reliability test using SPSS version 27 software showed that the Cronbach's alpha value reported in this current study are higher than 0.70, the threshold suggested by Nunnally (1978). The Cronbach's alpha values suggest that the measures have high internal consistency; hence, they are acceptable for further analysis. The researcher in this study performed the validity analysis, which comprised tests of discriminant validity, average variance extracted (AVE), and composite reliability. The range of the AVE and composite reliability values was 0.563 to 0.847 and 0.802 to 0.943, respectively. Hu and Bentler (1999) and Joreskog and Sorbom (1993) state that convergent validity can be established with composite reliability values larger than 0.70 and AVE values greater than 0.50. The results show that the current study achieved convergent validity and that the adopted measurement items accurately measure the variables they were intended to measure. The discriminant validity (DV) analysis was also performed and the results are presented in Table 4. The square root of the AVEs must be larger than the corresponding correlation coefficients, both vertically and horizontally, in order to establish acceptable DVs. The DV values shown in bold along the diagonal path of the inter-factor correlation matrix in Table 4 demonstrate that all of the DV values are acceptable because they are higher than the associated correlation coefficient values. The DVs imply that despite their similarities, they are different.

Table 3. Results of CFA factor loadings, reliability, and validity

Variable	Code	β	S.E.	C.R.	CR	AVE	Ca	P
Promotion and Training (PT)	PT1	0.77			0.933	0.665	0.931	
	PT2	0.821	0.058	16.935				***
	PT3	0.854	0.057	17.78				***
	PT4	0.891	0.055	18.767				***
	PT5	0.808	0.061	16.611				***
	PT6	0.742	0.065	14.972				***
	PT7	0.814	0.06	16.751				***
Documentation and Commands (DC)	DC1	0.717			0.922	0.628	0.919	
	DC2	0.79	0.071	14.659				***
	DC3	0.76	0.072	14.085				***
	DC4	0.762	0.072	14.122				***
	DC5	0.779	0.07	14.442				***
	DC6	0.876	0.063	16.249				***
	DC7	0.854	0.068	15.846				***
Emergency Preparedness and Response Plan (EPRP)	EPRP1	0.883			0.885	0.659	0.883	
	ERPR2	0.795	0.054	18.62				***
	ERPR3	0.743	0.054	16.753				***
	ERPR4	0.819	0.05	19.524				***
Safety Committee (SC)	SC1	0.784			0.846	0.579	0.846	
	SC2	0.742	0.075	13.894				***
	SC3	0.768	0.074	14.387				***
	SC4	0.75	0.073	14.049				***
Safety management policy (SMP)	SMP1	0.85			0.842	0.64	0.838	
	SMP2	0.806	0.057	16.249				***
	SMP3	0.74	0.063	14.836				***
Executive Management Commitment (EMC)	EMC1	0.864			0.934	0.779	0.931	
	EMC2	0.895	0.044	23.383				***
	EMC3	0.874	0.045	22.353				***
	EMC4	0.897	0.044	23.476				***
Safety Motivation (SM)	SM1	0.834			0.868	0.622	0.867	
	SM2	0.792	0.06	16.57				***
	SM3	0.77	0.058	15.988				***
	SM4	0.756	0.06	15.633				***
Safety Knowledge (SK)	SK1	0.865			0.921	0.702	0.921	
	SK2	0.881	0.046	22.509				***
	SK3	0.825	0.049	20.001				***
	SK4	0.778	0.052	18.147				***
	SK5	0.835	0.049	20.452				***
Safety Compliance	SaC1	0.859			0.802	0.577	0.789	
	SaC2	0.707	0.066	12.886				***
	SaC3	0.703	0.061	12.817				***

Safety Participation (SaP)	Sap1	0.909			0.943	0.847	0.943	
	Sap2	0.918	0.035	28.371				***
	Sap3	0.934	0.034	29.481				***
Safety rules and procedure (SRP)	SRP1	0.709			0.837	0.563	0.831	
	SRP2	0.691	0.075	11.813				***
	SRP3	0.819	0.071	13.61				***
	SRP4	0.775	0.073	13.065				***

Note: ***$p < 0.001$; S.E. = standardised error; β = standardised factor loading; C.R. = critical ratio; CR = composite reliability; Ca = Cronbach's alpha. AbbreSL1, PT1, DC1, ERPR1, SC1, SMP1, EMC1, SM1, SK1, SaC1, SaP1, and SRP1 had their parameters constrained to 1; hence, will not have S.E., C.R., *p-value*

Table 4. Discriminant validity results

	PT	DC	EPRP	SC	SMP	EMC	SM	SK	SaC	SaP	SRP
PT	**0.816**										
DC	0.434***	**0.793**									
EPRP	0.604***	0.462***	**0.812**								
SC	0.465***	0.466***	0.354***	**0.761**							
SMP	0.519***	0.387***	0.640***	0.321***	**0.8**						
EMC	0.419***	0.418***	0.489***	0.427***	0.409***	**0.882**					
SM	0.414***	0.453***	0.471***	0.427***	0.434***	0.480***	**0.789**				
SK	0.416***	0.511***	0.417***	0.435***	0.407***	0.375***	0.554***	**0.838**			
SaC	0.438***	0.425***	0.375***	0.378***	0.368***	0.380***	0.465***	0.460***	**0.759**		
SaP	0.472***	0.394***	0.570***	0.423***	0.425***	0.496***	0.376***	0.419***	0.346***	**0.92**	
SRP	0.521***	0.462***	0.448***	0.382***	0.379***	0.365***	0.329***	0.387***	0.346***	0.406***	**0.75**

