

**DEVELOPING A FRAMEWORK FOR A POSITIVE SAFETY
CULTURE TOWARDS IMPROVED SMALL AND MEDIUM-SIZED
ENTERPRISE CONTRACTOR PERFORMANCE IN GHANA**

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DECLARATION OF INDEPENDENT WORK

I, **Eric Kodzo Adzivor**, student number #####, do hereby declare that this research project submitted to the Central University of Technology, Free State, for the Degree **Doctor of Engineering: Civil Engineering**, is my own independent work, and complies with the Code of Academic Integrity, as well as other relevant policies, procedures, rules and regulations of the Central University of Technology, Free State, and has not been submitted before to any institution by myself or any other person in fulfilment (or partial fulfilment) of the requirements for the attainment of any qualification.

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ABSTRACT

Small and medium-sized enterprises (SMEs) in construction play a significant part in the economic development of countries. Governments worldwide have recognised construction SMEs' role in contributing to GDP and employing a large workforce. However, construction SMEs are challenged with a poor safety culture resulting in poor safety performance. This is due to the absence of a positive safety culture among the construction SMEs in Ghana which allows the SMEs to neglect the health and wellbeing of their employees resulting into high rates of accidents. The challenge is to determine what construction SMEs must do in order to establish a positive safety culture that will enhance their safety performance. The primary goal of this thesis was to develop a positive safety culture framework that will enhance the safety performance of construction SMEs in Ghana. To accomplish the aim of this study, a mixed-methods research technique was used in which both qualitative and quantitative data were collected and analysed. The Delphi method was employed to collect qualitative data. The Delphi method is a process used to arrive at a group opinion or decision by surveying a panel of experts. Out of the 31 health and safety experts who were purposively invited to participate in the Delphi process, 18 accepted voluntarily to participate in the study (58% response rate). The Delphi process ended in round three with 16 health and safety experts from Ghana. Consensus was reached on 79 leading indicators, which were categorised under 14 core elements of health and safety. The final enhanced conceptual framework for health and safety consisted of five independent variables, one intervening variable, and one dependent variable.

The results from the Delphi process led to the compilation of a semi-structured questionnaire used to gather the opinions of a larger group of construction SMES in Ghana. The survey was conducted among 450 purposively selected senior employees of construction SMEs in Ghana. However, 284 responses were acknowledged for analysis amounting to a response rate of 63.11%. The results led to the conceptualisation of a framework for improvement. The modified conceptual framework was evaluated for validity and reliability. In conclusion, a positive safety culture framework was developed to help construction SMEs in Ghana to enhance their safety performance. The findings revealed that safety information, safety commitment, safety awareness and safety adaptability positively influenced the safety culture of construction SMEs in Ghana. It was revealed further that a positive safety culture has a significant effect on the safety performance of construction SMEs. The findings from the study

indicated that the 79 leading indicator metrics established from literature and accepted by health and safety experts in Ghana, as well as the framework developed for positive safety culture might be used to help construction SMEs in Ghana to limit injuries, accidents, and fatalities for improved safety performance.

Keywords: Construction, contractors, safety culture, SMEs, safety performance, Ghana

DEDICATION

This study is in memory of my late uncle, **Mr. Prosper Hughes Adzivor**. May your gentle soul continue to rest with the Almighty God.

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LIST OF ABBREVIATIONS

| Acronyms | Full description |
|-----------------|---|
| ANOVA | Analysis of variance |
| AVE | Average Variance Estimate |
| CCA | Confirmatory Composite Analysis |
| CIOB | Chartered Institute of Building |
| CUT | Central University of Technology |
| EFA | Exploratory Factor Analysis |
| ERP | Economic Recovery Programme |
| GDP | Gross domestic product |
| GEDC | Ghana Enterprise Development Commission |
| GhIS | Ghana Institute of Surveys |
| GhISeP | Ghana Institute of Safety and Environmental Professionals |
| GIOC | Ghana Institute of Construction |
| GOIC | Gulf Organisation for Industrial Consulting |
| GRATIS | Ghana Appropriate Technology Industrial Service |
| HTU | Ho Technical University |
| H&S | Health and Safety |
| IET | Institution of Engineering and Technology |
| IOSH | Institution of Occupational Safety and Health |
| IPMA | Importance-Performance Map Analysis |
| IRCA | International Register of Certificated Auditors |
| ITTU | Intermediate Technology Transfer Units |
| MGhIS | Member Ghana Institute of Surveys |
| MWRWH | Ministry of Water Resources, Works and Housing |
| NBSSI | National Board for Small Scale Industries |
| OBP | Office of Business Promotion |
| OHS | Occupational Health and Safety |
| OHS MS | Occupational Health and Safety Management System |
| OSHAfrica | Occupational Safety and Health in Africa |
| PLS | Partial Least Square |
| PPE | Personal Protective Equipment |

| | |
|-----|--------------------------------|
| RGD | Registrar General's Department |
| SEM | Structural Equation Modelling |
| SME | Small and Medium Enterprise |
| UK | United Kingdom |
| US | United States |

DEFINITION OF TERMS

Accident: Accident is any “brief unexpected and unanticipated occasion or occurrence that normally leads to an uninvited and unsatisfactory outcome” that is the result of human activity rather than a natural event (Salmon *et al.*, 2020: 1).

Safety culture: Safety culture is defined as a set of norms, beliefs, attitudes, managerial and technical practices, roles and social, and etiquettes that shapes the safe behaviour and practices of management and employees of construction SMEs (Williams, Fugay & Adinyra., 2020: 5).

Health and safety: Health and safety refers to how positively construction SMEs manage risks and hazardous situations on construction sites in order to protect their entire workforces as well as their businesses for improved safety performance.

Safety commitment: Commitment to safety is the involvement of every individual employee in safety activities within construction SMEs for the purpose of enhancing safety performance. Top management of construction SMEs must be seen to be genuinely committed in maintaining a high standard of safety that will motivate employees to do same (Ajmal *et al.*, 2020: 3).

Safety behaviour: Safety behaviour is the extent to which every employee of construction SMEs behaves in order to maintain and enhance the level of health and safety (Piers *et al.*, 2009: 6). Managers of construction SMEs must demonstrate the importance of safety by recognising and providing everything needed by their employees to maintain and enhance safety during and after work.

Safety awareness: Safety awareness reflects the degree to which all employees of construction SMEs are aware of the risks and hazards with respect to themselves and co-workers during work (Piers *et al.*, 2009: 6). Management and employees of construction SMEs must demonstrate and maintain a high degree of vigilance at all times with regards to safety issues.

Safety adaptability: Safety adaptability is the degree to which both management and employees of construction SMEs are determined to learn from previous safety experiences and are willing and able to take all necessary actions to improve the level of safety in construction SMEs (Piers *et al.*, 2009: 6).

Safety information: Safety information reflects the degree to which safety information are distributed within construction SMEs to the appropriate individuals at the right time. Safety-related information should be distributed in the right manner to the appropriate individuals at the right time in order to prevent miscommunication that creates hazardous conditions (Piers *et al.*, 2009: 6).

Safety performance: Safety performance is either the depth of safety performance outcomes in construction SMEs, such as annual injuries, accidents and fatalities, and specific number of injured employees, etc. or the measure of individual employee health and safety behaviour (Guo *et al.*, 2019: 2).

CHAPTER 1: RESEARCH ORIENTATION

1.1. Introduction

The construction sector significantly contributes to gross domestic product (GDP) in the Ghanaian economy (Boadu *et al.*, 2020). According to Mustapha *et al.* (2018), its contribution to GDP is approximately 5% - 10% across all countries. Governments around the globe use the investments from the construction sector to stabilise their economies (Hamza *et al.*, 2022). Apart from its substantial contribution to GDP, the construction industry also contributes significantly to providing shelter and infrastructure, as well as providing employment opportunities for large numbers of non-skilled and skilled labour globally. The construction sector alone employs approximately 10% of the working population world wide (Mustapha *et al.*, 2018) while, in Ghana, it employs approximately 7% of the working population in the country (Boadu *et al.*, 2020). Despite all these significant contributions, occupational accidents in Ghana occurred at a rate of 43 in 1,000,000 hours worked, with a frequency of 63 accidents in every 1000 workers and severity rate of 418 days lost per 1,000,000 hours worked (Boadu *et al.*, 2020). Safety in the workplace started to receive attention in the 18th Century, during the First Industrial Revolution. This was when technological developments were first used to improve occupational safety, and when safety policies were used for the first time within the industrial context (Vierendeels *et al.*, 2018). According to Alpmen (2013), even though construction safety is a crucial aspect within the construction industry, its importance has been overlooked over the years. The main reason for the soaring rate of accidents within the construction industry is, the uniqueness of the industry compared with other industries in terms of work environments, broad use of very sophisticated machinery and heavy equipment, and a multiplicity of operations, which have made the majority of construction sites hazardous places in which to work (Bavafa *et al.*, 2018).

Accidents on construction sites are associated with both direct and indirect costs. Based on a study conducted by Alpmen (2013), it was estimated globally that indirect and direct costs of construction accidents (fatal and, or non-fatal) amounted to \$13 billion yearly, while the medical expenditure on non-fatal accidents alone cost over \$1.36 billion yearly, of which only 46% was reimbursed by the employees' compensation fund. Therefore, much is required of the industry to improve productivity levels and overall performance so that the full potential of the

industry can be achieved, as well as accelerated growth in the global economy. Health and safety within the construction industry, especially on construction sites, has been and still is a major concern for both professionals and academics. Both these sectors subscribe to the idea that safety programmes are a proactive means by which health and safety among construction workers on site can be ensured. Falling from height remains the dominant cause of fatal accidents within the construction industry, resulting in crushing, fractures, and dislocations, while slip, trip, and fall are the leading incidents in the workplace that result in minor injuries (Wong & Lee, 2016).

A study carried out by Subramaniam *et al.* (2016) indicated that construction SMEs in Malaysia have a growth rate of 4.7%, which far exceeds the average growth rate in the country. Notwithstanding this impressive achievement in growth, construction SMEs are buzzed with huge challenges in keeping their workers safe. Subramaniam *et al.* (2016) expressed the need for more rigorous research on health and safety among construction SMEs, since the risk of fatal accidents is 4.9 times higher in construction SMEs than in larger companies. In the light of the above, a new, practical, global coalition on health and safety at work was launched at the 21st World Congress on Safety and Health at Work which was held in Singapore in 2017, to address adequately the existing and emerging occupational health and safety concerns threatening sustainable development in the world.

1.2. Construction SMEs in Ghana

The construction sector in Ghana is dominated by construction SMEs that account for over 80%-90% of total employment (Arthur-Aidoo *et al.*, 2016). Peprah *et al.* (2016) revealed that construction SMEs in Ghana are among the major stakeholders in the economic development of the country, contributing no less than 70% to GDP as well as a higher employment rate than any other sector. Mustapha *et al.* (2016) reported that the greater number of construction companies in Ghana are made up of construction SMEs constituting about 90% (Oppong *et al.*, 2014) compared to the large-scale construction companies. The aforementioned justifications make it clear that construction SMEs are the backbone of the Ghanaian economy and are responsible for a substantial portion of new jobs in the nation. Arthur-Aidoo *et al.* (2016) stated that construction SMEs are essential to the construction sector in Ghana because of the huge numbers of projects in which these firms are involved. Realising the economic importance of

construction SMEs, some key institutions have been established in Ghana, such as the Office of Business Promotion (OBP) and, recently, the Ghana Enterprise Development Commission (GEDC) with the main objective of assisting Ghanaian SMEs to compete with their foreign counterparts in conducting business (Peprah *et al.*, 2016). Further institutions, such as the Economic Recovery Programme (ERP) instituted in 1987 to support SMEs institutionally, the National Board for Small Scale Industries (NBSSI), a subsidiary of the Ministry of Industry, Science and Technology, and the Entrepreneurial Development Programme were also established to train people to be self-employed. Equally important has been the emergence of the Ghana Appropriate Technology Industrial Service (GRATIS) to help to handle the activities of Intermediate Technology Transfer Units (ITTU) in the country. The Ministry for Private Sector Development was constituted again to address the development needs of construction SMEs in the country (Peprah *et al.*, 2016). Table 1.1 contains the definitions of construction SMEs applicable to the Ghanaian Construction Industry.

Table 1.1: Summary of definitions of SMEs commonly adopted in Ghana

| Item | Source | Definition |
|------|-------------------------------|--|
| 1 | Ntiamoah <i>et al.</i> (2014) | Small businesses are those with fewer than 10 employees, and medium-sized businesses are those with more than 10 employees. |
| 2 | (Oppong <i>et al.</i> , 2014) | Small- and Medium-Scale Businesses are those that employ between 1 and 5 people and have fixed assets (excluding real estate) worth up to \$10,000. Micro enterprises are defined as businesses with fewer than five employees and fixed assets worth up to \$100,000. |
| 3 | (Yeboah, 2014) | Businesses with assets of 5 million cedis and 25 million cedis in constant 1988 prices (US \$20,000 and US \$100,000 equivalent), respectively. |
| 5 | (Mensah, 2004) | Micro businesses as businesses employing up to 5 persons with fixed assets (excluding realty) not exceeding \$10,000 in value; small businesses as those which employ 6-29 people with fixed assets (excluding realty) up to \$100,000 in value; and medium businesses as those which employ 30-99 people with fixed assets of up to \$1 million in value. |

Source: Adapted from Arthur-Aidoo et al. (2018)

All firms including construction SMEs are required by law to register with the Registrar General's Department (RGD) and are classified under any of the four categories specified by

the Ministry of Water Resources, Works and Housing (MWRWH) (Kissi *et al.*, 2022). The limits of these classifications are stated further with regards to their assets, plant and labour holding as well as the size and nature of project in which they can engage, as indicated in Table 1.2.

Table 1.2: Categories of company classification in Ghana

| S/N | Classification | Category | Class | Financial Classification |
|-----|----------------|-------------------|-------|---------------------------|
| 1 | D | Building | 1 | >\$500,000.00 |
| 2 | K | Civil Engineering | 2 | \$200,000.00-\$500,000.00 |
| 3 | E | Electrical Works | 3 | \$75,000.00-\$100,000.00 |
| 4 | G | Plumbing | 4 | >\$75,000.00 |

Source: Kissi et al., (2022)

However, many of the traditional problems facing construction SMEs globally, including Ghana, involve poor health and safety management of the huge numbers of people they employ. Higher growth in productivity with its consequent economic growth rely strongly on the well-being of all employees of these construction SMEs. To achieve this goal, it is essential to establish a positive safety culture among these construction SMEs in order to lower the high rate of injuries, accidents and fatalities that bedevil construction SMEs. Their ability to grow undoubtedly depends on how much they have embraced and invested in a positive safety culture of every member involved in their production processes within the organisation.

1.3. Safety Culture

Piers *et al.*, (2009) opined that safety culture is the set of enduring values and attitudes regarding safety issues shared by every member of every level of an organisation. Piers *et al.*, (2009) stated further that safety culture refers to the extent to which every individual and every group in the organisation: is aware of the risks and known hazards induced by its activities; is continuously behaving so as to preserve and enhance safety; is willing and able to adapt itself when facing safety issues; is willing to communicate safety issues; and consistently evaluates safety-related behaviour. Aburumman *et al.* (2019) are of the view that a poor safety culture within an organisation creates an environment for errors and violations of safety rules and practices, which leads to an increase in accidents. Additionally, it also highlights management's failure to recognise or address organisational safety-relates issues. A perfect safety culture according to Aburumman *et al.* (2019), is the force that propels the system toward the objective

of maintaining the maximum resistance to an organisation's operating hazards. Safety culture, according to Piers *et al.* (2009), can be assessed through both qualitative and quantitative means. They added that during the assessment process using questionnaires or interviews, it is necessary that adequate strategies are used to stop respondents from providing desired answers. For the purpose of this research study, assessment and management of safety culture was based on the following five components. Firstly, **commitment** (which illustrates how strongly the organisation values safety and understands its significance at every level); secondly, **behaviour** (which describes how well each level of the organization acts to maintain and raise the degree of safety); thirdly, **awareness** (which speaks to how knowledgeable management and staff are about the dangers to themselves and everyone else involved in the organisation's operations.); fourthly, **adaptability** (the readiness of management and staff to draw lessons from past mistakes and implement required changes to raise the organisation's degree of safety); fifthly, **information** (how information on safety issues is disseminated to the appropriate people at the appropriate time in the organisation) (Piers *et al.*, 2009).

1.4. Problem Statement

Darko and Löwe (2016) observed that the contribution of Ghana's construction SMEs over the years to gross domestic product (GDP) has been over \$600 million. The industry in Ghana has over 23,000 registered contractors and many industry associations, including professional bodies (Darko & Löwe, 2016). It is the fastest-growing industry in Ghana. According to Kheni (2008), the issue of health and safety (H&S) in construction SMEs in Ghana is a major concern for governments, project participants, employers, and employees. According to researchers such as (Zaira & Hadikusumo, 2017; Wong & Lee, 2016), poor employee attitudes, a lack of management commitment, and a lack of worker safety awareness and training are the primary causes of workplace accidents. The sector in Ghana is characterised by several injuries, accidents and fatalities because of the non-existence of a single health and safety regulation, and lack of government commitment to enforcing safety regulations, policies and legislation (Williams *et al.*, 2020). Construction SMEs are faced with inadequate health and safety professionals, lack of health and safety training for employees, lack of health and safety policies, inadequate data collection systems, poor risk assessment, employees' attitude towards health and safety, lack of health and safety education in various institutions, cost of providing and maintaining health and safety on sites, communication difficulties, and shortfalls in accident reporting. The lack of a comprehensive national health and safety policy in Ghana is

one of the main obstacles to implementing health and safety practices among construction SMEs in Ghana. Annan *et al.* 2015; Kheni *et al.* (2008) found that insufficient support for regulatory bodies by government, limited institutional frameworks for occupational health and safety (OHS) management systems, and inadequate OHS education are the main challenges facing OHS implementation and practices in the country. According to Annan *et al.* (2015), research on health and safety practices in Ghana is not given enough attention, and existing research focuses on the root causes of OHS problems while ignoring the critical empirical and scientific interventions that are required, as there is a lack of research on business cases, OHS interventions, OHS attitudes, and a health and safety culture. As a result, there is a poor safety culture among construction SMEs in Ghana. Thus, the study's goal was to provide a framework for a positive safety culture which would aid construction SMEs to establish a positive safety culture for improved safety performance.