Note: Bold values represent discriminant validity

Abbreviation: PT = Promotion and Training, DC = Documentation and Commands, EMC = Executive Management Commitment, ERPR = Emergency Preparedness and Response Plan, SMP = Safety management policy, SRP = Safety rules and procedure, SC = Safety committee, SM = Safety motivation, SK= Safety knowledge, SaC = Safety compliance, SaP = Safety participation

4.2 Empirical Results

The researcher employed hierarchical regression analysis (HRA) in SPSS version 27 software to test the causal relationships among the variables. The results from the HRA are presented in Tables 5 and 6.

4.2.1 Results of the effects of safety management system on safety performance

In Table 5, the researcher tested the effect of safety management system (promotion and training (PT); documentation and commands (DC); executive management commitment (EMC); emergency preparedness and response plan (EPRP); safety management policy (SMP); safety rules and procedure; and safety committee (SC)) on safety performance (safety compliance and safety participation). The mediating effect of safety motivation in the relationship between safety management system and safety performance was also examined

in Table 5, following Baron and Kenny (1986). First, the researcher examined the control variables in models 1 and 6. Second, the effects of the safety management system's seven variables on safety compliance and participation were tested in models 2 and 7. The results from models 2 and 7 showed that promotion and training significantly influenced safety compliance ($\beta = 0.134$; $p < 0.05$) and safety participation ($\beta = 0.241$; $p < 0.001$). Hence, H1a and H1aa are supported. Also, documentation and commands significantly and insignificantly influenced safety compliance and safety participation, with unstandardized coefficients of $\beta = 0.173$ ($p < 0.01$) and $\beta = 0.056$ ($p > 0.01$), respectively. Hence, H1b is supported, but H1bb is unsupported. Again, executive management commitment had a significant positive impact on both safety compliance ($\beta = 0.104$; $p < 0.05$) and safety participation ($\beta = 0.190$; $p < 0.001$), thereby supporting H1c and H1cc. The results further showed that emergency preparedness and response plans did not significantly influence safety compliance ($\beta = 0.10$; $p > 0.05$) but did significantly positively impact safety participation ($\beta = 0.319$; $p < 0.001$); hence, H1d is unsupported, whereas H1dd is supported. Safety management policy also significantly influenced safety compliance ($\beta = 0.179$; $p < 0.01$) but did not support safety participation ($\beta = 0.034$; $p > 0.05$); hence, H1e is supported, but H1ee is not. Also, safety rules and procedures significantly impacted safety compliance ($\beta = 0.170$; $p < 0.01$) but could not influence safety participation ($\beta = 0.125$; $p > 0.05$); hence, H1f is supported, but H1ff is unsupported. Interestingly, safety committee significantly influenced safety compliance ($\beta = 0.196$; $p < 0.01$) and safety participation ($\beta = 0.127$; $p < 0.05$); hence, the results support H1g and H1gg.

4.2.2 Results of Safety Management System on Safety Motivation and Safety Knowledge

In model 3 of Table 5, which tested the effect of safety management system on safety motivation, the results showed that SRP ($\beta = 0.011$; $p > 0.01$) could not significantly influence safety motivation; hence, H2f is not supported. In contrast, PT ($\beta = 0.136$; $p < 0.05$), DC ($\beta = 0.165$; $p < 0.01$), EMC ($\beta = 0.185$; $p < 0.001$), ERPR ($\beta = 0.127$; $p < 0.05$), SMP ($\beta = 0.139$; $p < 0.01$), and SC ($\beta = 0.130$; $p < 0.01$) had significant positive impacts on safety motivation, thereby, supporting H2a, H2b, H2c, H2d, H2e and H2g.

Moreover, in model 1 of Table 6, PT, DC, SMP and SC significantly and positively influenced safety knowledge at an unstandardised beta estimate of $\beta = 0.164$ ($p < 0.01$; $t = 3.117$), $\beta = 0.262$ ($p < 0.001$; $t = 4.576$), $\beta = 0.129$ ($p < 0.05$; $t = 2.533$), and $\beta = 0.151$ ($p < 0.01$; $t = 3.067$), respectively. Hence, H3a, H3b, H3e and H3g are supported. In contrast, the effect of EMC, ERPR and SRP recorded unstandardised insignificant coefficient estimates of $\beta = 0.065$ ($p > 0.05$; $t = 1.499$), $\beta = 0.060$ ($p > 0.05$; $t = 0.983$) and $\beta = 0.118$ ($p > 0.05$; $t = 1.860$), thereby failing to support H3c, H3d and H3f.

4.2.3 Results of the Effects of Safety Motivation and Safety Knowledge on Safety Performance

In models 4 and 8 of Table 5, the results showed that safety motivation significantly influenced safety compliance and safety participation at an unstandardised beta estimate of $\beta = 0.362$ ($p < 0.001$; $t\text{-value} = 7.798$) and $\beta = 0.383$ ($p < 0.001$; $t\text{-value} = 6.819$), hence, the result supports H4 (H4a and H4b).

Furthermore, in models 2 and 4 of Table 6, the results showed that safety knowledge significantly and positively influenced safety performance compliance, with an unstandardized beta estimate of β = 0.370 (p < 0.001; t-value = *7.868*); hence, the results support H5a. Again, safety knowledge significantly and positively influenced safety participation, with an unstandardized beta estimate of β = 0.449 (*p < 0.001; t-value = 8.058*), thereby supporting H5b.

4.2.4 Results of the Mediation Effect of Safety Motivation in the Relationship between Safety Management System and Safety Performance

To perform this mediation testing, the researcher adopted the following approaches. First, the effect of the independent variable (e.g., safety management system) on the dependent variable (e.g., safety performance) was tested in models 2 and 7. Second, the effect of the independent variable on the mediating variable (e.g., safety motivation) was tested in model 3. Third, the mediating variable's effect on the dependent variable was tested in models 4 and 8. Fourth, the effects of the independent and mediating variables on the dependent variable were tested in model 9. This approach to testing mediation analysis is in line with those recommended by Baron and Kenny (1986), Kenny (2018), Ananthram et al. (2018), and Bhutto et al. (2021), to mention but a few. According to the rule of thumb for establishing the presence of mediation (Baron & Kenny, 1986), the following occurrences may happen: (i) a full mediation occurs where the inclusion of a mediator in a significant relationship between the independent variable (IV) and the dependent variable (DV) renders the direct effect of the IV on the DV insignificant but the effect of the mediating variable (Med.V) on the DV significant; (ii) a partial mediation occurs where the inclusion of Med.V in a significant relationship between the IV and the DV still makes the effect of the IV on DV significant and the effect of the Med.V on the DV also significant; (iii) no mediation occurs where the effect of the Med.V on DV remains insignificant after it has been include the model of the effect of IV and DV.

In models 5 and 9 of Table 5, the extent to which safety motivation would mediate the relationship between the safety management system and safety performance variables was tested. The analysis revealed interesting results. For instance, safety motivation significantly and directly influenced safety compliance in model 5 of Table 5, with an unstandardised estimate of β = 0.169 (*p < 0.01; t = 3.166*). Also, PT and DC still had a significant direct effect on safety compliance even when safety motivation was included in model 5 of Table 5. Therefore, the results show a partial mediation effect. Additionally, EMC, SMP, and SC could no longer significantly affect safety compliance after including safety motivation in model 5, suggesting a full mediation effect.

In contrast, safety motivation did not mediate the effects of EPRP and SRP on safety compliance, as neither EPRP nor SRP significantly affected safety compliance in model 5. For these reasons, the results support H6a, H6b, H6c, H6e, and H6g. However, the results fail to support H6d and H6f.

More surprisingly, when safety participation was regressed on the safety management system's variables and safety motivation in model 9 of Table 5, safety motivation had an insignificant direct effect of β = 0.030 (*p > 0.05; t = 0.516*) on safety participation. Therefore,

there was no mediation effect for safety motivation in the relationship between all seven safety management system variables and safety participation. As such, the results could not support H6aa, H6bb, H6cc, H6dd, H6ee, H6ff, and H6gg.

4.2.5 Results of the Mediation Effect of Safety Knowledge in the Relationship between Safety Management System and Safety Performance

In models 5 and 9 of Table 6, the extent to which safety knowledge could mediate the safety management system and safety performance is shown. To analyse the mediating effect of safety knowledge in the relationship between the safety management system and safety performance, the researcher used the same approach proposed by Baron and Kenny (1986). In model 5 of Table 6, the mediation analysis showed that safety knowledge continued to influence safety compliance significantly, with an unstandardized beta of $\beta = 0.166$ ($p < 0.01$; *t-value* $= 3.040$). Though PT, SMP, and SC significantly influenced safety compliance in model 2 of Table 6, the variables did not do so in model 5 of Table 6 after including safety knowledge. The results, therefore, suggest that the relationship between PT, SMP, and SC of safety management system and safety compliance was completely mediated by safety knowledge. Also, the impact of DC on safety compliance remained significant ($\beta = 0.130$, $p < 0.05$; *t-value* $= 2.166$) even after the inclusion of safety knowledge in model 5 of Table 6, suggesting a partial mediation effect. Hence, the mediation results support H7a, H7b, H7e, and H7g. Unfortunately, EMC, ERPR and SRP could not significantly influence safety knowledge in model 3 of Table 6. Per the rule-of-thumb for mediation effects, since EMC, ERPR, and SRP did not significantly influence safety knowledge, their impact on safety compliance cannot be mediated by safety knowledge. Hence, the study's results fail to support H7c, H7d and H7f.