1.5. Research Questions

Safety in the workplace goes beyond provision of safety equipment, procedures and systems. A well-established safety culture within construction SMEs is essential. Apparently, the consensus is that there is a need for more comprehensive work on models to be developed scientifically and verified empirically to address this gap in the research. Therefore, there is a need for scientifically-based mechanisms for the integration of a positive and progressive safety culture among construction SMEs in Ghana. The primary research question was: How could construction SMEs in Ghana improve their organizational level safety performance through the implementation of a safety culture? Following on from the principal research question was the research problem statement as follows: The lack of a positive safety culture leads to the hazardous performance of construction SMEs in Ghana.

To answer the above principal research question, it was broken down into the following secondary questions:

- What are the components that shape the safety culture of construction SMEs in Ghana?
- How do the components influence the safety culture of construction SMEs in Ghana?
- Which components significantly influence the safety culture of construction SMEs in Ghana?
- How does a safety culture influence the safety performance of construction SMEs in

Ghana?

- Which plans would assist construction SMEs to evolve a positive safety culture to improve safety performance in Ghana?

1.6. Research Aim

The aim of this study was to develop a positive safety culture framework that would improve the safety performance of construction SMEs in Ghana. The novelty of this research study is the framework for a positive safety culture.

1.7. Research Specific Objectives

Based on the above aim, the precise objectives of the study were:

- To explore the components that shape safety culture within construction SMEs in Ghana;
- To evaluate the influences of the components on safety culture of construction SMEs in Ghana;
- To analyse the components that significantly influence the safety culture of construction SMEs in Ghana;
- To evaluate how a safety culture influences the safety performance of construction SMEs in Ghana; and
- To develop a framework that would assist construction SMEs to evolve a positive safety culture to improve safety performance in Ghana.

1.8. Overview of the Research Methodology

Creswell (2014) opined that a mixed-methods is a research strategy where researchers gather, analyse and integrate both qualitative and quantitative data in a particular study or in a sustained, long-term programme of enquiry in order to find solutions to their research questions. The current study was based on mixed methods because a quantitative or qualitative method alone was insufficient to understand the research questions fully. Two major approaches were used to collect data for the current study using secondary and primary sources.

The secondary sources included databases, books, reports, journal and conference papers, while the primary data were gathered through questionnaires. A Delphi method with health and safety experts from Ghana was adopted for the study, and a questionnaire survey of construction SMEs to find answers to the research questions.

A three-phase process was followed in this research. In the first phase, the research problem was considered and the research questions, aim and objectives were generated. The main research aim of this study was to develop a framework for a positive safety culture that would engender positive and progressive safety performance among construction SMEs in Ghana. A literature review was carried out to identify the components that shape the safety culture within construction SMEs. Both qualitative and quantitative data were gathered to determine how these components influence the safety culture. The results of the literature review also helped to identify the core elements, or main indicators, the safety culture components, and a scale to measure the main indicator metrics or statements, and a conceptual positive safety culture framework was proposed.

In the second phase, Round 1 of the Delphi method was used to validate the indicator metrics/statements for their importance and impact when establishing a positive safety culture within construction SMEs. In Rounds 2 and 3, a structured questionnaire and open-ended questions were used in validating the components of the framework.

In the third and final stage, a pilot questionnaire survey was undertaken before the main questionnaire survey was administered to construction SMEs to test the conceptual framework refined in Phase 2. The goal of the current study was to develop a “best fit”, positive safety culture framework that would include safety culture indicators that would influence positive safety culture for improved safety performance in construction SMEs in Ghana, which would lead to reduction in injuries, accidents and fatalities.

1.9. Research Scope

The scope of the current investigation was limited to:

- Construction SMEs operating in the Construction Industry in Ghanaian;

- Construction SMEs that had live projects on-going at the time of the study;
- Targeted respondents that included health and safety officers, owners of construction SMEs, site agents, project managers and other senior members;
- The study was focused mainly on developing a positive safety culture framework for construction SMEs in Ghana to improve their safety performances.

1.10. Research Assumptions

The following presumptions were made with respect to the current study: A detailed discussion can be found in sections 7.2.1 – 7.2.5.

- Appropriate safety behaviour can be linked to the existence of a positive culture of safety among construction SMEs;
- The level of safety awareness among construction SMEs influences the safety culture existing within the construction SMEs;
- The flow of safety information to the appropriate people at the appropriate time can be linked to safety culture among construction SMEs;
- Safety adaptability among construction SMEs results in a positive safety culture;
- A positive safety culture can be linked to improved safety performance among construction SMEs.

1.11. Contributions of the Study

The OHS of any construction work environment depends on the presence of a positive culture of safety. A positive safety culture does not only protect the lives of construction workers, but it also increases the competitiveness of construction SMEs (Williams, 2019). According to Williams (2019), the safety culture of Ghanaian construction SMEs is at a pathological stage on the maturity ladder of health and safety culture. This is the stage where every worker is responsible for his/her own safety during work and is not supported by any policy. At this stage, construction SMEs do not care why accidents occur and how these accidents should be eliminated or even reported. It can be said that construction SMEs create conducive environments for injuries, accidents and fatalities in Ghana. Ametepey (2015) reported five key barriers impeding the implementation of safety culture in construction SMEs, namely: lack

of government commitment, resistance to cultural change, fear of higher investment costs, lack of health and safety legislation, and lack of professional knowledge. Simpson (2019) revealed the challenges facing construction SMEs in establishing positive safety cultures as being; poor risk assessment, lack of health and safety training for employees, lack of health and safety policies workers' attitudes towards health and safety, inadequate data collection systems, inadequate health and safety professionals, communication difficulties, lack of health and safety education in various institutions, cost of providing and maintaining health and safety on sites, and deficiencies in accident reporting. This indicates that there is a need for construction SMEs to increase their efforts in the fight against the occurrences of accidents in the construction sector. The construction sector and the government of Ghana must formulate policies necessary to force construction SMEs to pay much attention to the health and safety of workers as a matter of urgency. More needs to be done to address high rates of accidents and their negative impacts on both management and employees of construction SMEs.

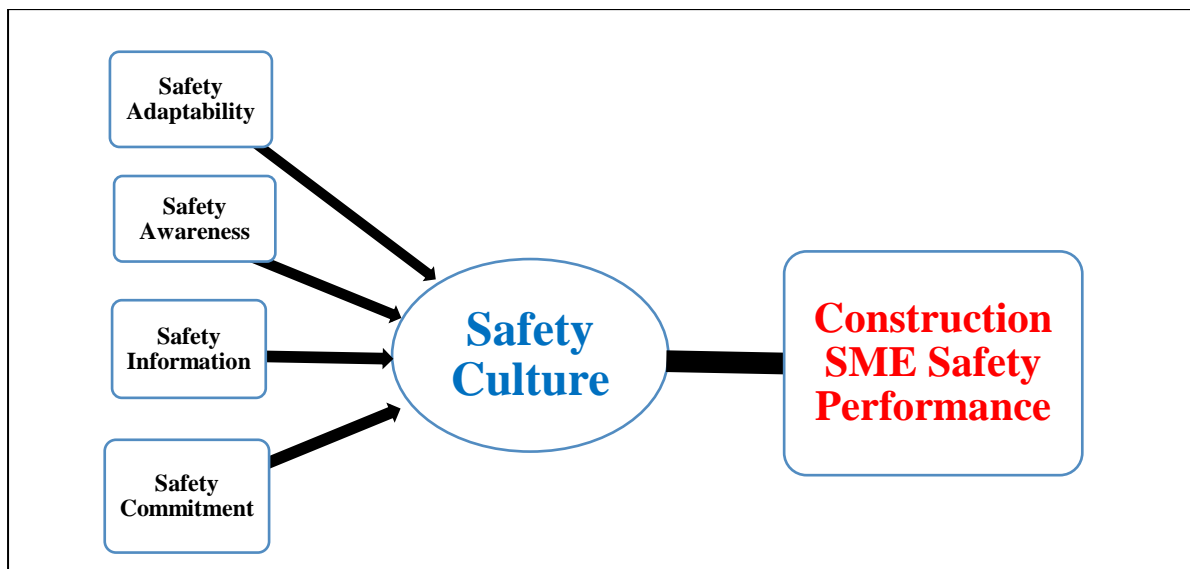


Figure 1.1: Developed framework for a positive safety culture for improved safety performance of construction SMEs in Ghana

Establishing a positive safety culture is essential to improve the unfavorable safety records of Ghana's construction SMEs in order to improve the sector's reputation in the country. To address this, a positive safety culture framework that would help to improve safety performances of construction SMEs was developed in the current study. A mixed-methods approach was adopted where qualitative data were gathered using the Delphi technique and quantitative data were collected using a questionnaire survey. The use of this method resulted

in the development of a framework that has the potential to establish a positive safety culture among construction SMEs for improved safety performance, as shown in Figure 1.1. Health and safety experts in the Ghanaian SME construction sector reached consensus on 71 leading indicator metrics as being very important to help construction SMEs to establish a positive safety culture within their respective construction companies. However, it can be concluded that the major contributions of the current study were, theoretically, the identification and confirmation of the 71 leading indicator metrics by health and safety experts that are based in Ghana, and ultimately, a framework for positive safety culture that was developed to improve the safety performance of construction SMEs in Ghana.

1.12. Structure of the Thesis

The report was structured into seven chapters, as indicated in Figure 1.2. Chapter One is the research orientation containing the introduction, problem statement, the primary research questions and secondary questions, the aim and objectives, an overview of the research methodology, scope, assumptions and the contributions of the research. Chapter Two contains a literature review relating to safety culture, construction SMEs, commitment, behaviour, adaptability, information, awareness and safety performance. In Chapter Three, the choice of a mixed-methods research approach for the study is explained. In Chapter Four, the data collected from a three-round Delphi technique are presented and discussed. In Chapter Five, the data collected from a questionnaire survey of construction SMEs are presented and discussed. In Chapter Six, the positive safety culture framework is presented and Chapter Seven is made up of the conclusions and recommendation based on the study.

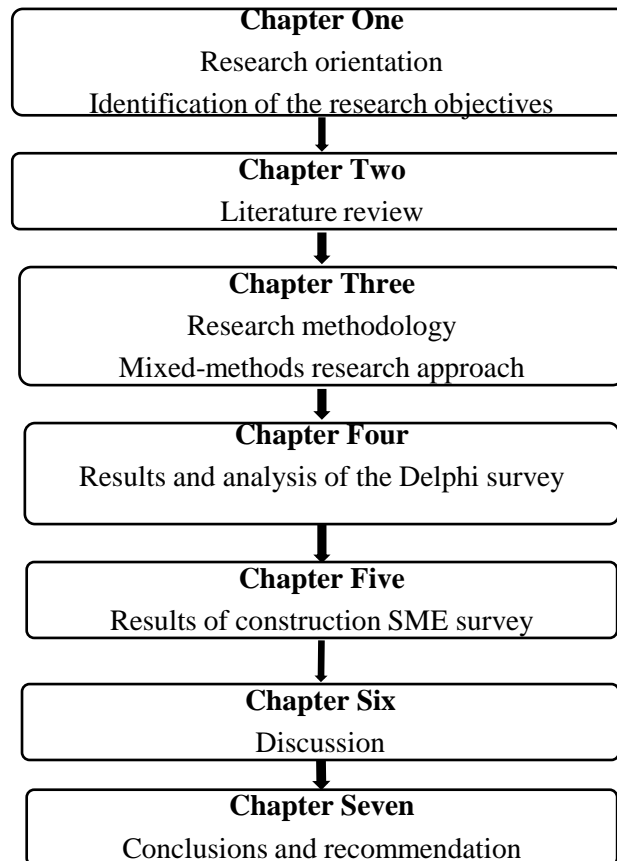


Figure 1.2: Structure of the thesis

Source: Researcher's construct

1.13. Chapter Summary

The aim and the specific research objectives, together with the research questions, were established in this chapter. To that purpose, Chapter One provided the basis for the literature review in Chapter Two, which is focused on identifying the core elements and their leading indicators and how they can be used to establish a positive safety culture among construction SMEs in Ghana to enhance their safety performances.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

To create a framework for a positive safety culture that will enhance safety performance of construction SMEs requires an extensive understanding of how health and safety is managed by construction SMEs. This chapter contains a detailed account of safety culture and the causes of accidents in the construction industry. Construction SMEs in Ghana are defined in detail and the state of their management of health and safety is considered as well as the impact of their operations on the Ghanaian economy. The components that shape safety culture and the leading indicator metrics are identified. The proposed conceptual framework for positive safety culture is also presented. Finally, safety culture and its six components together with safety performance are discussed in the chapter.

2.2. Health and Safety Management by Construction SMEs in Ghana

SMEs are involved in several construction activities, such as alteration, erecting, demolishing, repairing, civil engineering works and many similar functions, that are regarded as being dangerous (Kissi *et al.*, 2022). Gyensare *et al.* (2019) argued that construction SMEs are more burdened with illnesses, injuries, accidents and fatalities than larger construction companies because of a lack of proper health and safety management strategies. Tremblay & Badri (2018) revealed that injuries, accidents and fatalities are eight times higher in construction SMEs and there is 50% more non-fatal accidents. The negative safety culture among these construction SMEs in Ghana is the result of a lack of capacity of essential resources to comply with health and safety regulations as well as safety activities. Tremblay & Badri (2018) explained further that, despite the huge economic contributions made by construction SMEs to the growth of the Ghanaian economy, it is difficult to grow and expand in the sector as a result of impediments such as specific health and safety regulations that can guarantee and safeguard the health and safety of their workforce. Ghana currently had no single regulation that was specifically meant to care for the health and safety of all construction workers across the country, except those that are under several state legislations, such as the Factories, Offices and Shops Act, 1970 (Act 328), the Labour Act, 2003 (Act 651) and the Workmen's Compensation Act, 1999 (Act

526), which have made some provisions for health and safety of all employees in the country, including the construction sector (Gyensare *et al.*, 2019).

Single legislation is needed that will mandate the owners/managers of construction SMEs to enforce health and safety standards appropriately within their companies. Mustapha *et al.* (2016) have observed that the absence of relevant health and safety regulation in Ghana is the main cause of non-compliance with health and safety practices among most construction SMEs in the country. Mustapha *et al.* (2016) stated further that the presence of health and safety regulations would impose some actions on these construction SMEs which would involve expertise, money and management to be able to abide by these actions. Mustapha *et al.* (2016) maintained that construction SMEs in Ghana suffer major economic loss and personnel costs because of injuries, accidents and fatalities. In order to overcome these, it is necessary to establish a positive safety culture within construction SMEs that will encourage healthy behaviours at every level within the SME organisations. This proposes that owners/managers of construction SMEs who establish a positive safety culture within their companies are more capable of making their workforce conform to safety rules which leads to greater reduction in accident rates and increases productivity. It has been shown in research that only employees who are safe and healthy can invest their full capabilities into work for greater production with commensurate profit.

Managers/owners of construction SMEs must show a complete commitment to the health and safety of their workers by resolving all unsafe working conditions in order to encourage their employees to observe all safety regulations in the workplace. The ability of construction SMEs in Ghana to grow depends largely on their appetite to invest in restructuring, innovation and qualification, and these require a positive safety culture within the sector to boost the health and safety morale among their workforces (Domeher *et al.*, 2017). A negative safety culture, which is recognised as being a conduit for accidents, will not help construction SMEs to create and develop jobs and will affect their internationalisation efforts negatively. Barriers and drivers of health and safety issues that affect construction SMEs are identified in Table 2.1.

Table 2.1: Barriers and drivers of health and safety among construction SMEs

| Category | Barriers | Drivers |
|---------------------------------|---|---|
| Achieving Regulatory Compliance | <p>Within an Enterprise (Internal)</p> <ul style="list-style-type: none"> • Lack of knowledge • Lack of awareness • Poor management attitudes • Lack of expertise • Lack of financial resources <p>Outside the Enterprise (External)</p> <ul style="list-style-type: none"> • Poor regulatory framework • Lack of incentives | <p>Economic and reputation factors</p> <ul style="list-style-type: none"> • Avoid legal fines and penalties • Reduce charges • Gain market opportunities <p>Political factors</p> <ul style="list-style-type: none"> • Clear political commitment • Regulations with strong enforcement • Clear legal standards and information |
| Establishing management systems | <p>Internal</p> <ul style="list-style-type: none"> • Lack of human and financial resources • Interrupted implementation • Lack of knowledge • commitment • Poor management attitudes <p>External</p> <ul style="list-style-type: none"> • High cost for small firms • Weak institutional framework • Lack of economic incentives • Lack of SME-specific guidance | <p>Internal</p> <ul style="list-style-type: none"> • Documented legal compliance records (organisational benefits) • Improved employee morale (people benefits) • Cost savings from material reductions (financial benefits) • Desire to avoid bureaucratic burden from government inspections • Environmental awareness and societal expectations • Commitment by leadership and administration <p>External</p> <ul style="list-style-type: none"> • Prevention of market exclusion • Assured legal compliance (environmental benefits) • Customer satisfaction (commercial benefits) • Positive public image (communication benefits) |

Source: Adopted and from Lin & Koh (2019)

2.3. Accident Causation and Safety Culture

Abraha & Liyanage, (2015) noted that the existence of accidents on construction sites interrupts the flow of work and cash, and leads to human suffering. Suraji and Duff (2000) reported that the causes of accidents and fatalities in the construction industry, especially in construction SMEs, could originate from the client's team, client, architect and or the contractor as well as the employees. This highlights that the sources of accident causation are typically dispersed at all stages of a building project, such as the conception stage, design stage, and construction

stage. Therefore, it is appropriate for owners of construction SMEs to tackle these root causes at all the stages in order to minimise the rates of accidents, injuries, and fatalities within their respective companies. This calls for the establishment of a positive safety culture within construction SMEs for improved safety performance. To reduce or eliminate accidents from occurring on construction sites requires a complete understanding and identification of the root cause of an accident. To this effect, several theories of accident causation have emerged to provide a basis for analysing the root causes of accidents. According to Mahat *et al.* (2015), the purpose of accident causation theories is to identify the factors and the processes that lead to the cause of the accidents in order to develop strategies that will help either to minimise or eradicate the occurrence of these accidents entirely. Mahat *et al.* (2015) opined further that the goal of these theories is to explain why accidents occur. Yang and Haugen, (2018) noted that accident theories help to analyse every hazard and risk assessment. According to Yang and Haugen, (2018), each theory has a specific characteristic depending on the causal factors that are highlighted. Abraha and Liyanage (2015) reiterated that many researchers in the past believed that accidents occurred as a result of the failure or malfunctioning of machines or human beings. With reference to this statement, accident causation theories have undergone different developmental stages such as:

- A technical stage in which accidents were believed to have happened because of mechanical malfunctioning of equipment and tools;
- Mistakes by humans were considered to be the main causes of accidents;
- A socio-technical stage in which accidents were believed to have occurred through the combination of both humans and the equipment and tools they used for work;
- An organisational culture stage in which employees work with technology and one another within a particular, embedded culture of an organisation (Adzivor *et al.*, 2019)

Different theories of accident causation within the construction industry have since been developed by various researchers based on the above discussions.

2.4. The Concept of Safety Culture

The conception of safety culture arose in 1986 after the occurrence of accidents at Chernobyl. Major occupational accidents, such as the North Sea oil production platform, "Piper Alpha", in

1988 and the King's Cross underground fire in London in 1987 have been linked to a lack of safety culture (Çalış & Küçükali, 2019). According to Stemm *et al.* (2019), safety culture is the most significant theoretical advancement in construction health and safety because it is crucial to develop a plan to improve safety performance to combat the high rates of accidents within the construction sector. The basic goal of safety culture is to create a favourable safety environment that encourages management and employees to be aware of accidents, making it an important part of organisational culture. According to Asad *et al.* (2022), construction SMEs frequently experience injuries, accidents, and fatalities because they do not have a strong safety culture. Since researchers and stakeholders within the construction sector have recognised the benefits of safety culture in reducing accidents, injuries, and fatalities within construction SMEs, it is gaining much attention. Poor safety culture among construction SMEs results in workers continuing to work in the presence of unsafe conditions that can result in injuries, accidents and fatalities (Shaikh *et al.*, 2021). According to Grebenšek and Kosel (2015), the following depicts the existence of a negative safety culture within an organisation:

- When employees' concerns about safety are not addressed consistently;
- When employees do not learn from past events;
- When safety cases indicate that the system is safe, but the operational team believes that the accident was inevitable;
- When there is a belief that safety is the responsibility of someone else.

In order to develop a strong positive safety culture within construction SMEs, management and quality leadership are two essential components that must be considered thoroughly (Byrnes *et al.*, 2022). Olcay *et al.* (2021) purported that, only when construction SMEs have a strong safety culture, 98% of injuries, accidents and fatalities will be avoided in the construction sector. According to Aburumman *et al.* (2019), the lack of a safety culture within construction SMEs creates room for mistakes and violation of safety rules, which exposes the inadequacies of management's efforts to care for construction workers. Aburumman *et al.* (2019) stated further that management's failure to recognise or rectify the gaps in their safety management systems is a common indicator of a construction site with a poor safety culture. Many industries around the globe in recent years have recognised the importance of safety culture as the appropriate means to fight the occurrence of injuries, accidents and fatalities. According to Aburumman *et al.* (2019), a perfect safety culture is the force that propels any safety

management system toward the objective of maintaining maximum resistance to an organisation’s operating hazards. It can be inferred from the above submissions that an “ideal” safety culture is “the engine” that will propel health and safety management systems within the construction industry in order to reduce the rates of injuries, accidents and fatalities. Despite years of study about safety culture in the construction sector, there is no universal agreement on what it is or how it is measured (Al-Bayati *et al.*, 2019). Table 2.2 shows different definitions of the term “safety culture” by different health and safety researchers.

Table 2.2: Definition of safety culture

| References | Definition of Safety Culture |
|----------------------------------|---|
| Cooper (2018) | Safety culture is considered as social construct that enables both academia and industry to manage health and safety within an organisation in order to avoid injuries, accidents and fatalities. |
| Al-Bayati <i>et al.</i> (2019) | Safety culture is considered to be the values of a construction company that indicate the underlying beliefs and principles that guide safety decision-making. |
| Aburumman <i>et al.</i> (2019) | Safety culture is described as the “shared values (i.e. what is important) and beliefs (i.e. how things work) that interact with an organisation's structures and control systems to produce behavioural norms (i.e. the way we do things around here). |
| Stemn <i>et al.</i> (2019) | Safety culture is described as the core principles and beliefs of a construction SME specific to H&S. |
| Guldenmund (2000) | The norms, values, and practices that relate to safety are shared among groups. |
| Musa and Isha (2021) | The beliefs, values, attitudes, and ensuing behaviours displayed by members of a community, group, or an organization define the safety culture. |
| Al-Bayati (2021) | The norms and values that direct decision-making on safety are represented by the construction safety culture. |
| Al-Mekhlafi <i>et al.</i> (2021) | Safety culture is thought to result from both individual and group attitudes, beliefs, and behavioural patterns. It establishes an organization's commitment, willingness, management methods, and capacity for handling health and safety issues. |
| Musonda <i>et al.</i> (2021) | Safety culture is common values (what is important) and mindsets (how things work) that combine with an organisation’s arrangement and control systems to yield behavioural standards (the way things are done). |
| Williams <i>et al.</i> (2020) | The beliefs, conventions, attitudes, roles, and social, managerial, and technological practices that make up the safety culture influence how management and employees behave and carry out their jobs safely. |

Source: Adapted and modified from (Adzivor et al., 2019)

Without official, written laws or regulations, it is understood that culture encourages people to behave consistently over a long period of time. Therefore, if safety is made a culture within an organisation, it would create a positive health and safety environment that would encourage every employee to become safety conscious without necessarily advocating health and safety standards. Al-Mekhlafi *et al.* (2021) reported that safety culture is the manifestation of the commitment of individuals and organisations to take personal obligation for safety, to act to recognise and disseminate safety concerns, to adapt and revise behaviour based on lessons learned from past mistakes, and how they are compensated. According to Çalış & Küçükali (2019), safety culture:

- refers to values common among all members of groups or organisations;
- addresses formal safety issues, supervision, and management processes in an organisation;
- concerns everyone from the minimum rank to the uppermost;
- is effective in modifying the behaviour of employees in the workplace;
- is reflected in a commitment reward system informed by safety performance;
- is reflected in the organisational passion to develop and learn from mistakes, events, and accidents.

2.5. Characteristics (Components) of Safety Culture

The frequency of mistakes and contraventions of safety regulations and procedures within construction SMEs is a clear sign of negative safety culture (Aburumman *et al.*, 2019). This proposes that the directors of these construction SMEs are not absolutely committed to health and safety-related matters. This further suggests that the managing directors of these SMEs in the construction industry are not genuinely concerned about health and safety-related issues within their respective companies. Maintaining a positive safety culture in construction SMEs is the most effective strategy to reduce injuries, accidents, and fatalities (Aburumman *et al.*, 2019). Therefore, it can be inferred that, once a positive safety culture is upheld, health and safety-related problems of construction SMEs will improve significantly. According to Rubin *et al.* (2020), positive safety culture predicts better safety performance, compliance, and participation. Workers in construction SMEs in Ghana would adhere to safety measures conscientiously once safety culture has become the norm among the various construction

SMEs. Since Ghana lacks any explicit legislation that addresses the health and safety of construction employees, it is more important than ever to implement a safety culture among construction SMEs in Ghana. At this point, construction SMEs must establish a positive safety culture in order to win over the minds and hearts of all workers. Stemm *et al.* (2019) purported that when a positive culture of safety is established and accepted by management and all construction workers, it will reduce the number of incidents that occur within construction SMEs. The essential components of safety culture are: the importance of safety; workers' involvement at all levels; the role of safety staff; caring trust; openness in communication; belief in safety improvements; and integration of safety into the organisation (Adzivor *et al.* 2019).

Trinh and Feng (2020) opined that psychological, behavioural and contextual safety-related aspects that make up a practical framework could be used to measure safety culture in order to get understanding into the link among safety culture and safety outcome measures. According to Yari *et al.* (2019), positive culture of safety creates an environment in which everything associating to safety is regarded to be utmost important. Iqbal *et al.* (2019) admitted that safety culture is difficult to measure since it is not an appreciable concept. Nevertheless, Iqbal *et al.* (2019) further indicated that in order to get measureable and reproducible evaluation outcomes, it is necessary to choose the right model, data collection methods, and approaches. Choudhry *et al.*, (2007) reported that a positive safety culture has five essential elements that can be used to measure it and these are; (1) management concerns for the workforce, (2) management commitment to safety, (3) mutual trust and credibility between management and employees, workforce empowerment (4) continuous monitoring, corrective action, review of the system (5) continual improvements to reflect the safety of a workforce. Vecchio-Sadus and Griffiths (2004) stipulated that a positive safety culture can be promoted through management commitment, changing attitudes and behaviours, employee involvement, promotional strategies, training and seminars, and unique campaigns. Wiegmann *et al.* (2004) identified five critical components according to which safety culture can be assessed, namely: management involvement, organisational commitment, employee empowerment, reporting systems, and finally reward systems,. Piers *et al.* (2009) also identified six main components as being the characteristics of safety culture as follows: behaviour, commitment, awareness, information, adaptability and justness. For this research study, the following five, main components were considered in measuring safety culture:

- Adaptability was used to assess how eager management and employees were to draw lessons from the past and implement necessary improvements to the level of safety of the SME construction firm.
- Information was used to assess how safety-related information is communicated throughout the organisation to the appropriate individuals at the appropriate times.
- Behaviour was used to assess how well each level of the organisation behaves in a way that upholds and enhances the degree of safety within the construction SMEs.
- Commitment was used to assess the extent to which construction SMEs as a whole value safety, have a positive attitude towards safety, and understand its significance.
- Awareness was used to assess the level of knowledge of management and employees of construction SMEs regarding the hazards to themselves and anybody else involved in their operations.

According to Wiegmann *et al.* (2004), measurement of safety culture is mostly carried out through employee surveys. Safety culture measurement is crucial since the results are needed to track safety improvements that have occurred over time inside construction SMEs. According to Musonda *et al.* (2021), some researchers are of the view that safety culture cannot be measured, while others believe it should be measured and enhanced over time. In this research it is believed that safety culture within construction SMEs can be quantified through the use of appropriate instruments, as discussed in this study. It is believed that measurement is imperative. When safety culture is quantified, it gives construction SMEs a clear indication of the state of health and safety and the chance to develop new strategies for enhancing protection to prevent accidents (Musonda *et al.*, 2021). Safety culture measurement is necessary because it will help construction SMEs to trail progress and develop new methods to improve the culture of safety within construction SMEs. Table 2.3 shows the positive safety culture constructs used in this study and their respective core elements.

Table 2.3: Positive safety culture constructs and their respective core elements

| Constructs | Core elements | Reference |
|--------------|------------------------------|---|
| Commitment | Management concerns | (Boukhris <i>et al.</i> , 2020; Hassan & Esmail, 2018) |
| | Safe work procedures | (Emuze, 2022; Deepak & Mahesh, 2019) |
| Information | Reporting | (Al-Bayati, 2021; Oswald <i>et al.</i> , 2018) |
| | Information sharing | (Nitsche, 2019; Pedro <i>et al.</i> , 2022; Zou <i>et al.</i> , 2017) |
| Adaptability | Adaptability and flexibility | (Bal & Izak, 2021; Cavalliere <i>et al.</i> , 2019; Myers <i>et al.</i> , 2013) |
| | Collective responsibility | (Dekker, 2020; Thabit & Younus, 2018) |
| Awareness | Equipment and plant | (Marks & Teizer, 2013; Teizer <i>et al.</i> , 2010) |
| | Hazard and risks | (Hasanzadeh <i>et al.</i> , 2017; Zhang & Fang, 2013) |
| | Education and training | (Fung <i>et al.</i> , 2016; Okorie & Ogbu, 2017) |
| Behaviour | Worksite norms | (Fugas <i>et al.</i> , 2011) |
| | Job satisfaction | |

2.6. Safety Culture Models and Frameworks

In a study conducted by Scroubelos & Sa (2014), the six pillars were established on which construction SMEs must focus in creating a clear plan towards achieving safety excellent through the advancement of a positive safety culture. The elements that predicted this safety culture model were: management commitment, total employee involvement, communication, record-keeping, management of change, and continual improvement in safety-related issues. Vierendeels *et al.* (2018) used the following elements: technological domain, human domain, and organisational domain, to develop a positive safety culture model. The result was an integrated and comprehensive model that illustrated the complexities of positive safety culture. The three-fold Venn diagrams in the model showed how the elements and factors of each domain are connected and affect one another. The organisational domain of safety climate perceptions, the technological domain of observable factors and the personal psychological domain of behavioural motivation form a looped structure for occupational safety research in which the domains have an impact on each other. Stiles (2021) developed a method for assessing and evaluating the maturity of safety culture within project delivery organisations. In the paper, the relevance of existing models for the maturity of safety culture was established for a multi-stakeholder organisation through the development of an updated maturity matrix

tool. The following factors were used in the model: management visibility and commitment, attitude of the workforce, rewards and recognition, culpability for accidents, prioritisation of safety, contractor selection and management, accident and incident reporting, reporting of near miss, close call and unsafe act, cascading feedback and communication, monitoring of safety and engagement in safety meetings and forums. Bisbey et al. (2021) reviewed theoretical models of organisational safety culture and identified vital factors necessary for the development of safety culture. These key factors create conditions that would encourage employees to adapt the values, norms, and assumptions of safety culture, and four behaviours used to achieve them. The model was based on elements such as leader commitment and prioritisation of safety, policies and resources for safety, group cohesion, psychological safety, safety knowledge, employee sense of control, and individual commitment to safety. Mustapha *et al.* (2018) developed a health and safety compliance model for construction SMEs in Ghana. The integrated model promotes health and safety compliance as a six-factor construct which includes: safe acts of workers, safe environment, safe working conditions, government support, reactions of workers to safe conditions, and contractor's organisational culture. In the model of reciprocal determinism, Bandura, (1986) developed a triad consisting of the person, environment (situation), and behaviour. He maintained that the reciprocal influences among these components did not work at the same time or with equal strength, but rather, there was a process of action and reaction or one of "perpetual dynamic interplay". From the above, it is evident that no framework of positive safety culture has been developed in Ghana to help construction SMEs to establish a positive safety culture for enhanced safety performance.

2.7. Identified Elements/Leading Indicators and Measuring

Metrics/Statements

Health and safety elements/leading indicators and the measuring metrics of these elements/leading indicators have not been identified in any single study. The fourteen core elements and their leading indicator metrics presented in Table 2.5 are considered to be important to establish a positive safety culture among construction SMEs in Ghana to enhance safety performance. Five safety culture constructs: safety commitment, safety behaviour, safety information, safety adaptability, and safety awareness, were identified and these constructs were measured using the fourteen core elements/leading indicators as follows:

- Safety commitment, with two core elements/leading indicators: management concerns and safe work procedures.
- Safety behaviour, with two core elements/leading indicators: worksite norms and job satisfaction.
- Safety awareness, with three core elements/leading indicators: equipment and plant, hazard and risks, and education and training.
- Safety information, with two core elements/leading indicators: reporting and information sharing.
- Safety adaptability, with two core elements/leading indicators: adaptability and flexibility and collective responsibility.
- Safety performance, with three core elements/leading indicators: management contributions, worker contributions, and supervisor contributions.

The conceptual framework for positive safety culture is proposed accordingly in Table 2.4, which was also included in the Delphi survey questionnaire. Ultimately, 87 measuring metrics were discovered and categorised into 11 core elements.

Table 2.4: Positive safety culture constructs and their respective core elements

| Constructs | Core elements | Reference |
|--------------|--|---|
| Commitment | Management concerns; Safe work procedures. | (Ashour <i>et al.</i> , 2018; Boukhris <i>et al.</i> , 2020) (Emuze, 2022; Deepak & Mahesh, 2019) |
| Information | Reporting; Information sharing. | (Al-Bayati, 2021; Oswald <i>et al.</i> , 2018) (Chen <i>et al.</i> , 2021) |
| Adaptability | Adaptability and flexibility; Collective responsibility. | (Bal & Izak, 2021; Cavalliere <i>et al.</i> , 2019) (Dekker, 2020) |
| Awareness | Equipment and plant; Hazard and risks; Education and training. | (Marks & Teizer, 2013) (Hasanzadeh <i>et al.</i> , 2017) (Fung <i>et al.</i> , 2016; Okorie & Ogbu, 2017) |
| Behaviour | Worksite norms; Job satisfaction. | (Adzivor <i>et al.</i> , 2022) (Tremblay & Badri, 2018) |

Table 2.5 contains 14 core elements/leading indicators and their 87 leading indicator metrics for the proposed framework for positive culture of safety that will enhance the safety performance of construction SMEs.

- To measure management concerns, eight leading indicator metrics were proposed;
- To measure safe work procedure, twelve leading indicator metrics were proposed;

- To measure worksite norms, eight leading indicator metrics were proposed;
- To measure job satisfaction, six leading indicator metrics were proposed;
- To measure equipment and plant, four leading indicator metrics were proposed;
- To measure hazards and risks, nine leading indicator metrics were proposed;
- To measure education and training, four leading indicator metrics were proposed;
- To measure reporting, six leading indicator metrics were proposed;
- To measure information sharing, five leading indicator metrics were proposed;
- To measure adaptability and flexibility, four leading indicator metrics were proposed;
- To measure collective responsibility, seven leading indicator metrics were proposed.