Regarding the extent to which safety knowledge could mediate safety management system and safety participation, the study found that safety knowledge significantly influenced safety participation, with an unstandardized beta estimate of $\beta = 0.143$ ($p < 0.05$; t-value = 2.390) when included in model 9 of Table 6. The impact of PT and SC on safety participation remained insignificant after introducing safety knowledge in model 9 of Table 6. The results suggest that safety knowledge fully mediates the effects of PT and SC on safety participation, thereby supporting H7aa and H7gg. On the contrary, the results in Table 6 indicate that the impacts of DC, EMC, ERPR, SMP, and SRP on safety participation were not mediated by safety knowledge. Therefore, the study's results could not support H7bb, H7cc, H7dd, H7ee, and H7ff.

Table 5 Hierarchical regression analysis showing the mediating effect of safety motivation (SM) in the relationship between safety management system and safety performance (compliance-SaC and participation-SaP)

Variables	SaC Model 1 *B (t)*	SaC Model 2 *B (t)*	SM Model 3 *B (t)*	SaC Model 4 *B (t)*	SaC Model 5 *B (t)*	SaP Model 6 *B (t)*	SaP Model 7 *B (t)*	SaP Model 8 *B (t)*	SaP Model 9 *B (t)*
(Constant)	3.966***	1.512***	-.255	2.996***	1.555***	3.574***	.061	2.548***	.069
	(10.291)	(3.483)	(-0.594)	(7.930)	(3.627)	(7.805)	(0.129)	(5.579)	(0.145)
Gender	.113	.071	.104	.065	.053	.042	.003	-.009	.000
	(1.082)	(0.753)	(1.120)	(0.670)	(0.572)	(0.337)	(0.032)	(-0.077)	(0.001)
Age	.005	.005	.017**	-.001	.002	-.007	-.004	-.013	-.004
	(0.766)	(0.870)	(2.935)	(-0.112)	(0.379)	(-0.828)	(-0.586)	(-1.689)	(-0.658)
HEQ	.061	-.047	-.031	.024	-.041	.340***	.177**	.300***	.178**
	(0.952)	(-0.793)	(-0.525)	(0.392)	(-0.714)	(4.432)	(2.772)	(4.137)	(2.782)
Lenth.Service	-.016	-.017	-.010	-.014	-.015	.025	.017	.027*	.017
	(-1.445)	(-1.648)	(-1.003)	(-1.347)	(-1.497)	(1.831)	(1.530)	(2.131)	(1.554)
Mar.Status	-.198	-.142	.233	-.259**	-.182	-.141	-.085	-.205	-.092
	(-1.900)	(-1.527)	(2.525)	(-2.679)	(-1.957)	(-1.135)	(-0.839)	(-1.754)	(-0.899)
Job.Title	.004	-.005	.040	-.013	-.012	-.010	-.021	-.029	-.022
	(0.141)	(-0.185)	(1.483)	(-0.459)	(-0.437)	(-0.286)	(-0.704)	(-0.837)	(-0.742)
PT		.134*	.136*		.128*		.241***		.171**
		(2.065)	(2.054)		(1.996)		(4.440)		(2.822)
DC		.173**	.165**		.145*		.051		.045
		(2.940)	(2.835)		(2.469)		(0.789)		(0.702)
EMC		.104*	.185***		.073		.190***		.184***
		(2.331)	(4.194)		(1.610)		(3.909)		(3.697)
ERPR		.010	.127*		-.012		.319***		.315***
		(0.157)	(2.051)		(-0.187)		(4.672)		(4.583)
SMP		.179**	.139**		.056		.034		.030
		(2.503)	(2.656)		(1.062)		(0.590)		(0.511)
SRP		.170**	.011		.068		.125		.124
		(3.074)	(0.172)		(1.058)		(1.755)		(1.748)
SC		.196**	.130**		.074		.127*		.123*
		(2.889)	(2.584)		(1.461)		(2.302)		(2.207)
SM				.362***	.169**			.383***	.030
				(7.798)	(3.166)			(6.819)	(0.516)
R^2	0.027	0.248	0.345	0.169	0.269	*0.098*	*0.394*	*0.202*	*0.393*
ΔR^2	0.027	0.222	0.312	0.142	0.021	*0.098*	*0.318*	*0.104*	*0.090*
F	1.625	8.870***	14.113***	10.314***	9.166***	*6.423****	*19.096****	*12.852*	*17.714****

Note: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; values in parentheses represent t-values

Abbreviation: PT = Promotion and Training, DC = Documentation and Commands, EMC = Executive Management Commitment, ERPR = Emergency Preparedness and Response Plan, SMP = Safety management policy, SRP = Safety rules and procedure, SC = Safety committee, SM = Safety motivation, SaC = Safety compliance

Table 6. Hierarchical regression analysis showing the mediating effect of safety knowledge (SK) in the relationship between safety management system and safety performance (safety compliance (SaC) and safety participation (SaP)