Table 2.5: Fourteen core elements/leading indicators and measuring metrics

| Core element/leading indicators | Measuring metrics of leading indicators/positive safety culture indicators | Source(s) | |
|---|--|--|--------------------------------|
| Management concerns (Ashour <i>et al.</i> , 2018; Boukhris <i>et al.</i> , 2020) | Safe working conditions enforced. | (Cui <i>et al.</i> , 2013) | |
| | Zero tolerance for safety violations. | (Cui <i>et al.</i> , 2013; Newaz <i>et al.</i> , 2019) | |
| | Monitor and correct safety errors. | (Newaz <i>et al.</i> , 2019) | |
| | Safety first is applied to all at work. | (Newaz <i>et al.</i> , 2019) | |
| | Safety resources are prioritised. | (Guo <i>et al.</i> , 2016) | |
| | Safe operations are prioritised. | (Cui <i>et al.</i> , 2013) | |
| | Well-being of workers is prioritised. | (Guo <i>et al.</i> , 2016) | |
| | Health of workers is prioritised. | (Guo <i>et al.</i> , 2016) | |
| | At-risk work is flagged by co-workers. | (Newaz <i>et al.</i> , 2019) | |
| | Safety instructions are reinforced on site. | (Adzivor <i>et al.</i> , 2022) | |
| | Unsafe acts are monitored and corrected. | (Adzivor <i>et al.</i> , 2022) | |
| | Unsafe conditions are corrected. | (Adzivor <i>et al.</i> , 2022) | |
| | Safe work procedure (Emuze, 2022; Deepak & Mahesh, 2019) | Fatigue is monitored and managed. | (Adzivor <i>et al.</i> , 2022) |
| | | Work pressure is monitored and managed. | (Adzivor <i>et al.</i> , 2022) |
| Safety audits are conducted regularly. | | (Gunduz & Laitinen, 2017) | |
| Safety inspections are conducted regularly. | | (Aghimien <i>et al.</i> , 2019) | |
| Method statements comply with SWP. | | (Kheni <i>et al.</i> , 2008) | |
| Task execution complies with SWP. | | (Guldenmund, 2007) | |
| Work is completed in a safe manner. | | (Adzivor <i>et al.</i> , 2022) | |
| Worksite norms (Adzivor <i>et al.</i> , 2022) | New workers are taught to follow SWP. | (Adzivor <i>et al.</i> , 2022) | |
| | Equipment, tools and plant are used safely. | (Gunduz & Laitinen, 2017) | |
| | Safety is improved continuously. | (Adzivor <i>et al.</i> , 2022) | |
| | Hazard awareness and control are executed. | (Gunduz & Laitinen, 2017) | |
| | Risk awareness and control are executed. | (Adzivor <i>et al.</i> , 2022) | |
| | Accidents and near-miss incidents are mitigated. | (Gunduz & Laitinen, 2017) | |

| Core element/leading indicators | Measuring metrics of leading indicators/positive safety culture indicators | Source(s) |
|---|--|---|
| Job satisfaction (Tremblay & Badri, 2018) | Workers make safety suggestions. | (Meng & Chan, 2020) |
| | Workers contribute to safety improvement. | (Verbakel <i>et al.</i> , 2013) |
| | Workers are involved in safety planning. | (Kheni <i>et al.</i> , 2008) |
| | Work is inspiring and fulfilling. | (Håvold & Nettet, 2009) |
| | Work uses skills and talents. | (Adzivor <i>et al.</i> , 2022) |
| | Achievements and progress are rewarded. | (Håvold & Nettet, 2009) |
| | Motivation to improve SWP at work. | (Håvold & Nettet, 2009) |
| Equipment and plant (Marks & Teizer, 2013) | Work is done purely for salaries and wages. | (Håvold & Nettet, 2009) |
| | Suitable plant and equipment are available. | (Newaz <i>et al.</i> , 2019; Nyantakyi <i>et al.</i> , 2020) |
| Hazards and risks (Hasanzadeh <i>et al.</i> , 2017) | Routine upkeep is performed on plant. | (Adzivor <i>et al.</i> , 2022; Grote & Künzler, 2000; Newaz <i>et al.</i> , 2019) |
| | Operators are trained to use equipment. | (Díaz-Cabrera <i>et al.</i> , 2007; Guo <i>et al.</i> , 2016; Newaz <i>et al.</i> , 2019) |
| | Safety rules and policies are clear. | (Adzivor <i>et al.</i> , 2022) |
| Reporting (Al-Bayati, 2021; Oswald <i>et al.</i> , 2018) | Workplace SWP is understood. | (Adzivor <i>et al.</i> , 2022) |
| | Unsafe acts and conditions are mitigated. | (Adzivor <i>et al.</i> , 2022) |
| | Hazard reporting is encouraged on sites. | (Saunders <i>et al.</i> , 2017) |
| | The collective undertakes safety analysis. | (Saunders <i>et al.</i> , 2017) |
| | Blame game does not hinder incident reports. | (Choudhry <i>et al.</i> , 2009; Vecchio-Sadus & Griffiths, 2004) |
| Information sharing (Chen <i>et al.</i> , 2021) | Reporting lines and systems are clear. | (Adzivor <i>et al.</i> , 2022) |
| | Reports lead to reviews and improvements. | (Díaz-Cabrera <i>et al.</i> , 2007) |
| | Incident reporting is nurtured and rewarded. | (Choudhry <i>et al.</i> , 2009) |
| Education and training (Fung <i>et al.</i> , 2016; Okorie & Ogbu, 2017) | Incident reporting leads to better SWPs. | (Díaz-Cabrera <i>et al.</i> , 2007) |
| | Workers are willing to report incidents. | (Cui <i>et al.</i> , 2013; Håvold & Nettet, 2009) |
| | SWP information is shared timeously. | (Petschonek <i>et al.</i> , 2013) |
| | Safety information is in multiple languages. | (Vecchio-Sadus & Griffiths, 2004) |
| Adaptability and flexibility (Bal & Izak, 2021; Cavalliere <i>et al.</i> , 2019) | Voluntary safety information-sharing exists. | (Milijic <i>et al.</i> , 2013) |
| | New safety regulations are shared timeously. | (Bronkhorst <i>et al.</i> , 2018) |
| | Safety concerns receive timely attention. | (Bronkhorst <i>et al.</i> , 2018) |
| | Safety inductions are detailed and timely. | (Vecchio-Sadus & Griffiths, 2004) |
| | Tool-box talks are enriched with examples. | (Eaves <i>et al.</i> , 2016; Kheni <i>et al.</i> , 2008) |
| | Safety information is provided regularly. | (Bronkhorst <i>et al.</i> , 2018) |
| | Training covers SWPs and regulations. | (Meng & Chan, 2020) |
| | Workers use SWP to execute tasks. | (Newaz <i>et al.</i> , 2019) |
| | Safe equipment and plant are used on sites. | (Newaz <i>et al.</i> , 2019) |
| | Safety promotions are embraced on sites. | (Newaz <i>et al.</i> , 2019) |
| | Mindfulness in relation to safety exists. | (Newaz <i>et al.</i> , 2019) |

| Core element/leading indicators | Measuring metrics of leading indicators/positive safety culture indicators | Source(s) |
|---|--|---|
| Collective responsibility (Dekker, 2020) | Co-workers often discuss safety hazards. | (Bronkhorst <i>et al.</i> , 2018; Newaz <i>et al.</i> , 2019) |
| | Co-workers care for the safety of each other. | (Bronkhorst <i>et al.</i> , 2018; Cui <i>et al.</i> , 2013) |
| | Co-workers care about equipment safety. | (Newaz <i>et al.</i> , 2019) |
| | Co-workers discuss accident prevention. | (Newaz <i>et al.</i> , 2019) |
| | Work pressure does not violate safety. | (Meng <i>et al.</i> , 2019) |
| | Co-workers report safety violations. | (Meng <i>et al.</i> , 2019) |
| | Co-workers raise alerts to SWP violation. | (Bronkhorst <i>et al.</i> , 2018) |
| Management contributions (Winge <i>et al.</i> , 2019) | Regular safety inspection is expedited. | (Choudhry <i>et al.</i> , 2009) |
| | Safety equipment is functional. | (Adzivor <i>et al.</i> , 2022) |
| | Safety equipment is accessible and available. | (Choudhry <i>et al.</i> , 2009) |
| | Safety first is applied under work pressure. | (Milijic <i>et al.</i> , 2013) |
| | Overtime work is controlled. | (Adzivor <i>et al.</i> , 2022) |
| | Blame game is prohibited. | (Choudhry <i>et al.</i> , 2009) |
| | Regular safety inspection is expedited. | (Wu <i>et al.</i> , 2010) |
| Worker contributions (Newaz <i>et al.</i> , 2021) | Workers encourage one another to be safe. | (Cui <i>et al.</i> , 2013) |
| | Workers keep worksite clean. | (Sawacha <i>et al.</i> , 1999) |
| | Workers ignore safety rules. | (Lyu <i>et al.</i> , 2018) |
| | Workers take short cut to complete tasks. | (Guo <i>et al.</i> , 2016; Lyu <i>et al.</i> , 2018) |
| | Workers use SWPs to complete the job. | (Cui <i>et al.</i> , 2013) |
| | Workers keep worksite clean. | (Sawacha <i>et al.</i> , 1999) |
| | Workers do not ignore safety rules. | (Guo <i>et al.</i> , 2016; Lyu <i>et al.</i> , 2018) |
| Supervisor contributions (Zhang <i>et al.</i> , 2018) | Supervisors allow safety suggestions. | (Guo <i>et al.</i> , 2016; Lyu <i>et al.</i> , 2018; Petschonek <i>et al.</i> , 2013) |
| | Supervisors disallow safety violations. | (Guo <i>et al.</i> , 2016) |
| | Supervisors prioritise productivity. | (Lyu <i>et al.</i> , 2018) |
| | Supervisors do not ignore SWP deviations. | (Milijic <i>et al.</i> , 2013; Saunders <i>et al.</i> , 2017) |

2.8. The Influences of the Characteristics (Components) on Safety Culture of Construction SMEs

The conceptual framework that was used to guide the additional investigation of literature to support the development of a positive safety culture that will improve the safety performance of construction SMEs was established. The purpose of the framework developed was to identify the variables influencing a positive safety culture and how these variables will enhance the safety performance of construction SMEs in Ghana, as illustrated in Figure 2.1. Following

the conceptual framework proposed in Chapter One, the variables used in the proposed framework are now discussed. In order to ensure an appropriate safety culture and its influences on safety performance, it was necessary to analyse some independent variables, that could affect safety culture. In the current study, specific independent variables were identified in Chapter One. Among these variables were: safety commitment, safety behaviour, safety information, safety awareness and safety adaptability. Therefore, it was proposed that safety culture could be influenced by these specific variables as shown in Figure 2.1. All the variables introduced in Chapter One, are fully discussed in this section.

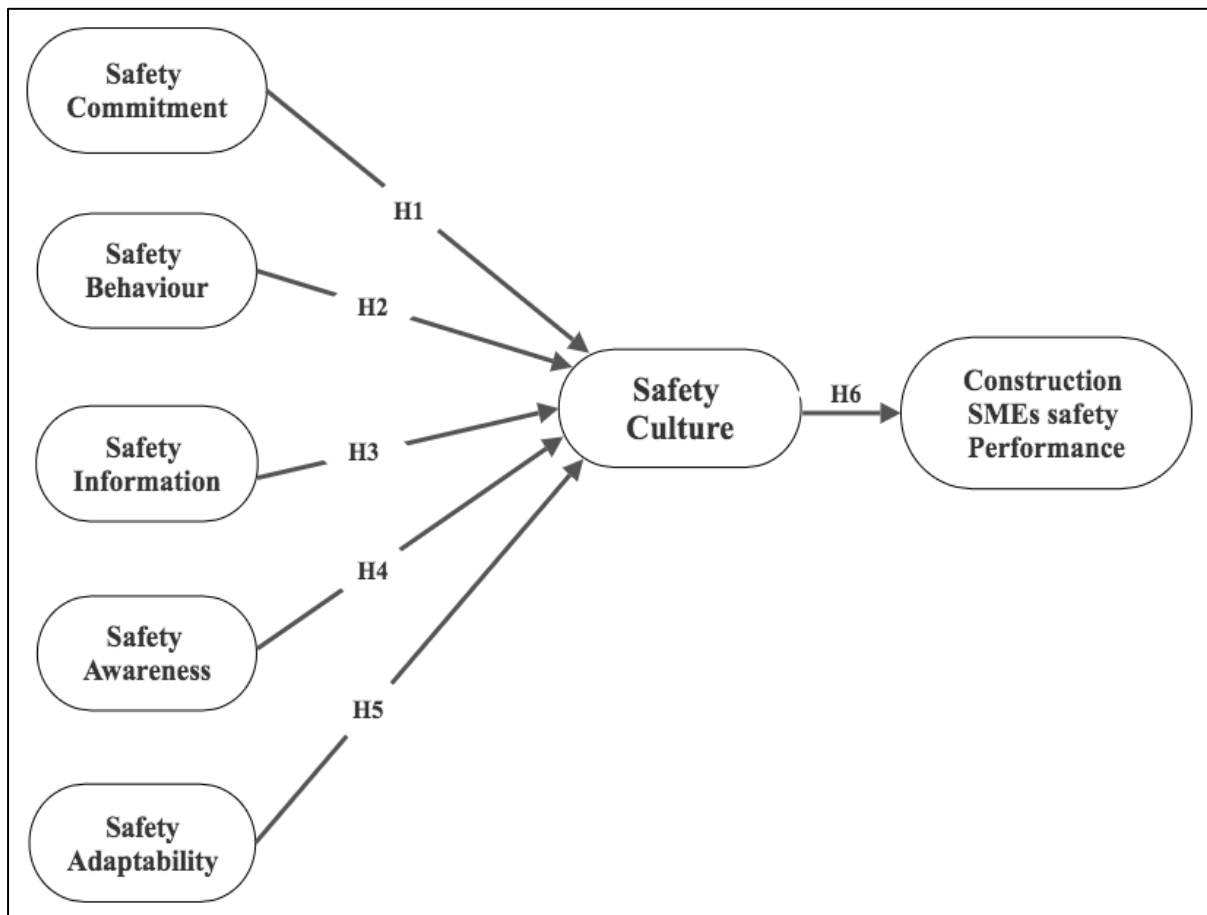


Figure 2.1: Conceptual framework for a positive safety culture for construction SMEs

Source: Author's construct, 2022

2.8.1. The Concept of Safety Commitment

According to Ajmal *et al.* (2020), commitment to safety is the involvement of every individual employee in safety activities within construction SMEs in order to improve safety performance. Genuine commitment from every individual within construction SMEs is required for a self-sustaining safety culture, hence managers of construction SMEs need to be aware of the more

nuanced facets of cultural phenomena in order to properly foster safety culture (Turner, 1995). The degree to which construction SMEs at all levels have a favourable attitude toward safety and understand its significance is reflected in their level of commitment to safety. Ajmal *et al.* (2020) indicated that the level of commitment to safety is usually demonstrated by the behaviour and attitude of employees. When employees of construction SMEs are committed to safety, they behave safely on site, not only because they perceive hazards, but they rather do so because safety has become a culture among them (Delegach *et al.*, 2017). Furthermore, employees with a high level of commitment to safety, become involved constantly in all safety activities within the company. According to Buniya *et al.* (2021), a lack of attention to safety results in a weak or bad safety culture, which is the main cause of accidents on building sites in developing nations. A poor safety culture among construction SMEs exists because health and safety is not well established or prioritised in the culture of construction SMEs (Tremblay & Badri, 2018). When there is commitment to safety, there is team work and collaboration between construction employees to prevent accidents, injuries and fatalities.

Buniya *et al.* (2021) reiterated that limited awareness of safety commitment at top management level in construction SMEs affects the understanding, strategies and commitment to safety and risks across construction SMEs. This, in turn, affects any safety implementation strategy that has been introduced to reduce the occurrence of accidents and injuries for improved safety performance. There is general consensus among many researchers about the importance of commitment to safety by upper management and how this has a positive influence on the general perception of health and safety by every employee (Buniya *et al.*, 2021; Ajmal *et al.*, 2020; Ashour *et al.*, 2018; Tremblay & Badri, 2018; Delegach *et al.*, 2017). Evidently, it matters how employees feel about senior management's dedication to safety. Within the context of safety culture, the idea of management commitment to safety is described as "the extent to which management is regarded to have placed a high level of importance on health and safety, is how they communicate and act on safety issues" (Fruhen *et al.*, 2019). Managerial commitment to safety is one of the key components of safety culture. Managerial commitment to safety shows how leaders view safety within construction SMEs and the numerous things they do to encourage employees that safety is a priority in the organisation. According to Fruhen *et al.* (2019), employees' impressions of management commitment to safety should be founded on observable behaviours indicating managers are devoted to safety, which directly influences the existence of a positive safety culture. For example:

- Managers/owners of construction SMEs should emphasise in their communications the value of safety;
- Managers/owners of construction SMEs must make decisions that devote resources to enhancing safety.

2.8.1.1. The Influences of Safety Commitment on the Safety Culture of Construction SMEs

Commitment to safety is described as individual involvement in health and safety activities within an organisation to achieve safety goals that will improve safety performance in construction SMEs (Ajmal *et al.*, 2020). Commitment to safety in construction SMEs is a shared responsibility between individuals or groups of construction workers. It can be argued that responsibility can only be established if a positive safety culture exists among construction SMEs. According to Ajmal *et al.* (2020), the behaviour and attitudes of employees contribute to safety commitment which has a direct impact on safety culture. In addition, when employees have a high level of commitment to safety, they engage in safe practices during work. Boukhris *et al.*, (2020) stated that managements of construction SMEs must encourage their employees to exhibit safety commitment in a manner that will demonstrate a positive safety culture, because behaviour that is committed to safety has the potential to minimise the rate of accidents, injuries and fatalities among construction SMEs. According to Ashour *et al.* (2018), the level of commitment to safety by construction SMEs must be demonstrated by their involvement in the safety training of employees, the attention accorded health and safety in job design, and safety committees. Construction SMEs must effectively be committed to health and safety by supporting and investing in the safety of construction sites, as this will create a strong platform for positive safety culture (Delegach *et al.*, 2017). This involves further the commitment and attachment of all employees to all health and safety protocols of construction SMEs, hence every construction worker who is effectively committed to safety will do their utmost best to maintain safety on site with a genuine desire to maintain a positive safety culture at all times.