Variables	SaC Model 1 *B (t)*	SaC Model 2 *B (t)*	SK Model 3 *B (t)*	SaC Model 4 *B (t)*	SaC Model 5 *B (t)*	SaP Model 6 *B (t)*	SaP Model 7 *B (t)*	SaP Model 8 *B (t)*	SaP Model 9 *B (t)*
(Constant)	3.966***	1.512***	.513	2.600***	1.555***	3.574***	.061	1.918***	-.012
	(10.291)	(3.483)	(1.218)	(6.561)	(3.627)	(7.805)	(0.129)	(4.088)	(-0.026)
Gender	.113	.071	.054	.081	.053	.042	.003	.003	-.004
	(1.082)	(0.753)	(0.595)	(0.839)	(0.572)	(0.337)	(0.032)	(0.028)	(-0.044)
Age	.005	.005	.019***	-.002	.002	-.007	-.004	-.015*	-.006
	(0.766)	(0.870)	(3.225)	(-0.277)	(0.379)	(-0.828)	(-0.586)	(-2.014)	(-0.988)
HEQ	.061	-.047	-.073	.043	-.041	.340***	.177**	.318***	.187**
	(0.952)	(-0.793)	(-1.279)	(0.723)	(-0.714)	(4.432)	(2.772)	(4.495)	(2.947)
Lenth.Service	-.016	-.017	-.018	-.011	-.015	.025	.017	.032*	.020
	(-1.445)	(-1.648)	(-1.780)	(-0.996)	(-1.497)	(1.831)	(1.530)	(2.561)	(0.079)
Mar.Status	-.198	-.142	.030	-.186	-.182	-.14.	-.085	-.126	-.089
	(-1.900)	(-1.527)	(0.334)	(-1.928)	(-1.957)	(-1.135)	(-0.839)	(-1.102)	(-0.887)
Job.Title	.004	-.005	-.091***	.033	-.012	-.010	-.021	.025	-.008
	(0.141)	(-0.185)	(-3449)	(1.168)	(-0.437)	(-0.286)	(-0.704)	(0.733)	(-0.263)
PT		.134*	.164**		.128*		.241***		.093
		(2.065)	(3.117)		(1.996)		(4.440)		(1.317)
DC		.173**	.262***		.145*		.051		.013
		(2.940)	(4.576)		(2.469)		(0.789)		(0.203)
EMC		.104*	.065		.073		.190***		.181***
		(2.331)	(1.499)		(1.610)		(3.909)		(3.731)
ERPR		.010	.060		-.012		.319***		.311***
		(0.157)	(0.983)		(-0.187)		(4.672)		(4.572)
SMP		.179**	.129*		.056		.034		.015
		(2.503)	(2.533)		(1.062)		(0.590)		(0.268)
SRP		.170**	.118		.068		.125		.108
		(3.074)	(1.860)		(1.058)		(1.755)		(1.521)
SC		.196**	.151**		.074		.127*		.106
		(2.889)	(3.067)		(1.461)		(2.302)		(1.899)
SK				.370***	.169**			.449***	.143*
				(7.868)	(3.166)			(8.058)	(2.390)
R^2	0.027	0.220	0.361	0.171	0.268	*0.098*	*0.394*	*0.237*	*0.425*
ΔR^2	0.027	0.222	0.315	0.141	0.019	*0.098*	*0.318*	*0.140*	*0.009*
F	1.625	8.870***	15.188***	10.474***	9.091***	*6.423***	*19.096***	*15.771***	*18.380***

Note: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; values in parentheses represent t-values

Abbreviation: PT = Promotion and Training, DC = Documentation and Commands, EMC = Executive Management Commitment, ERPR = Emergency Preparedness and Response Plan, SMP = Safety management policy, SRP = Safety rules and procedure, SC = Safety committee, SK= Safety knowledge, SaC = Safety compliance

The results of the study in relation to the research goals and hypotheses are covered in this part. In order to gauge the effect of the safety management system on safety performance in the mines, the study looked at promotion and training (PT), documentation and commands (DC), executive management commitment (EMC), emergency preparedness and response plan (EPRP), safety management policy (SMP), safety rules and procedures, and safety committee (SC). The study has shown that the safety management system is a multifaceted construct with good model fit, adequate validity, and reliability. As a result, this study has expanded on the work of Chen and Chen (2012) to include the safety committee and safety regulations and procedures. Vinodkumar and Bhasi (2010) and Flin et al. (2000), who, respectively, advise that SRP and SC play a significant role in the effective execution of a safety management system, support the idea that safety rules and procedures and the safety

committee should be considered as dimensions of the safety management system.

The study also examined the mediating functions of safety knowledge and safety motivation in the connections between the seven safety management system dimensions and safety performance, and the results were highly intriguing.

5.1 Effect of Safety Management System on Safety Performance

The study's findings indicate that promotion and training significantly influenced safety compliance and participation. The results show that as employees receive promotions and training, they tend to be equipped with newer energy and the ability to perform, confirming earlier studies by Vinodkumar and Bhasi (2010), and Mashi et al. (2017). Such employees can perform to expected standards, such as following safety protocols and demonstrating safety practices that protect themselves and their co-workers (Namian, Albert, Zuluaga, et al., 2016). Also, documentation and commands showing a significant positive influence on safety compliance support Jahn's (2019) findings. This finding implies that documentation and command provide a framework for employees to carry out their activities while reducing risk. Such practice can serve as a cornerstone to facilitate safety compliance (Shohet et al., 2019). Executive management commitment significantly influences both components of safety performance. The results support similar findings in Bayram (2018). The findings suggest that when management genuinely prioritises workplace safety, it has a cascading effect, changing the entire company's culture and making safety a shared responsibility rather than just another item on a list of requirements.