For every construction SME in Ghana to remain efficient, competitive and profitable, they need healthy employees. To achieve this, they need the commitment of all employees to a positive safety culture effectively enshrined in their daily activities in a manner that will improve the well-being and good health of each employee (Ajmal *et al.*, 2021). Niu & Liu, (2022) argued

that employees of construction SMEs with a commitment to a positive safety culture will have more positive attitudes towards safety, lower work pressure, stronger psychological capital, and accident and disability rates. Fruhen *et al.*, (2019) proposed three structures of safety commitment that are necessary for construction SMEs to adopt when establishing a positive safety culture as follows:

- Affective commitment to health and safety is a reflection of an emotional, and occasionally intense, sense of responsibility for the safety of people both inside and outside the organisation;
- Normative commitment is the moral need to prioritise safety as a fundamental human and social good and as the correct goal to pursue health and safety; and
- Calculated commitment to safety that also shows a rational or transactional need to prioritise safety as well as other external constraints (regulations and job security) as a duty to the company' survival.

A combination of all these three types of commitments is the essence of a positive safety culture because, when employees become emotional and passionate about health and safety for themselves and others during work, they value health and safety as a moral human obligation and this entreats them to prioritise health and safety as the means of business survival by adhering to all health and safety protocols in the workplace. In this study, two core elements were used to measure safety commitment among construction SMEs in Ghana: management concerns (Deepak & Mahesh, 2022) and safe work procedure (Emuze, 2022).

2.8.2. The Concept of Safety Behaviour

According to Piers *et al.* (2009), safety behaviour is the manner in which every employee of construction SMEs behaves in order to maintain and enhance the level of health and safety. Health and safety behaviour by workers of construction SMEs determines the actions taken by the employees to protect themselves, such as adhering to safety rules and regulations in the workplace in order to prevent dangers to themselves and all other employees, as well as wearing the necessary personal protective equipment (PPE) for specific work. Researchers, such as Khoshnava *et al.* (2020), Kim *et al.* (2022), Xia *et al.* (2020), Yap and Lee (2020) argued that approximately 70%-80% of construction site accidents are caused by human-related factors,

especially unsafe acts and behaviours of employees of construction SMEs, since they are the frontline personnel in the firms who are exposed directly to risks, injuries, accidents and fatalities on construction sites. Nonetheless, working knowledge and skills, safety mindfulness, and the nature of activities of work together with safety procedures are the greatest influencers of the risk tolerance of workers of construction SMEs in handling hazards on construction sites (Yap & Lee, 2020). Therefore, it is critical that unsafe behaviours of employees of construction SMEs are prevented by establishing a positive safety culture. The prevention of unsafe behaviour by workers of construction SMEs is a preventive method that will help construction SMEs to address hazards on construction sites by establishing a positive safety culture before being harmed.

Khoshnava *et al.* (2020) asserted that the main causes of accidents on construction sites are mainly the result of two factors: unsafe circumstances (such as unsafe physical or mechanical environments, and hazards) and unsafe employee behaviours (such as a person's actions or behaviour that deviates from customary safety procedures). Because of the connections between unsafe working environment and unsafe employee behaviour, the rate of injuries, accidents, and fatalities is proportionate to these two major components. Psychologically, unsafe employee behaviour is frequently influenced by dangerous working conditions (harsh environment), and vice versa (Khoshnava *et al.*, 2020). Understanding the nature and cause of this complicated issue can significantly lower accident rates among construction SMEs in Ghana and around the world. According to Tremblay and Badri (2018), the rates of fatalities are eight times higher in construction SMEs than those of major construction firms, and non-fatal accidents that are up to 50% higher. Tremblay and Badri (2018) identified four factors that explain this phenomenon as follows:

- SMEs in the onstruction industry have less financial and human resources available to them. When the economy is uncertain, managers of construction SMEs are hesitant to devote time and money to issues that do not frequently emerge, which undoubtedly includes health and safety concerns.
- A second consideration is that few managers of construction SMEs are particularly sensitised to health and safety or have significant knowledge or expertise in this realm.

- A third consideration is that health and safety is not a well-established value among construction SME culture. Managers frequently hold rigid, biased attitudes and assumptions about health and safety.
- Lastly, SMEs in the construction industry frequently operate in more remote locations. Many managers consider the support that specialized health and safety firms could offer to construction SMEs to be too expensive and technically complex.

According to Amponsah-Tawaih and Adu (2016), there are two main categories of safety behaviour: safety compliant behaviour and safety participation behaviour. Safety compliant behaviours are concerned with those safety activities that workers of construction SMEs are required to carry out in a manner that ensures a safe work environment, whereas safety participation behaviours do not contribute directly to workplace safety, but rather help in developing a conducive working environment that supports health and safety. According to Tremblay and Badri, (2018), the following six points were noted to favour putting in place a reliable health and safety management system among construction SMEs to control the occurrences of injuries, accidents and fatalities:

- Commitment to health and safety on the part of construction SMEs' higher management;
- Risk management. Construction SMEs cannot improve their safety performances without controlling safety risks. The risk management process is made of five phases: (1) risk analysis, (2) risk identification, (3) risk control, (4) monitoring of the corrective measures taken, and (5) follow-up;
- Training of employees in important health and safety practices to be adopted on construction sites;
- Leadership by managers of construction SMEs is also identified as an important factor in improving health and safety. Two key aspects of leadership are identified as being the most important: (1) being communicative and attentive to the pre-occupations of workers and (2) favouring the participation of workers;
- Safe behaviour that includes compliance with all safety regulations and participation in the detection and eradication of dangers; and
- Considering prevention from a continuous improvement perspective.

2.8.2.1. *The Influences of Safety Behaviour on the Safety Culture of Construction SMEs*

According to the Domino Theory, the two most important elements contributing to the occurrence of accidents are unsafe employee behaviour and unsafe object circumstances (Zhang *et al.*, 2020). They identified eight major causes of construction site accidents and these are: a lack of safety equipment, a lack of appropriate training, deficient safety enforcement, unsafe site conditions, unsafe methods of carrying out work, isolated deviation from prescribed behaviour and a poor safety attitude of not using safety equipment. However, there is a need for health and safety intervention among construction SMEs to establish a positive safety culture to promote effective safety behaviour. Health and safety interventions are referred to as the steps taken by managers of construction SMEs to improve health and safety within their respective companies (Mazlina Zaira & Hadikusumo, 2017). According to Seo *et al.* (2015), although difficult to develop in the short term, the longevity of positive safety culture among construction SMEs will affect the safety behaviour of employees significantly. This suggests that the presence of a positive safety culture helps workers of construction SMEs to recognise warnings and danger signals before the occurrences of injuries, accidents and fatalities, thereby preventing accidents. This means positive safety culture and safe behaviour of workers of construction SMEs are positively related. Newaz *et al.* (2019) identified five key factors of safety culture among construction SMEs: supervisor safety behaviour, management commitment, safety behaviour, co-worker safety behaviour, and psychological agreement to be safe. The existence of a positive safety culture within construction SMEs helps to predict safety-related behaviours by employees, for example, raising health and safety concerns to management, adhering to health and safety regulations, and reporting health and safety incidents (Tear *et al.*, 2020). Conversely, defective and unfavourable perceptions amidst employees of construction SMEs demonstrate a weak culture of safety, and this increases unsafe behaviours among employees. The safety behaviour of employees is influenced by helping for safety (group mindsets and actions of safety management), management commitment to safety (management prioritisation of safety), incident reporting (the extent to which respondents trust it is safe to report incidents), commitment of colleagues to safety (beliefs about the authenticity of the safety-related behaviour of colleagues), communication (whether staff are knowledgeable about safety-related issues), and safety support (availability of resources and instruction for safety management) (Tear *et al.*, 2020). These factors have a major effect on positive safety culture. According to Piers *et al.* (2009), job satisfaction (contact with coworkers and appreciation of work), job safety behaviour (prevention of incidents and

accidents by employees, and unnecessary taking of risk), mutual expectations and encouragement (earning the trust of colleagues by maintaining a safe record, and mutual expectations of employees in respect with safe behaviour), and mutual expectations and encouragement are all factors that influence how employees behave in regards to safety (condition of equipment, and access to equipment). For the purposes of this study, job satisfaction and worksite norms were used to test the influences of safety behaviour on safety culture within construction SMEs operating in the Ghanaian Construction Industry. Employees who are satisfied, pay more attention to safety issues in respect of safety norms and practices instituted by the organisation. Uzuntarla *et al.* (2020) reported that approximately 90% of construction site accidents are caused by the unsafe behaviour of construction workers and this calls for an establishment of a positive safety culture which is regarded as a behavioural regulator in dealing with the high rates of injuries, accidents and fatalities.

2.8.3. The Concept of Safety Awareness

According to Chen *et al.* (2019), safety awareness is the ability of employees to judge and identify dangers in purposeful production activities, and awareness of an unsafe factor is what the human brain has on objective existence – the unsafe behaviour of employees and the unsafe state of things and environmental response to unsafe conditions. The commitment to health and safety by workers of construction SMEs depends on the level of awareness of employees of health and safety (Buniya *et al.*, 2021). A low level of safety awareness implies a negative safety culture. Training of the employees of construction SMEs in safety practices, equips them with adequate knowledge on how to work safely as individuals and collectively, while lack of skilled construction workers automatically results in poor safety behaviours as a result of poor safety awareness. Xia *et al.* (2018) identified four levels of causes of accidents within construction SMEs, namely: pre-conditions for unsafe acts, unsafe acts, organisational influences, and unsafe supervision which can lead directly to safety awareness among construction SMEs. According to Sanni-Anibire *et al.* (2020), the main causes of accidents on construction sites are the failure of workers to obey work procedures, negligence of workers, work at high elevation, poor site management, operating equipment without safety devices, harsh work operations, failure to use personal protective equipment, low knowledge and skill level of workers, workplace issues, and poor attitude of workers towards safety. It is believed that insufficient awareness of safety considerations at management level of construction SMEs impacts the understanding and approaches for managing health and safety across construction

SMEs (Buniya *et al.*, 2021). Li *et al.* (2019) found that safety awareness was low among construction SMEs and that this low safety awareness and inadequate knowledge about safety are the major contributors to accidents within construction SMEs. Therefore, it is crucial to motivate workers in construction SMEs to share information about safety awareness. Education and training of construction SMEs are key factors in the development of safety awareness and understanding of specific hazards associated with construction operations and their environment (Fung *et al.*, 2016; Okorie & Ogbu, 2017). Stressing the value of educating construction SMEs' employees on health and safety, Okorie and Ogbu (2017) asserted that inadequate education of employees of construction SMEs negatively affects their competencies, skills, knowledge and safety awareness. This results in problems such as absenteeism of workers because of accidents, low productivity and, consequently, a reduction in the overall profits of construction SMEs. Health and safety education and training are two major ways to increase safety awareness, knowledge and understanding of hazards and how these hazards can be controlled on construction sites in order to avoid accidents. According to Hou *et al.* (2020), safety awareness depends heavily on the experience of workers in construction SMEs. However, Hou *et al.* (2020) explained that safety awareness is fairly difficult to measure directly, but it can be determined from the behaviours of construction workers. This statement concurred with the assertion by Choi *et al.* (2020) that 70.67% of workers in construction SMEs who were injured or died had less than one month's working experience at work, whereas 14.29% had more than 20 years' working experience. According to Choi *et al.* (2020), some of the underlying factors that result in insufficient safety awareness among construction SMEs are personal factors, social influences, and environmental conditions. In order to improve safety behaviour among construction SMEs, the level of safety awareness must be increased among employees (Wang *et al.*, 2018).

2.8.3.1. The Influence of Safety Awareness on the Safety Culture of Construction SMEs

Within a positive safety culture, workers usually develop awareness of site safety in recognition that safety is paramount in every activity they undertake (Wang *et al.*, 2018). Safety awareness measures how well management and staff of construction SMEs are aware of the risks to their own safety and the safety of others related with the operations of the business. (Piers *et al.*, 2009). According to Piers *et al.* (2009), the influence of safety awareness on safety culture depends on: the attitude of employees towards unreported hazards, employees concern for safety, and awareness of job-induced risk. Safety awareness gives an employee the opportunity

to recognise a wide range of hazards and the effects of individual actions in the workplace. Constant vigilance about safety among employees can literally make a difference between the occurrence of injuries, accidents and fatalities. Tyler (2017) reported that the following are the indicators that a construction company has strong awareness of organisational safety:

- Majority/all staff members have been trained in indentifying hazards;
- Workers have access to information from the company about the frequency of hazards;
- A reliable group of experienced workers;
- Important safety information is directly shared with employees.;
- Regular usage of checklists is common for work tasks; and
- When necessary, policies, processes, checklists, etc. accommodate multiple languages..

When a construction SME provides an environment of safety awareness in which employees work, a positive safety culture will be improved simply because all the employees will have more optimistic perspectives about safety. Safety awareness enables employees and management to maintain a high degree of constant vigilance on construction site with respect to safety. Fung *et al.* (2016), and Okorie and Ogbu (2017) have reported that one of the key components in the measurement of safety awareness is the level of education and training that employees have received. According to Hasanzadeh *et al.* (2017), hazards and risks are major components of safety awareness. Hasanzadeh *et al.* (2017) stated further that the more experienced workers in construction SMEs are, the less processing time they need to identify hazards and risks on construction sites, giving them the chance to become easily aware of the impending danger and vice versa. A large number of workforces in construction SMEs attributed their unsafe behaviours to an inappropriate working environment and inappropriate work arrangement, which forced them to behave in an unsafe way in order to get the job done (Zhang & Fang, 2013).

All of these factors lead to a poor or negative safety culture among construction SMEs. Seker and Zavadskas (2017) believed that hazards and risks as well as unsuitability of equipment and plant are responsible for accidents within the construction sector. Marks and Teizer (2013) reported that many construction workers have been killed on construction sites as a result of the use of equipment and plant to carry out construction work. It can be inferred from the above discussions that, when construction SMEs train, supervise, control working environment, use

appropriate equipment and plant under their intended conditions, carry out tasks safely, make prudent judgement of hazards and risks, their employees will become more conscious of the value of safety and behave accordingly. This, in turn, will create strong safety awareness among employees to carry out their jobs in an absolutely safe manner and environment to enhance safety performance through a positive safety culture. This concurred with the assertions of Choudhry (2014) that, if the health and safety habits of workers are changed, their attitudes towards safety will follow accordingly and this will create a positive safety culture. In the current study, safety awareness was measured using equipment and plant, hazards and risks, and education and training. According to Misnan and Mohammed (2014), when a positive safety culture exists within construction SMEs, their employees will adopt positive patterns of attitudes towards health and safety practices in the company.

2.8.4. The Concept of Safety Information

Safety information refers to the extent to which safety information is disseminated among employees of an organisation at the right time and among the right people (Piers *et al.*, 2009). Employees of construction SMEs should be encouraged to communicate safety-related information at the right time, in the appropriate manner to the appropriate people on construction sites in order to avoid hazardous situations that lead to accidents. For any safety management system to be successful within construction SMEs, safety information must be communicated, because effective communication supports a strong safety management system. Piers *et al.* (2009) reported that communicating safety information effectively is necessary to: learn about the various dangers and hazards that might occur on construction sites; ensure that roles and responsibilities assigned to employees are well understood; identify exposures; establish the amount of risk and provide suitable mitigations to warn against dangers; promote critical emergency response; avoid unsafe health and safety practices; and, especially to get knowledge of the issues and dangers that construction employees face. Safety information is more crucial for workers of construction SMEs than the larger construction firms because the employees of construction SMEs generally do not grasp the regulations governing health and safety, risk management systems, the safety climate of construction sites, and diligent assistance to officials (Ahn, 2022). Essentially, safety information plays a key role in planning safety in order to identify hazardous situations on construction sites. According to Eyiah *et al.* (2019), it can be said that poor communication of safety information within construction SMEs will have a negative impact on employees, employers, progress, productivity, profit margins as

well as safety performance and this will result in more accidents within construction SMEs. The safety information communicated and received by workers of construction SMEs must be accurate and must be recognised and easily interpreted correctly by workers in identifying hazards on sites.

According to Chen *et al.* (2021), sharing safety information is the bridge that connects the behaviour of workers of construction SMEs. Safety information includes employers sharing information that most often indicates the safety status of a particular activity with employees within an organisation (Luo & Wu, 2019). Therefore, it is appropriate to indicate that injuries, accidents and fatalities occurred only when there was failure in sharing safety information. However, Chen *et al.* (2021) purported that accidents are related to inadequate supply of safety information, incorrect cognition of safety information, and faulty feedback to safety information. For any safety system to be successful, safety information must be timely, accurate and well understood by those for whom the information is intended in order to avoid accidents. Wu & Huang (2019) iterated that possible breakdowns in safety information-sharing results in injuries, accidents and fatalities, and these breakdowns can be analysed from the following two perspectives: failures in the process of sharing information, and failures in the safety information itself:

- In terms of the process of sharing safety information, a breakdown implies that there is a lack of communication between the transmitter and the receiver:
 - Failures in gathering safety information: individuals or construction SMEs are unable to compile all relevant safety information (or the information gathered is erroneous, insufficient, or inappropriate), leading management and staff to make wrong decisions;
 - Failures of safety information analysis: the individuals or construction SMEs use wrong approaches to apply the acquired safety information, and the incoming safety information is inappropriately interpreted, resulting in unsuitable judgements by both managers and employees;
 - Failure in the application of safety information: Individuals or SMEs engaged in construction are unable to carry out the required steps. In other words, judgments are made based on the ineffective or improper application of the information that has been gathered;

- Misunderstandings, missing safety information, misperceptions, a lack of communication, and a lack of or insufficient safety information feedback between the transmitter and the receiver could occur during the flow of safety information.
- A breakdown indicates that there may not be enough important safety information in terms of the safety information itself. Many categories can be used to classify improper or inaccurate information, according to Westrum's concept of needed information:
 - It does not provide accurate answers to the questions that the receiver needs. If the safety data gathered is inaccurate or lacking, it will affect how it is used and may even cause the receivers to make poor or unsuitable judgments.
 - It is out of date. Safety forecasts and judgments are made easier with the use of safety information. Safety information is not only meaningless if it cannot be gathered, analyzed, and applied quickly enough; it also runs the risk of having negative repercussions. In other words, if the safety information gathered is out of date, operators may fail to recognize a present danger and misdirect their efforts to resolve risks or hazards;
 - It is not relevant. The way the safety information is provided prevents the receiver from using it properly.