The emergency preparedness and response plan (EPRP) among contract mineworkers significantly influenced safety participation but had a lesser impact on safety compliance. The findings suggest that EPRP may have little to do with compelling employees to follow safety compliance strictly. However, in the case of safety participation, EPRP encourages employees to show civic duties. Showing civic duty motivates employees to go all out to protect fellow workers and mitigate the effects of calamities, thereby supporting the work of Tanze (2025). The safety management policy significantly influenced safety compliance but had a lesser effect on safety participation. The findings suggest that the mines' safety management policy can ensure compliance with mandatory safety activities. However, the safety management policy cannot persuade employees to participate in safety activities voluntarily. According to Akpan (2011), this circumstance may occur when employees feel less involved in safety decisions that affect them and their work. Also, safety rules and procedures significantly influenced safety compliance but had a lesser effect on safety participation. The findings suggest that employees acknowledge the relevance of safety rules and procedures to protect their health, reduce the likelihood of accidents, and possibly face the consequences of flouting them; hence, they will demonstrate safety compliance behaviour. This finding confirms the claim made by Hale and Borys (2013), and Mashi et al. (2017). However, since employees know that safety participation is voluntary, they may attach less importance to non-mandatory safety rules and procedures, confirming the findings of Vinodkumar and Bhasi (2010). Safety committee significantly influenced the two dimensions of safety performance (safety compliance and participation), confirming similar findings in McGuire et

al. (2020) and Tam and Fung (1998). The results imply that a well-organized safety committee may serve as a liaison between employees and management, helping identify risks, resolve issues, and advance safety compliance and participation.

5.2 Effect of Safety Management System on Safety Motivation

The majority of the researchers' assumptions regarding the connection between safety motivation and the safety management system (SMS) were fulfilled. All other factors taken into account in this study as components of the safety management system had a considerable positive impact on safety motivation, with the exception of the effect of safety regulations and procedures, which did not significantly affect safety motivation. The reason for this significant relationship could be that the SMS not only addresses compliance but also provides the entire workforce with an additional layer of security through standards and guidelines covering all aspects of workplace safety. According to Chen and Chen (2014) and Adjekum (2017), this act motivates employees to work safely because they feel enthusiastic about their organizations' structured frameworks (e.g., safety management systems). In contrast, the reason safety rules and procedures (SRP) had less effect on safety motivation could be that employees viewed the SRP items as what they are mandated to do once they are on the mine site. Hence, whether the SRP motivates them or not, they had little or no choice but to obey it. Under such circumstances, the explanatory variable (safety rules and procedures) may be unable to cause any change in the response variable (safety motivation) (Zhu et al., 2020).

5.3 Effect of Safety Management System on Safety Knowledge

Regarding the effect of the safety management system on safety knowledge, three of study's expectations were not met, while four were. Executive management commitment, emergency preparedness and response plan, and safety rules and procedures insignificantly influenced safety knowledge. One possible reason for the insignificant relationship could be confounding variables. According to Zeldow and Hatfield (2021) and MacKinnon and Lamp (2021), when a single model contains multiple explanatory variables, some variables can obscure the actual effect of others on the outcome variable.

Promotion and training significantly influenced safety knowledge, confirming similar findings in Vinodkumar and Bhasi (2010) and Mohammed et al. (2021). The finding suggests that as employees receive promotion and training, they get a better understanding of their work and its associated risks. This inclination toward knowledge helps them reduce the risk of workplace incidents (Evangelista et al., 2025; Namian, Albert, Zuluaga Carlos, et al., 2016). Documentation and commands (DC) significantly influenced safety knowledge. The significance of this could be that DC serves as a blueprint, equipping employees with the information they need to do their jobs. Employees with adequate knowledge of their responsibilities can maintain workplace health and safety (Bjerkan et al., 2021; Kassie et al., 2023). The safety management policy significantly influenced safety knowledge, providing stronger support for Vinodkumar and Bhasi (2010) and Shi et al. (2025). As organizations implement safety policies that give employees easy access to the mines' internal reporting channel, these employees become better informed and know the safety protocols to follow

regarding safety-related concerns (Lu et al., 2020; Maharja, 2021). The findings revealed that the safety committee significantly influenced safety knowledge, providing support for (Maharja, 2021). Through open communication, inspections, and tailored solutions, safety committees establish a cooperative platform for hazard identification, training, policy formulation, and incident review, promoting common understanding and useful skills. These initiatives increase general knowledge and make safety a shared responsibility (Maharja, 2021).