2.8.4.1. *The Influence of Safety Information on the Safety Culture of Construction SMEs*

Alara and Inuwa (2020) shared the opinion that a lack of effective communication of safety information among all parties is the cause of the weak or negative safety culture present in construction SMEs. Alara and Inuwa (2020) added that, for safety information to be compelling, it has to be fully understood by those for whom it is intended, using the appropriate strategies. Luo and Wu (2019) have also discussed the important role that effective communication of safety information plays in enhancing a positive safety culture. The time has come for construction SMEs to incorporate the language of positive safety culture into job descriptions as well as performance evaluations of all employees. The objective of establishing a strong, positive safety culture in construction SMEs is not to eradicate risk and hazards completely, but to recognise their presence, and apply better precautionary measures to address them on sites in order to minimise accidents. The role of safety information in all of this cannot be over-emphasised. According to Pi *et al.* (2019), complete, timely and accurate safety information is the bedrock of a positive safety culture, hence owners of construction SMEs must pay special attention to the accuracy and timeliness of safety information across the length

and breadth of their companies. Min *et al.* (2020) advocated the establishment of mechanisms to communicate safety information within construction SMEs to support a strong, positive safety culture.

Alara and Inuwa (2020) identified appropriate mechanisms that will impart safety information on SMEs construction sites to improve a positive safety culture as being: the construction SMEs mission statement, checklists, strategic plan and policy, safety induction, manuals and operating procedures, reports of hazards, incidents and near-misses, training, a health and safety website, brochures and notice-boards, posters, health and safety signs, toolbox talks, health and safety week, and public reporting. Adebisi and Rasheed (2021) also identified operating procedures as the strategies used most frequently by organisations to communicate safety information. Nitsche (2019) and Pedro *et al.* (2022) concluded that access to safety information is a pillar of a positive safety culture, thus safety information must be shared freely, widely and effectively to improve safety culture. Effective sharing of safety information will not only have a positive impact on construction SMEs' workers, but also promote a positive safety culture that will encourage employees to adhere to all legal safety requirements at all times, even when no one is watching (Zou *et al.*, 2017).

Another important element of safety information is the reporting of unsafe behaviours, potential hazards and risks on construction sites by workers. According to Oswald *et al.* (2018), workers in construction SMEs must be trained to understand what near misses are, together with what and how to report as well as how to distinguish between unsafe acts and unsafe conditions. Workers must be trained with regard to what to report and what not to report, because reporting unsafe acts or unsafe conditions itself can create additional problems. To report, workers must be able to identify unsafe behaviours within the workforce from near-miss or accident data records, develop the right observation checklists, be educated on how to report, observe each other at construction sites and, finally, provide both negative and positive feedback, through graphical and written means to all concerned (Oswald *et al.*, 2018). It is noted that the accuracy of safety information depends on the reports from employees which, in turn, consolidates the existence of a positive safety culture. Al-Bayati (2021) suggested that, when employees of construction SMEs feel at ease reporting dangerous circumstances, know how/where to file an injury, accident or fatality report, and they are assured that if they report safety hazards, they will be resolved, this will improve safety information and create an

atmosphere of positive safety within construction SMEs. In the context of the current study, safety information was measured using safety reporting and safety information-sharing.

2.8.5. The Concept of Safety Adaptability

The concept of safety adaptability was first proposed by Ilgen and Pulakos in 1999. According to Piers *et al.* (2009), the degree to which both staff members and management of construction SMEs are prepared to draw lessons from the past and implement corrective measures in order to raise the bar for health and safety. Waldeck *et al.* (2021) defined adaptability as an individual's cognitive, behavioural, and emotional regulation or adjustment when there is change and uncertainty. Adaptability empowers employees and management of construction SMEs to anticipate problems, keep up with changes and embrace new ways of doing things, as well as coping with emergencies and adjusting swiftly to alterations. Martin *et al.* (2021) stated that adaptability enables workers in construction SMEs to respond effectively to changes and different demands on construction sites. Martin *et al.* (2021) stated further that adaptability “constructively regulates psycho-behavioural functions in response to new, changing, and/or uncertain circumstances, conditions and situations” that arise on construction sites. Human adaptability to unforeseen problems and ability to adjust is regarded as an asset for the development of construction SMEs because human attributes, such as adaptability, imagination, and mindfulness, enable humans to carry out work in circumstances where failures are envisaged (Harvey *et al.*, 2019). Therefore, it can be said that encouraging adaptability among construction SMEs will support them in becoming resilient to unforeseen problems during work. Adaptability can be strengthened through continuous learning, flexibility, and experiences of workers.

2.8.5.1. *The Influences of Safety Adaptability on the Safety Culture of Construction SMEs*

The adaptability of employees of construction SMEs to safety practices is one of the surest means to reduce the occurrences of accidents among construction SMEs. Ogundipe *et al.* (2018) identified the following factors that prevent workers in construction SMEs from implementing positive health and safety practices: adaptation of employees to safety procedures they are against their traditional training, working conditions that are unethical due to human psychological quirks, inadequate guidance regarding the working condition, site safety managers provide insufficient and inefficient supervision, and unsafe practices by

workers because of religious assertions. Lack of workers adaptability to safety practices on construction sites is the main cause of injuries, accidents and fatalities in construction SMEs. Mosly (2022) added that qualification, attitudes, adaptability, and the individual character of workers in construction SMEs are the four main factors that influence their safety practices. Therefore, it is evident from the above submission, that safety adaptability will play a major role in preventing accidents on construction sites of construction SMEs and promoting a positive culture of safety. Adaptability of workers to safety practices, including the training of new and old workers in safety practices instead of the traditional practices of workers, will lead to improvement in safety practices among workforces (Adeagbo *et al.* 2019). The capabilities of workers in construction SMEs to suggest alternative approaches to safety planning on construction sites is positively related to how they adapt effectively to safety instructions and practices. Adaptability underpins the commitment to health and safety and the well-being of workers in construction SMEs, and this, in turn, guarantees improvement in positive safety culture.

Flexibility in the workplace has been identified as measure of the adaptability of workers to safety practices within typical working environments (Cavalliere *et al.*, 2019). Flexibility in the workplace has been defined by Myers *et al.* (2013) as a means by which construction SMEs provide policies and programmes that give workers the opportunities to modify the timing, location or structures of their work, and the degree to which employees are able to interpret these policies as they affect their lives concerning their professional careers, especially where, when, and how long they want to work. Bal and Izak (2021) identified four main types of flexibility in the workplace and defined them as follows: organisational flexibility, which refers to the capacity of an organisation to alter in response to changes in the environment in which it operates; employee flexibility, which is the capacity of employees to accept changes in their work or in their organisations; Flexible work is the capacity to modify an organisation's agreements with its employees in order to facilitate a higher capacity to adapt to changing conditions; and flexible work arrangements, which are organisational strategies that assist employees in choosing where and when work is conducted. All four types of flexibility effectively tap into every aspect of adaptability and can be changed quickly in the workplace (Bal & Izak, 2021). Whether at the organisational level, or level of employees, workplace flexibility determines how everybody in an organisation adapts to changes in the working environment in order to protect self as well as co-workers, to prevent injuries, accidents and fatalities. According to Kurien *et al.* (2018), construction workers have some degree of

adaptability and flexibility that assists them in carrying out their work. Owners and managers/directors of construction SMEs can easily build on this to create a positive safety culture that will lead to improved health and safety performance. Three key points found in the definition of adaptability by White *et al.* (2005) that are crucial to safety adaptability in construction SMEs if they intend to uphold the principle of a positive construction safety culture. Firstly, there must be behavioural change among all employees towards safety. Maintaining a particular course of action in spite of environmental changes is not adaptive, even if it is effective. This means that doing the same thing over and over again does not display adaptability. Secondly, whatever changes are made must be effective. If the changes made are difficult, workers might never be adaptive to the new safety practices, thus the changes must work. Thirdly, the changes made must be in response to a shift within the company's safety procedures. Changing the safety behaviour of employee at random only is never adaptive but, rather, adaptation only comes from situational and environmental changes.

It can be inferred from the above discussions that safety adaptability is not an individual matter but, rather, a collective responsibility of everybody involved in the entire construction process. However, it is a collective responsibility of every employee of construction SMEs to ensure that workplaces are safe, secure and completely free from hazards and risks that can lead to injuries, accidents and fatalities. Thabit and Younus (2018) warned that, for construction sites to be safe for all, every employee must take charge of ensuring that they remind one another constantly of what is expected of them to achieve all safety goals together as a team but not as individuals. Dekker (2020) added that individualisation is not the means to achieve safety adaptability within construction SMEs. Rather, employees and their work must be arranged to be responsible collectively for each other's safety during and after work. However, for the purposes of this study, workplace flexibility and collective responsibility were used to measure safety adaptability in construction SMEs in Ghana.

2.9. The Concept of Safety Performance

The idea of safety performance is based on keeping workplaces safe. According to Guo *et al.* (2019), safety performance is either the depth of an organisation's safety performance outcomes, such as yearly injuries, accidents and fatalities and the specific number of injured employees, etc. or the measure of the health and safety behaviour of individual employees. To

achieve the ultimate safety performance within construction SMEs, organisational safety culture and the behaviours of workers in construction SMEs related to safety will eliminate and/or minimise numbers of injuries, accidents and fatalities on the construction sites (Sanni-Anibire *et al.*, 2020), thereby enhancing the level of safety. When workers of construction SMEs are fatigued, they make errors that lead to injuries and accidents on construction sites and reduce safety performance (Lee *et al.*, 2020). In recent years, safety performance in construction SMEs remains a major concern for construction practitioners. Despite several attempts at improvement made by industry role-players to influence safety performance positively, it still remains poor among construction SMEs (Ye *et al.*, 2022). For construction SMEs, there is a need to determine their safety efforts thoroughly in order to increase their safety performance that will support the reduction of the rates of injuries, accidents and fatalities across companies. It is necessary for the workers in construction SMEs, researchers and construction stakeholders to fathom the factors that will contribute to increasing safety performance within construction SMEs. Singh and Misra (2021) reported that constant involvement of management and employees in safety practices within construction SMEs can lead to significant enhancement in safety performance. According to Guo *et al.* (2019), safety performance of construction workers has two parts: safety participation and safety compliance. Safety compliance entails the actions employees take to maintain their own safety and that of co-workers on construction sites, whereas safety participation involves voluntary actions that individual employees take that contribute indirectly to improving the general safety performance of an organisation such as voluntarily assisting co-workers to address health and safety issues within the company. Rahlin *et al.* (2019) reported that behaviour-based safety initiatives adopted by construction SMEs have the potential to influence safety performance positively. According to Rahlin *et al.* (2019), behaviour-based safety, which is typically influenced by various organisational climates, basically includes everything an employee does or says to ensure safety within the workplace. Rahlin *et al.* (2019) further identified two main safety performance types, namely: organisational safety performance, which can be improved by effective safety management systems adopted by management; and individual or employee safety performance, which is easier to measure and can provide useful results. Chen *et al.* (2018) suggested that safety performance can be studied from four different perspectives: organisational, managerial, control, and behavioural, and all four perspectives are strongly inter-related. Poor safety performance among construction SMEs has been recognised as one of the main causes of accidents, injuries and fatalities on construction sites, and positive safety performance can only be achieved by construction SMEs through: (1) leadership, (2)

implementation of health and safety regulations, (3) performance measurement (4) health and safety planning, (5) health and safety compliance, (6) health and safety inspection, and (7) safety culture, which are all inter-related (Khalid *et al.*, 2021).

To measure safety performance effectively, it is important to establish the indicators that can be used to determine the value of safety performance among SME construction firms. This has become necessary because there is constant pressure on construction SMEs currently to provide a safe working place for all the stakeholders in the industry for improved health and safety, and productivity. According to Singh and Misra (2021), the aim of any measurement of safety performance is to determine the readiness of a construction company to control the occurrences of injuries, accidents and fatalities by setting health and safety targets and goals. Singh and Misra (2021) identified the following indicators, which they referred to as safety performance measuring instruments that are important to assess safety performance in the construction industry, namely: organisational safety, safety plan, specialised safety rules, safety equipment, monitoring safety, prompt response to emergency, selection and evaluation of sub-contractors, safety panels, execution of the project, promotional activities related to safety, and psychological factors. These indicators must be inter-related because adopting single indicators to measure safety performance will be ineffectual and inaccurate, hence a full collection of all these indicators is required for true measurement of safety performance within a construction company. Sukamani and Wang (2020) used the following five key factors to measure safety performance, namely: safety attitude, safety climate, safety behaviour, safety budget, and safety culture. It was reported by Shaikh *et al.* (2021) that proactive safety management strategies will have a more pronounced and meaningful impact on construction SMEs' performance in terms of health and safety.

Historically, lagging indicators, such as injury rate, and number of accidents and fatalities, were used to measure safety performance (Qi *et al.*, 2022). However, the use of these lagging indicators could not provide the necessary information to avoid the occurrence of future injuries, accidents and fatalities, which compelled scholars to propose the use of leading indicators, rather, to measure safety performance (Qi *et al.*, 2022; Ye *et al.*, 2022; Shaikh *et al.*, 2021). According to Ye *et al.* (2022), leading indicators are considered to be the actions taken to stop the occurrences of injuries, accidents and fatalities in a workplace. Ye *et al.* (2022) stated further that one such leading indicator is the performance of construction workers, which is considered to be one of the leading indicators of safety performance, because the unsafe

behaviours of workers are mostly responsible for accidents on construction sites. Therefore, it is important to state that, to enhance the safety performance of construction SMEs, the safety behaviours of their employees must be improved. Shaikh *et al.* (2021) identified 48 leading indicators to measure safety performance which they classified under six broad sub-headings, namely: people indicators, cultural indicators, process indicators, infrastructure indicators, metrics indicators, and technology indicators. According to Maliha *et al.* (2021), the safety contribution of supervisors is one of the major factors that impacts positively on safety performance of construction SMEs. The continuous presence of a supervisor on site will affect the safety practices and behaviours of workers of construction SMEs which has direct effects in reducing the rates of fatalities, injuries, and accidents. The presence of a supervisor will affect the safety compliance and safety participation of workers, thereby having a positive impact on safety performance (Shaikh *et al.*, 2021). Construction employees are also encouraged to take more responsibility for their personal safety as well as the safety of their coworkers on site. This will foster a strong positive safety culture among the workers within the construction company, because a strong positive safety culture has a splendid impact on the safety performance of any organisation, including construction SMEs (Maliha *et al.*, 2021; Sukamani & Wang, 2020). Zhang *et al.* (2018) noted that construction project supervisors had a tremendous influence on the safety performance of their employees. Zhang *et al.* (2018) also purported that management contributions towards safety are another influential factor that has a direct, positive influence on safety performance. According to Zhang *et al.* (2018), management contributions can be seen in areas such as organisational structure, safety responsibility and accountability, communication, involvement of employees, and the responses and behaviours of employees are significant in improving safety performance. Winge *et al.* (2019) added that management of construction SMEs must contribute to the wellbeing of their respective workers by rewarding positive safety behaviours or introducing safety incentive schemes, providing safety training for employees, as well as establishing and monitoring safety committees to improve construction health and safety performance. Newaz *et al.* (2021) noted that worker contributions to safety practices significantly affects the overall safety performance of construction SMEs. Winge *et al.* (2019), reviewed 49 studies and identified the following characteristics to improve safety performance: management contributions, employee/worker contributions, a formal management programme, training, audits and observations, continuous improvement, communication, and supervisor contributions. Construction workers must contribute to safety performance by ensuring that they take heed of all safety regulations, wear the required personal protective equipment (PPE)

for particular jobs, report accidents and near misses, and always protect themselves and co-workers during work. This potentially will improve safety performance and reduce the rates of injuries, accidents and fatalities that have bedevilled construction SMEs. In the current study, safety performance was measured using worker contributions, management contributions, and supervisor contributions. According to Sanni-Anibire *et al.* (2020), safety performance in the construction sector can be enhanced through proactive or reactive means. Proactive methods rely on evaluating the safety climate of construction SMEs, their safety culture, and identification and observation of danger. Reactive methods are focused on rates of injuries, accidents and fatalities, as well as the cost of compensating accident victims.

2.9.1. The Influences of Safety Culture on the Safety Performance of Construction SMEs

According to Piers *et al.* (2009), safety culture is the set of enduring ideas and attitudes about safety that are shared by every employee at every level of an organisation. The term "safety culture" is the degree to which each and every member of an organisation is aware of the dangers and risks posed by its operations, acts continuously in a safe manner, is able to adapt when safety issues arise, is open to communicating those issues, and consistently assesses safety-related behaviour. Fang and Wu (2013) define safety culture as "a mixture of attitudes, beliefs, values, behaviours, and norms held by the individuals and groups from different parties in a construction project (for both workers and management) team, and it is gradually formed and evolved in the construction project environment that would influence the commitment to, and the style and proficiency of, how all parties interact with one another in a construction project." Safety culture has been considered to be one of the crucial elements in measuring safety in a workplace. Measurement of safety culture in the construction industry, especially among construction SMEs, is vital (Shanmugapriya & Subramanian, 2016). A clear and favourable perception of workplace safety results in a favourable safety climate which, in turn, improves safety culture (Deepak & Mahesh, 2019). According to Cooper (2018), there is much proof that supports the notion that safety culture has positive effects on improving the safety performance of high-risk industries globally by reducing the rates of injuries, accidents and fatalities. This suggests that organisations with positive safety cultures will have lower rates of injuries, accidents and fatalities than those with negative safety cultures. The use of safety culture to enhance safety performance, according to Stemn *et al.*, (2019), is focused on how social dynamics inside an organisation affect members with regard to safety.

The level of maturity of safety culture has a major impact on raising safety performance. In order to reduce, and eventually eliminate, injuries, accidents and fatalities, construction SMEs must improve their safety performances. It will take time to establish a safety culture within construction SMEs, but there might be more rapid growth in some construction SMEs than others, hence its eventual impact on safety performance. Feng *et al.* (2014) identified three fundamental factors that will enhance construction SMEs safety performance; namely: safety investment, safety culture, and project hazards, with safety culture being the most important. Feng *et al.* (2014) added that improvement in safety investments and safety culture levels will lead to corresponding improvement in safety performance, thereby reducing rates of accidents, injuries and fatalities within the construction industry. This implies that the severity of accidents and fatalities in the construction sector, especially among construction SMEs, depends, not only on human efforts, but also on safety culture. Higher levels of safety culture are typically linked to higher levels of expected safety performance and lower targets for risk (Cooper, 2019). This implies that better safety performance is not necessarily produced by greater protection and a safer environment without an improvement in safety culture. The goal of a positive safety culture is to create an atmosphere in which people are aware of the hazards they face at work and how to protect themselves against these hazards. Boughaba *et al.* (2014) also advocated that a positive safety culture as perceived by construction employees (i.e. a high policies, score of management commitment, procedures and rules) has a direct impact on safety performance (i.e. a high rating for employees' assessment of their commitment to and involvement in safety). To promote safety culture in construction SMEs, owners must focus on factors such as safety behaviour, safety incentives, safety manager's commitment as well as safety training. Feng *et al.* (2014) discovered that, without an improvement in safety culture, greater protection and a safer workplace might not always result in higher safety performance. So, it can be said that safety culture has an impact on the safety performance of SMEs engaged in construction in Ghana. In this regard, construction SMEs in Ghana must establish a positive safety culture that will encourage their workers at all levels to be committed to safety, report every incident, become involved in all safety matters and, finally, become supportive in the quest to minimise the occurrences of accidents, injuries and fatalities in the construction sector for the enhanced safety performance of construction SMEs. A well-established safety culture should become an important aspect of construction SMEs to enable them to overcome the negative safety performance records in Ghana and the world at large (Mohammadi *et al.*, 2018). This will encourage friendly, trustworthy, and safe construction sites, where employees would strongly encourage and remind co-workers of impending danger or unsafe acts, which are the

signs of a positive culture of safety. Jimoh *et al.*, (2020) stated that, developing a positive culture of safety to positively affect the safety performance of construction SMEs, management and employee commitments are important requirements.

2.10. Overview of the Literature and Gaps in Knowledge

The breakdown of the literature reviewed in Chapter Two, in line with the research objectives, is indicated in Table 2.6. The gaps in knowledge were identified through an extensive literature review based on the research questions and objectives. The gaps identified included: non-existence of a positive safety culture framework among construction SMEs, and how this relates to safety performance. Furthermore, not much attention has been given to the components of safety culture and their leading indicator metrics that lead to the minimisation in the occurrences of accidents among construction SMEs in Ghana. Therefore, based on the literature review, it was evident that there was no positive safety culture framework that had been developed to assist construction SMEs in Ghana to establish a positive safety culture for improved safety performance. Hence, the aim of this study was to develop a framework for a positive safety culture that would improve the safety performance of construction SMEs in Ghana. Answers to the research questions have been provided to close the knowledge gaps that have been identified, as shown in Table 2.6, in order to realise fully the contribution of this study and to meet the research objectives indicated in Section 1.7.

Table 2.6: Breakdown of literature review in relation to research objectives

| Section number | Literature review section | Objectives | | | | |
|----------------|---|------------|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 2.5 | Characteristics (components) of safety culture | x | | x | | x |
| 2.8 | The characteristics of safety culture among construction SMEs | | x | x | | x |
| 2.9 | The concept of safety performance | | | x | x | x |

Note: The “x” indicates where each objective has been treated under the literature review

2.11. Chapter Summary

In this chapter, management of health and safety by construction SMEs has been discussed and construction SMEs have been defined in the Ghanaian context. Safety culture was discussed, including identification of positive safety culture components, namely: safety commitment,

safety information, safety adaptability, safety behaviour, and safety awareness. Theories about the causes of accidents were highlighted with respect to safety culture. The influences of safety commitment, behaviour, information, adaptability, and awareness were also established in the chapter. As indicated in Chapter One, the purpose of the study was to determine the independent variables that influence safety culture within construction SMEs in Ghana, as well as the influence of safety culture on improved performance of SME contractors.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

The methodology used to accomplish the aim of this research study is explained in this chapter. The methodology was based on the “research onion”, which consists of the research philosophy, the choice of the research methodology, the research strategy, the research time horizons, the research process, data collection process, data analysis and, finally, the integration of the research objectives. A mixed-methods research approach was used to collect both qualitative and quantitative data to achieve the research objectives. The data collection process, analysis and interpretation have also been explained in this chapter.

3.2. The Application of the Research Onion

Different research methodologies and frameworks are available from which researchers can choose, with each having different advantages and disadvantages. The "research onion," developed by Saunders, Lewis, and Thornhill in 2009, is one of the most popular and comprehensive research frameworks (Alturki, 2021). The development of the research onion was based on the philosophy of the research paradigm that is distinguished by three types of research assumptions: ontology, epistemology and axiology (Killam, 2013). According to Creswell and Clark (2018), philosophical assumptions are often integrated into the decision-making of researchers based on their worldviews or sets of beliefs. It is a good practice for researchers to make their worldviews very clear to help readers to be aware of the potential sources of influence on a researcher. All the layers of the research onion framework represent a specific aspect of a particular study, depicting different paradigms, strategies, and choices available for researchers to use throughout their investigations. According to Berryman (2019), a research paradigm philosophy, which is made up of ontology, epistemology and axiology, is the framework that guides researchers in determining the structure of a particular research project.

3.2.1. Ontology

Ontology refers to the assumptions made to understand the variety of phenomena in the world (Žukauskas et al., 2018). According to Berryman (2019), ontology provides insight into what a researcher believes to be the nature of reality. Ontology is the study of what exists, how it is perceived, what elements it comprises and how these elements interact with one another. Ontology is a philosophical system that informs researchers about the social world, what can be learnt about the social world and how researchers can do so (Leavy, 2017). It is the study of what is reality, why things happen in the manner they do. There are two diametrically opposed beliefs on reality: subjectivity and objectivity. An “objectivist” stance refers to the view that reality exists separately, intact and touchable, but does not depend on any individual gratitude and acknowledgement. “Subjectivity”, on the other hand, refers to the interpretation that reality is never determined but, rather, built by humans as they interact with the world within which they live. Ontologically, it was assumed in the current research that the study context is real.

3.2.2. Epistemology

According to Berryman (2019), epistemology describes ways of knowing, how individuals know what they know, and who can be referred to as the knower. Killam (2013) argued that epistemological assumptions are associated with the way knowledge is created, acquired, and communicated or what it means “to know”. It is the background on which the decision is based regarding the kind of knowledge a researcher deems to be appropriate, adequate and legitimate for a particular research study (Žukauskas et al., 2018). Epistemology is the study of theories of knowledge, how knowledge is derived, as well as the reliability and validity of claims regarding knowledge (Kant, 2014). This entails researchers to identify, expound and validate the epistemology that governs the choice of a particular research method because it can have a major impact on the data collection process. However, epistemological choice is often determined by ontological considerations in a specific subject area. Ontology and epistemology embody the understanding of what researchers consider to be the nature of the world, the nature of truth, and the ways of being in that world; together they construe the worldview of a researcher. From an epistemological point of view, the current study was focused on quantifiable facts that would result in the generation of reliable and significant data. In order

to generalise the data to generate laws for the entire sector, the study included research to identify causal links among the gathered data.

3.2.3. Axiology

Axiology is a theory of the values that make humans struggle for an enhanced quality of existence (Viega, 2016). Axiology addresses questions regarding what is valued and considered to be desirable or good for human beings and society at large (Biedenbach & Jacobsson, 2016). These values drive human beings to understand the nature of reality through aesthetics and ethics, which include a research process. In every research study, researchers must make key axiological choices that must be based on how positively their own values and beliefs influence the research (Saunders *et al.* 2019). Axiologically, the researcher remained impartial and removed from this study and the data to prevent influencing the conclusions.

The context and parameters under which an investigation is conducted are determined by the researcher's knowledge of the research onion and any resulting judgments (involving data gathering techniques, processing of data and procedures of analysis). In the research onion, illustrated in Figure 3.1, the first layer denotes the research philosophy regarding the development and nature of knowledge. This enables researchers to adopt varieties of research philosophies such as critical realism, positivism, post-modernism, pragmatism as well as interpretivism. Following the research philosophy, is the selection of either a abductive, deductive or inductive research approach to theory development in the second layer.

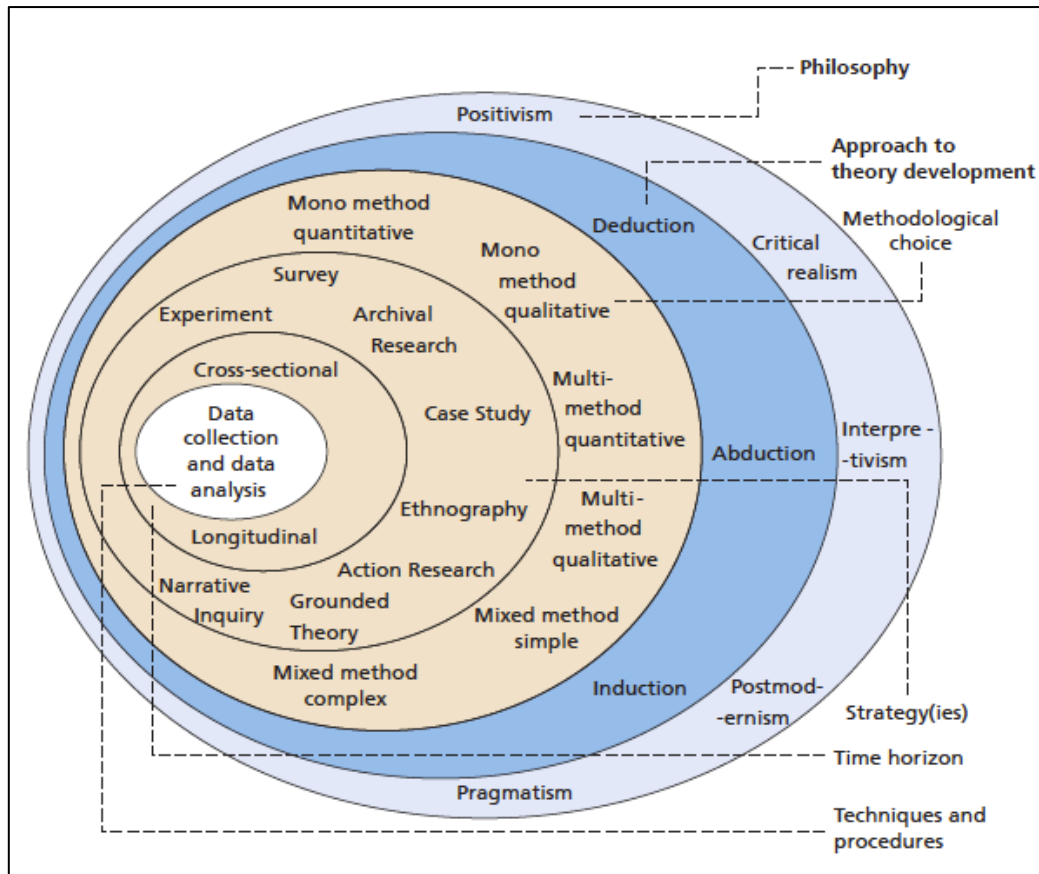


Figure 3.1: The research onion

Source: Adapted from Saunders et al. (2019)

In the next layer the choice of methodology is made from mixed-method complex, mixed-method simple, multi-method qualitative, multi-method quantitative, mono-method qualitative, and mono-method quantitative. The fourth layer allows researchers to choose from different research strategies such as narrative enquiry, grounded theory, action research, ethnography, case study, archival research, survey, and experiment. Time is crucial in every research study, hence researchers can collect either “cross-sectional” data only once over a brief period of time or “longitudinal” data multiple times over an extended length of time. Finally, the core of the research, which includes methods for data gathering and methods for data analysis, is at the center of the onion. Table 3.1 shows the structural research layers adopted for this study.

Table 3.1: The structural research layers adopted using the research onion

| S/N | Structural research layer | Research decision points |
|-----|------------------------------------|----------------------------------|
| 1 | Research philosophy | Pragmatism |
| 2 | Approach to theory development | Deductive and inductive approach |
| 3 | Methodological choice | Mixed-methods |
| 4 | Research strategy | Survey research |
| 5 | Research time horizon | Cross-sectional |
| 6 | Research techniques and procedures | Semi-structured questionnaires |

3.3. Research Philosophy

Research philosophy, according to Saunders et al. (2019), is a set of ideas and presumptions that researchers hold in an effort to advance knowledge in a certain field of study. These assumptions are often made consciously or unconsciously by researchers at every stage of a research study. Assumptions are the outcome of acknowledged research philosophy that helps in the choice of research methodology, research strategy, data collection techniques and analysis procedures (Saunders *et al.* 2019). Research philosophy helps to outline the research and gives researchers the opportunity to clarify the research method used in order to comprehend the expectations that support the research techniques. Research philosophy is an important element in research because it determines which research design is appropriate and why (Al-Ababneh, 2020).

The aim of this study was to develop a positive safety culture framework that will improve the safety performance of construction SMEs in Ghana. To achieve this aim, a pragmatist research philosophy was adopted. Pragmatism can provide philosophical justification for either quantitative, qualitative or mixed methods (Maarouf, 2019). The choice of pragmatist philosophy is dependent on the research problem, that aims to contribute practical solutions that inform future practice. This statement was supported by Saunders *et al.* (2019). The focus of pragmatism is on “what” and “how” a research problem can be solved using the appropriate methods based on the criteria that a researcher believes are necessary to find a solution to a research problem. A research philosophy of pragmatism was adopted for this study because of the research problem statement that, the lack of a positive safety culture leads to hazardous safety performance of construction SMEs in Ghana. The research objectives were formulated from the research questions that were used to address the research problem, as presented in Figure 3.2.

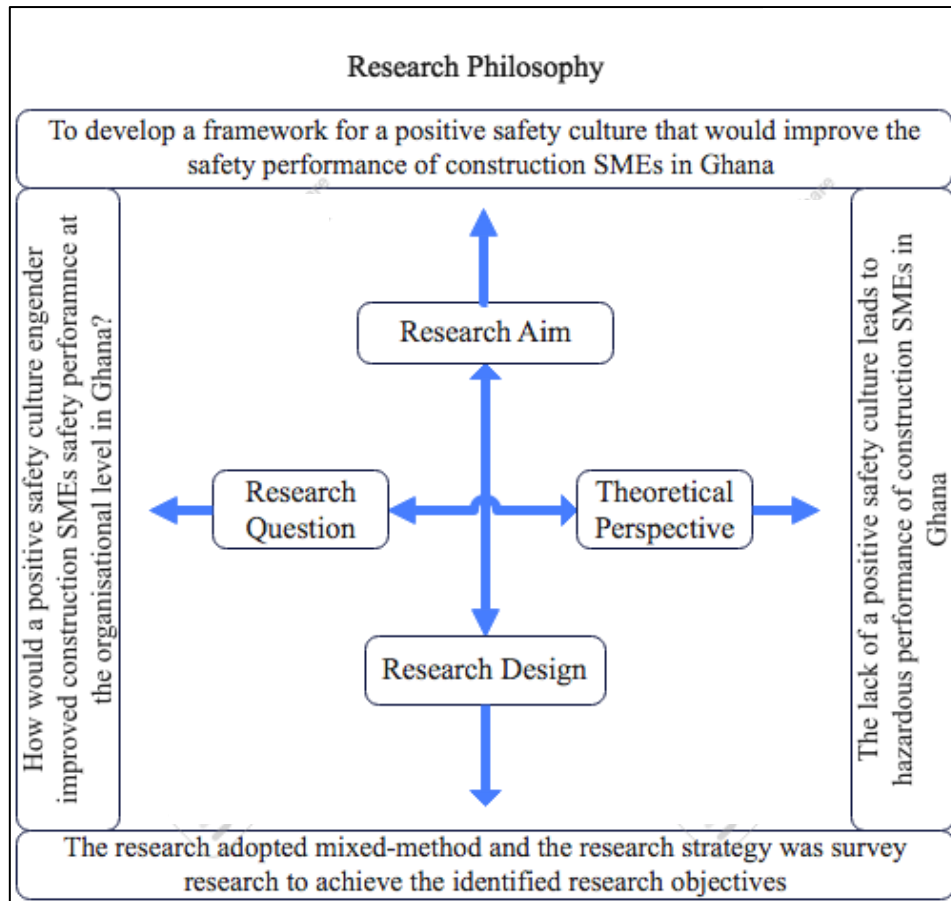


Figure 3.2: Research philosophy: main aspect of the research

Source: Adapted from Žukauskas *et al.* (2018)

The main aspect of the research philosophy has been grouped under four main categories: research aim, research design, theoretical perspective and research questions, as shown in Figure 3.2. It is clear from the foregoing that interactions between these four groups will contribute to the creation of a framework for a strong safety culture that will assist Ghanaian construction SMEs in lowering the incidence of injuries, accidents, and fatalities in the sector. The theoretical perspective of the study was based on positive safety culture and improved safety performance of construction SMEs. For the research design/model, a mixed-methods was used, based on the Delphi method and a self-administered, survey questionnaire.

3.3.1. Approaches to Theory Development

Because the degree to which a given study is concerned with theory testing or theory building raises a crucial question concerning the design of that research, theory is used in every research endeavour (Saunders *et al.*, 2019). Killam (2013) argued that theory has a direct impact on the

research approach that a researcher is likely to adopt. There three ways to theory formation namely; abductive, deductive, and inductive, as seen in the research onion in Figure 3.1. According to Al-Ababneh (2020), the inductive research approach is used when a researcher is collecting data and developing a theory in line with the findings. The main research question formulated for the current study was: How would a positive safety culture engender positive and progressive safety performance in construction SMEs at organisational level in Ghana?. The research objectives were formulated in order to answer the research questions. In order to accomplish the study's goals and objectives, the inductive research approach was employed to help the researcher understand the research topic and explain the findings. The researcher's choice of research design was aided by the inductive research methodology.

3.4. Methodological Choice

A mixed-methods research approach was used in this study. The mixed-methods research is defined as an approach in which elements of quantitative and qualitative research approaches are combined in a study (for example, use of quantitative and qualitative viewpoints, data collection, inference techniques, analysis) to ensure comprehension and confirmation on a wider and deeper scale (Baškarada & Koronios, 2018). Nunfam (2021) held the view that a mixed-methods research contains the practice of collecting, evaluating and mixing qualitative and quantitative approaches, information and findings to make inferences to understand a research phenomenon meticulously. According to Creswell & Clark (2018), there are three, fundamental, mixed-methods designs that offer a useful framework for researchers using a mixed methods approach: the explanatory sequential design, the convergent design, and the exploratory sequential design.