5.4 Effect of Safety Motivation and Safety Knowledge on Safety Performance

The results showed that both aspects of safety performance (safety compliance and participation) are strongly impacted by safety motivation. These findings are consistent with those of Quansah et al. (2022). For instance, safety motivation, which encourages workers to view regulations as beneficial to their well-being rather than merely a means to avoid disciplinary action, helps employees appreciate safety protocols. In fact, this gratitude increases safety compliance by encouraging staff to follow safety protocols (Quansah et al., 2022; Wen Lim et al., 2018; Zohar et al., 2015). Also, employees feel a sense of ownership when safety motivation boosts safety participation (Jiang & Probst, 2016). These employees will be more inclined to demonstrate safety participation behaviour by making recommendations, taking part in training, and raising concerns about risks (Jiang & Probst, 2016; Quansah et al., 2022).

Similarly, safety knowledge significantly influenced safety compliance and safety participation, providing support for (Alhumaid et al., 2021; Gressgård, 2014). The theoretical viewpoint that defines safety knowledge as employees' comprehension of safety operating procedures, safety training, and safety instructions (Hofmann et al., 1995) can be used to interpret these results. One could claim that improving employees' work skills and attitudes toward work procedures and rules enhances safety compliance. Additionally, safety knowledge underscores the importance of risk mitigation, thereby increasing employee motivation to comply with safety standards (Gressgård, 2014). Regarding the safety knowledge-participation relationship, employees gain a deeper understanding of safety as their knowledge grows, which empowers and motivates them, making them more capable and responsible (Neal & Griffin, 2006; Yu et al., 2021). This act fosters a sense of ownership, encourages participation in safety initiatives, and allows them to share critical experiences and insights with colleagues, further ingraining safe practices throughout the team (Neal & Griffin, 2006; Yu et al., 2021).

5.5 Effect of Safety Motivation as a Mediator in the Relationship between Safety Management System and Safety Performance

Some predictions were fulfilled, while others were not, with regard to the degree to which safety motivation mediators between the safety management system and safety performance in the mines. For instance, safety motivation partially mediated promotion and training, and safety compliance. The finding is evidence that promotion and training develop employee competence. Competent employees may see this development as an employer investment in their careers and, as such, ought to establish a sense of purpose to maintain safety at all times

(safety motivation) (Hedlund et al., 2016). This act, in turn, results in employees showing safety compliance behaviour (performing a job with safety equipment and carrying out tasks with the highest level of safety). Also, documentation and commands provide firms with updated training records and revised procedures.

According to Shohet et al. (2019),), these updates can enhance employees' opinions of the company's dedication to safety, which will encourage them to follow safety guidelines. Studies like Yeboah et al. (2025), Omidi et al. (2025), and Liu et al. (2025) suggest safety motivation is a strong psychological link between top management action and performance outcome are supported by the fact that safety motivation fully mediated executive management commitment and safety compliance. These findings suggest that strong management commitment makes workers feel highly driven, helping them translate management's downward signals into upward compliance with safety.

Again, safety motivation fully mediated the safety management policy and safety compliance in the mines. The findings suggest that before a safety management policy affects safety compliance, safety motivation must be sparked. When companies don't ignite this spark, workers may think their safety standards aren't genuine (Ghoddousi & Zamani, 2025) and that the company doesn't care about their well-being (Faeni et al., 2025), which could lead to a decline in safety compliance. Additionally, the relationship between the safety committee and safety compliance in the mines was totally mediated by safety motivation. According to the findings, companies with a safety committee that acknowledges workers by including them in the creation, evaluation, and application of clear, workable safety policies and procedures customized to particular workplace hazards will motivate workers to follow the safety guidelines than organizations that do not (Ndana, 2018).

However, the links between safety regulations and procedures and safety compliance in the mines, as well as between the emergency preparedness response plan and safety compliance, were not mediated by safety motivation. Furthermore, the connection between safety management system characteristics and safety participation in the mines was not shown to be mediated by safety motivation. These non-mediation results imply that the proactive safety behavior (safety participation) of mine workers in connection to the safety management system is not significantly influenced by safety motivation.

5.6 Effect of Safety Knowledge as a Mediator in the Relationship between Safety Management System and Safety Performance

The study examined how safety knowledge functions as a mediator in the connection between mine safety performance and the safety management system. The results showed that safety knowledge acted as a mediator between the two aspects of safety performance (safety compliance and participation) in the mines and promotion and training. The results imply that mining companies with effective promotion and training initiatives can equip their staff with adequate knowledge, enabling them to understand the need for specific procedures. The benefit is that when workers understand what to do and why, they are more likely to exhibit safety compliance behavior (follow rules and use personal protective equipment appropriately) and engage in other safety civic activities (put in extra effort to improve

workplace safety) (Ricci et al., 2022).

Safety knowledge acted as a partial mediator in the interactions between documentation and commands (DC) and safety compliance. The findings suggest that when mining companies make documentation and commands easily comprehensible, workers acquire knowledge that enables them to understand the necessity of adhering to accepted and authorized safety procedures (safety compliance). In contrast, safety knowledge did not mediate the relationships between documentation and commands, and between documentation and safety participation. Also, safety knowledge did not mediate the relationship between executive management commitment and safety performance. The insignificant mediating effects in the above-mentioned relationships suggest that executive management commitment may not require a confounding variable, such as safety knowledge, to influence safety performance variables. Similarly, safety knowledge did not mediate between the emergency preparedness and response plan (EPRP) and safety performance. The results suggest that EPRP can still affect some aspects of safety performance (e.g., safety participation) even without the intervention of safety knowledge.

Surprisingly, safety knowledge fully mediated the relationship between safety management policy and safety compliance, but not between safety management policy (SMP) and safety participation. The significant mediation effect suggests that, as safety management policy includes activities such as safety walkabouts, toolbox meetings, and training, employees' behaviours and decisions at work are influenced by these SMP activities, which improve their knowledge of risks and lead them to follow proper safety protocols (safety compliance).

Furthermore, safety knowledge did not mediate the path from safety rules and procedures to safety compliance and participation. Lastly, safety knowledge fully mediated the paths from safety committees to safety compliance and participation. These results imply that the safety committee might not be able to enhance safety performance in mines if they lack safety knowledge. A possible reason for this full mediation effect could be that the safety committee may decide on a range of initiatives and regulations to improve workplace safety. However, before the organization can profit from these policies and programmes, their users must first understand them (Ndana, 2018). Therefore, by understanding the programmes and policies that promote high safety performance, safety knowledge becomes relevant and provides that mechanism. Hence, the outcome of this full mediation.

6. Implications of the Study

6.1 Theoretical Implications

The study has some theoretical implications. First, the study has established the multidimensionality of the safety management system (SMS) across seven variables, the highest reported to date in the literature. Vinodkumar and Bhasi (2010) did a great job when they considered six factors as pillars of safety management system. Chen and Chen (2012) also considered the safety management system to consist of five factors, including documentation and commands (DC), promotion and training (PT), executive management commitment (EMC), emergency preparedness and response plan (EPRP), and safety

management policy (SMP). The current study, based on Vinodkumar and Bhasi (2010) and Flin et al. (2000), extended the work of Chen and Chen (2012) to include safety rules and procedures (SRP) and the safety committee (SC). The assessment of the measurement model revealed that the SMS's multidimensionality model is excellent.

Second, the study has demonstrated the degree to which seven safety management system variables can affect safety performance variables, either directly or indirectly through the mediating roles of safety motivation and knowledge.

6.2 Managerial Implications

The study also has some managerial implications. The extension of the Chen and Chen (2012) study can enable organizations to broaden their training scope regarding safety management systems (SMS). Again, the study has shown that most dimensions of the safety management system affect safety compliance more than safety participation. For instance, six safety management system variables (PT, DC, EMC, SRP, SMP, and SC) significantly affected safety compliance. In contrast, four safety management system variables (PT, EMC, EPRP, and SC) affected safety participation. The findings suggest that workers are more likely to comply with safety regulations than to take part in safety initiatives. Therefore, mining companies should make sure that the elements of their safety management system connect with workers in a way that encourages voluntary participation in safety activities.

Additionally, the mediating roles of safety knowledge and motivation imply that before mining companies can fully experience the impact of the SMS on safety performance, certain components of the system (such as executive management commitment, promotion and training, safety committee, etc.) will need additional mechanisms to be in place.

7. Conclusion

The current study acknowledges the significant contributions of the mining companies to Ghana's economy. It has provided both direct and indirect jobs to the people of Ghana. The mines' contributions to stabilising Ghana's economy are unquestionable. Based on this study's findings, the researchers suggest that mining companies could have a safety management system (SMS) that resonates with employees, especially contract mineworkers. Also, safety committees should be encouraged, as they bring together representatives from all units to deliberate and determine the way forward for workplace safety. This act makes employees follow and engage in acceptable safety practices. Safety knowledge is critical to helping employees better understand the SMS and why they must adhere to safety requirements. Therefore, mining companies could deliver regular training for their employees. Similarly, safety motivation is essential to have employees support the SMS. Therefore, mining companies could have programmes like rewarding good safety behaviour, as this can motivate employees to support workplace safety (Omidi et al., 2025).

8. Limitations of the Study

This study is not without limitations. The study focused on only contract mineworkers. Hence, it will be erroneous to generalise the findings. In future studies, the researcher will expand the

scope to include other sectors, including construction, oil and gas, pharmaceuticals, and healthcare. Also, because exposure and outcome were measured simultaneously, the study's cross-sectional survey design makes it more difficult to determine cause-and-effect relationships. Therefore, longitudinal research may be used in future studies to determine the true causal relationship between the factors.

Regarding variable selection for mediating roles, the study focused on safety motivation and knowledge. Other factors that the researcher might have taken into account include psychological capital, safety priorities, and safety consciousness. The researcher will take these factors into account in future investigations. A quantitative research design was employed in the study. Questionnaires were a helpful tool for gathering answers from contract mineworkers. Questionnaire usage can easily generate biases. Therefore, the researcher mitigated these biases by promising participants ultimate anonymity. The participants were encouraged to fill out the questionnaire honestly when the researcher informed them that their answers would only be used for academic purposes. The study also assessed the reliability of all variables, which ranged from 0.70 to 0.90, suggesting the absence of common-method bias (Podsakoff et al., 2003).

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