The researcher used exploratory, sequential, mixed-methods design in this study, where qualitative data were gathered and analysed using the Delphi method, as presented in Chapter Four. The researcher formulated the research hypotheses from the indicator metrics of positive safety culture. The identified indicator metrics were converted into questionnaire, in a 5-point Likert Scale, that was distributed among the senior management employees of construction SMEs in Ghana, using a purposive sampling technique to collect the quantitative data. This design was adopted because the separate phases of the design assisted the researcher to implement the research, and describe and report on the poor safety culture that exists among

construction SMEs in Ghana. The method was useful because it was necessary to collect quantitative data based on what was learned during the first, qualitative phase, as supported by (Creswell & Clark, 2018).

3.5. Research Strategy

According to Rahi (2017), research strategy is the process of collecting and interpreting data with a clear objective. It is a data collecting system or the general plan of a research project that guides a researcher on how to answer a research question (Abdelhakim & Badr, 2021). There are different research strategies available from which to choose, as mentioned in the research onion in Figure 3.1. However, Al-Ababneh (2020) opined that no research strategy is superior than others, and the choice of one research strategy or a combination of any number of strategies depends on the research objective(s) and question(s), extent of existing knowledge and the research philosophy. One research strategy, a research survey, was used in the current study. Both qualitative and quantitative data were collected using the survey technique and the Delphi method, respectively.

3.5.1. The Delphi Method

According to Wahid *et al.* (2021), the goal of the Delphi method is to build consensus using pre-determined criteria. The approach entails planned discussion and consensus-building among a team of experts on the challenging issue under inquiry (Ameyaw *et al.*, 2016). The basic goal of the method is to attain the most appropriate consensus among a panel of experts on a subject by using a series of questionnaires intermingled with controlled feedback of opinions. The experts were questioned repetitively either by interview or questionnaires without direct contact with one another. The Delphi technique was utilised to gain consensus on leading indicators and their core elements of health and safety in Ghana.

In order to address military concerns, Olaf Helmer and Norman Dalkey developed the Delphi technique at the RAND Corporation in 1953. The name originated from the Greek oracle whom the majority of Greeks visited for consultation about their future. Since its inception, the method has become the choice preferred by most researchers, especially those in academia, to settle decisions that must be made by experts when there is a scarcity of empirical evidence on

a subject in a particular field. Marchais-Roubelat & Roubelat (2011) observed that the Delphi technique has been recognised in many subject areas such as agriculture, academia, automotive, administration, banking, criminal justice and, currently, construction health and safety because of its quantitative and qualitative advantages. It is the appropriate choice of technique when there is lack of complete knowledge, agreement, lack of evidence, or uncertainty. Trevelyan and Robinson (2015) identified four main characteristics of the Delphi method, namely: anonymity among participants, which permits the private expression and modification of opinions; iteration, with controlled feedback of group opinions, it permits exchange of information and the sharing of perceptions between the participants; statistical aggregation of group responses, it enables the analysis and interpretation of data; and expert input, It indicates that each participant is aware of the study area. However, Marchais-Roubelat & Roubelat (2011) stated that the Delphi method is generally based on two key conventions: the first is that group decisions made by experts in the field of study are more effective than those made by individuals, and the second is that, during direct inter-personal interaction, over-assertive members of the group might affect the consensus reached by the group, or group bias might be involved.

3.5.1.1. The Characteristics of the Delphi Technique

Four essential features are regarded as being critically important when using the Delphi method. These essential features are: anonymity (Okura & Takizawa, 2018), iteration (Winkler & Moser, 2016), controlled feedback (Winkler & Moser, 2016) and statistical aggregation of group response (Winkler & Moser, 2016). According to Adzivor *et al.* (2022), anonymity is normally achieved by using a questionnaire which gives all the experts the opportunity to express their opinions without any interference from the other group members. Furthermore, it gives the experts the chance to deal with each issue on the basis of merit alone. Each expert is given the opportunity to revise his or her ideas and assessments of each concept being considered through the iteration of the questionnaire over a number of rounds without the involvement of other group members. Between each questionnaire iteration, every group member is informed about the opinions and judgements of each anonymous member through controlled feedback. The statistical aggregation of group response is a statistical summary of the group response, in which mean or median values are sent to group members either to maintain or change their views based on the group mean or median. Panellists are given additional information, such as reasons why an expert opinion or judgement falls outside a pre-

determined limit. At the end, the final result represents the opinion or judgement of all group members and not just one member who is most vocal.

3.5.2. The Delphi Questionnaire

A letter was written to invite health and safety experts in Ghana to participate in a Delphi expert panel (Appendix A1). Included in the invitation letter was a structured, open-ended question as part of an introductory questionnaire (Appendix B1). In addition, personal information, academic information and professional category were requested to confirm that each member was a true health and safety expert for the study (Appendix A2).

The instrument required two types of responses to establish:

- the importance of the actions/statements/leading indicator metrics for positive safety culture to enhance construction SMEs' safety performance;
- the impact of the actions/statements/leading indicator metrics on positive safety culture to enhance construction SMEs' safety performance.

A total of 87 actions/statements/leading indicator metrics were identified after a literature review. The 87 leading indicator metrics were categorised under 14 core elements, as shown in Table 3.2.

Table 3.2: Health and safety core elements

| S/N | Core elements |
|-----|------------------------------|
| 1 | Management concerns |
| 2 | Worksite norms |
| 3 | Safe work procedures (SWP) |
| 4 | Collective responsibility |
| 5 | Job satisfaction |
| 6 | Equipment and plant |
| 7 | Hazard and risk |
| 8 | Adaptability and flexibility |
| 9 | Education and training |
| 10 | Reporting |
| 11 | Information sharing |
| 12 | Management contributions |
| 13 | Worker contributions |
| 14 | Supervisor contributions |

3.5.3. The Pilot Study

Questionnaires are either created or adopted by the researcher. Whether created or adopted, the developed questionnaire must be evaluated thoroughly before it is used in the main study. The most reliable means to evaluate the instrument is known as pre-testing or pilot testing. According to Viechtbauer *et al.* (2015), A pilot study is a brief research project that comes before a confirmatory investigation. The main purposes are to test the study method/procedures and the validity of the instruments, to estimate the recruitment rate and, finally, to estimate parameters, such as the variance of the outcome variable, to estimate the sample size for the main study (In, 2017). It is important that any questions that have been validated or been used in any previous study are tested through piloting in order to confirm their applicability to the current study. Availability of time and financial resources is one of the key factors that determines the number of respondents in a typical pilot study. Several researchers conduct pilot studies with the aim of calculating the sample size for the main study. Hassan *et al.* (2006) identified the following six important purposes of a pilot testing or pilot study:

- To evaluate the feasibility of the study procedure and spot study flaws;
- To test whether the format is comprehensible, whether the questionnaire(s) asks the intended questions, and whether the selected, validated tool is appropriate for the target population;
- To test the suitability of data gathering method using the selected interview technique (face-to-face or telephone) or self-completed questionnaire (postal or administered at a centre);
- To evaluate the data gathering process – the time it takes to complete the questionnaire and the individuals' interest in taking part in the study;
- To evaluate the accuracy of data entry, item coding and the appropriateness of statistical tests;
- To collect preliminary data for the primary outcome measure, in order to determine the appropriate sample size (especially in randomised control trials).

3.5.4. The Delphi Pilot Study

A Delphi pilot study took place from May 2019 to June 2019. The purpose of the pilot study was based on the six main reasons for conducting a pilot study identified by Hassan *et al.* (2006). The pilot study for this research involved a statistician from the university who scrutinised the questions, as well as the study promoter who corrected the wording of the leading indicator metrics.

3.5.4.1. The Panellists

The most crucial step in the entire Delphi process is choosing the right specialists to make up a Delphi panel. An expert in a Delphi panel is referred to as anyone with knowledge and skills in a particular field of study (Hong *et al.*, 2019). To select an expert panel for the Delphi method, the researcher must consider two important components: panel size and expert qualification.

3.5.4.2. The Size of the Panel

The minimum or maximum sample size for a Delphi study has never been established. However, researchers have settled on any sample size that is convenient to them. Domoney *et al.* (2020) were of the view that a panel size of 8-15 is appropriate with the justification that smaller numbers would reduce the validity of the result and that more than 15 would add little value to the result. According to Wahid *et al.* (2021), a sample size of more than 15 members provides better reliability, whereas less than 6 decreases reliability. A panel size of 31 health and safety experts in Ghana was used in the current study, selected using a purposive sampling method, which was in accordance with the work of Wahid *et al.* (2021). This sample size was deemed to be appropriate because of the rich experiences and knowledge of these experts in the chosen field.

3.5.4.3. Qualification and Selection of Panel Members

There has always been a debate among researchers about who is qualified to be an expert in a Delphi survey and how to recruit an expert appropriately. What is important is that all the recruited experts must remain impartial throughout the whole Delphi process to obtain results that reflect the opinions and judgements of the respondents accurately. Accordingly, the criterion for selecting the panel members (experts) must be considered thoroughly to avoid doubts in the final results.

Alyami *et al.* (2013) recommended six criteria which include: academic qualification; decision-maker; manager or practitioner in the field of study; accredited professional; practical experience and sufficient knowledge; willingness to participate; and expert with a level of influence regarding the adoption of the resulting methodology. The choice of experts for the current study depended on at least 7 of the following minimum requirements:

- Country of residence;
- Knowledge in health and safety in Ghana;
- Academic qualification;
- Work experience;
- Employment;
- Influence and recognition in health and safety in Ghana;
- Book authorship;
- Member of a faculty in an accredited higher learning institution;
- Safety association participation/affiliation;
- Willingness to participate;
- Publications in conferences and journals.

Based on the above minimum requirements, 31 health and safety experts were established and invited to constitute the Delphi panel. All the experts were from Ghana and were all living in Ghana at the time of the study. This was necessary because they understood the situations of negative safety culture among the construction SMEs in Ghana, as well as the Ghanaian cultural inclination with regards to construction health and safety in the country. Hence, they were therefore better positioned to meaningfully contribute to the establishment of a framework for a positive safety culture among construction SMEs to enhance their health and safety performances in Ghana. An email was sent to the 31 health and safety experts inviting them to participate in the Delphi process. Subsequently, 18 health and safety experts voluntarily agreed to participate in the study. This was in line with Agumba *et al.* (2014) who suggested that 10 to 50 experts are appropriate for any Delphi study. The 13 experts, who declined to participate after the initial email, gave no reason for their refusal to participate in the study.

3.5.5. The Delphi Process

The core elements identified and the leading indicator metrics were developed into an organised questionnaire. The structured questionnaire was then put through a pilot test with the assistance of a supervisor and one statistician. The supervisor ensured the readability of the content, ease of answering and the rating scale used for the questionnaire, while the statistician checked readability and the rating scale in order to ensure the face validity of the questionnaire prior to the commencement of the Delphi process. The questionnaire (Appendix B1) was then sent by email to 31 health and safety experts in three rounds of the Delphi survey between July 2019 and October 2020. The number of rounds for a Delphi study has never been established. After a bibliometric review of 88 papers in which the Delphi method was used, undertaken by Ameyaw *et al.*, (2016), it was found that consensus was attained in 40 of them after two to three rounds. Three rounds of iteration were adopted in the current study to achieve consensus, as indicated by Montes *et al.* (2017). This was in accordance with Ceric (2014) and Zahoor *et al.* (2017), who found that the number of participants decreased during the first and second rounds, indicating that the accuracy of subsequent rounds would decrease.

In the first Delphi round of the current study, a structured questionnaire was used (Appendix B1). The questionnaire was sent by email to 31 health and safety experts and 18 experts responded, giving a 58.06% response rate. The other 13 experts did not respond to the email and did not give any reason for their refusal to participate in the study. The experts rated each indicator metric based on individual expertise and experience in terms of the importance and the impact of each on positive safety culture among construction SMEs in Ghana. Some of the experts asked for clarifications of some of the questions and others raised concerns about the Delphi process, which were all addressed. The group medians of the responses in round one were determined using Microsoft Excel 2020 and the results were returned to the experts in round two of the Delphi process for comparative purposes. Care was taken to ensure that each expert was sent the exact round-one question with the group median score attached.

In round two, the questionnaire (Appendix B2) was sent by email to 18 respondents, and 17 experts responded, representing a 94.4% response rate. The experts in round two were given the chance to review their ratings based on the group median. In addition, they were also given the opportunity to give reasons if their rating was 2 units more or less than the provided group median. One expert, who did not complete the round, gave no reason for withdrawing. This

was consistent with Agumba (2013) who stated that the experts are entitled to change their initial ratings based on feedback from previous rounds of response.

Round three of Delphi comprised 17 respondents from round two, and 16 of them responded, representing a 94.1% response rate. In round three, the Delphi questionnaire (Appendix B3) consisted of 87 leading indicator metrics. In this round, the experts were given the chance to review their ratings based on the feedback from round two. The experts were offered another opportunity to give written comments on their ratings if it was 2 units more or less than the provided group median. In this round, the experts were allowed to add any new indicator metrics that, according to their opinions and judgements, would help to establish a positive safety culture to improve the safety performance of construction SMEs. No indicator metrics were dropped until the final round, and only grammatical corrections were made in some of the indicators. In accordance with Agumba (2013), this gave the experts the opportunity to rate each indicator metric during all three rounds.

3.5.6. Data Analysis and Criteria for Attaining Consensus

One major problem with the Delphi method is its scientific method of attaining consensus. Several different methods have been proposed in different research studies. Diamond *et al.* (2014) argued that some researchers have adopted degree of uncertainty around a point estimate, formal measures of agreement, the proportion of participants agreeing to a particular viewpoint to define consensus or decreases in variances of group responses. Diamond *et al.* (2014) indicated further that, amongst these criteria, the most common was the use of percentage agreement to determine consensus. According to Latif *et al.*, (2016), it is extremely recommended to utilise a median score on a Likert-type scale. Diamond *et al.* (2014) identified that the median threshold used in the determination of consensus in most Delphi studies was 75% (range: 50%-97%). In the current study, the criteria used to determine consensus were “median value of 5-10 and 50% or more of the experts rating each indicator metric with a group median score of between 5-10 in the importance scale, and median impact percentage 50%-100% (5-10) and 50% or more of the experts rating each indicator metric between 50%-100% (5-10) in the impact scale”, as indicated in Table 3.3. This median cut off point was set to select the best leading indicator metrics that would help to establish a positive safety culture to improve safety performance among construction SMEs in Ghana.

Table 3.3: Impact scale

| | % response (5-10) importance scale | Importance median | % response (5-10) impact scale | % median impact |
|-----------|---|--------------------------|---------------------------------------|------------------------|
| Consensus | 50% response and above | 5.00 – 10.00 | 50% response and above | 5.00% - 10.00% |

3.5.7. Structure of the Pilot Delphi Questionnaire

The questionnaire distributed among the construction SMEs in the pilot stage was consisted of sections that included a cover letter. In the cover letter, the study was described and instructions were given on how the questionnaires should be answered.

Section A contained the history of the respondents and the construction SMEs for which they were working, such as title of job, years of experience working in the construction industry and the involvement of the respondents with the company. Section B was related to positive safety culture practices of construction SMEs. Questions based on the degree of agreement or disagreement with each leading indicator metric and safety culture statement were administered using a 5-point Likert scale. Finally, in Section C, the questions asked were based on the safety performance of construction SMEs in Ghana, using 5-point Likert Scale ratings which were based on agreement or disagreement with each statement/leading indicator metric. The reasons for the pilot study included:

- Check the questions to see if there are any duplicates that may be deleted to make the questionnaire shorter.;
- Test the adequacy of the questionnaire;
- Check whether questions asked were correctly understood by respondents;
- Check whether the range of responses provided for each question was adequate;
- Provide an indication of the probable cost and duration of the study;
- Provide an indication of the expected response rate of the study.

3.5.8. The Pilot Study of the Current Study

The pilot study was done between June 2021 and November 2021. A total of 55 questionnaires (Appendix C1) were distributed among 10 construction SMEs in Ghana. These construction

SMEs were selected based on the definition and classification of construction SMEs in Ghana by Arthur-Aidoo *et al.* (2018). The questionnaires were distributed among these companies by email and by drop and collect. A cover letter was included in the questionnaire, inviting relevant personnel or any other person with the requisite experience in health and safety in the company to participate. A week was allotted for the responders to finish the survey. Calls were placed as a follow-up to remind the respondents about the survey. According to Agumba (2013), it is important to inform each respondent participating in a pilot study about the nature of the study. Furthermore, it was made clear to each participant that this was a pilot study. All respondents were urged to share their thoughts on any issues they had while completing the survey. They were as well given the opportunity to add any additional questions to the existing questionnaire that they felt were necessary to improve positive safety culture among construction SMEs in Ghana.

3.5.9. Findings from the Pilot Study

The results from the pilot study and their effects on the main study were grouped under questions with low response rates, inadequate response options and duplicate questions.

3.5.9.1. Pilot Study Results

The Cronbach's alpha levels for each leading indicator metric was calculated. At this stage, factor analysis was not done because of the size of the sample. However, the alpha levels from the analysis of the pilot study indicated an acceptable internal consistency in the scale. One factor had a low alpha level of 0.336 that was unacceptable, as shown in Table 3.4. The factor with the low alpha value was "supervisors allow safety suggestions" that measured "supervisor contributions" and was deleted from the questionnaire for the main study. It was predicted that, the presence of this factor in the main study would have a negative effect on the construct because the nature of the factor made it difficult for the respondents to understand.

Table 3.4: Cronbach’s alphas for the pilot study

| S/N | Construct | Cronbach’s alpha |
|-----|-----------------------------------|------------------|
| 1 | Management concerns (MC) | 0.861 |
| 2 | Worksite norms (WN) | 0.823 |
| 3 | Safe work procedures (SWP) | 0.891 |
| 4 | Collective responsibility (CR) | 0.804 |
| 5 | Job satisfactions (JS) | 0.814 |
| 6 | Equipment and plant (EP) | 0.788 |
| 7 | Hazards and risks (HR) | 0.812 |
| 8 | Adaptability and flexibility (AF) | 0.818 |
| 9 | Education and training (ET) | 0.927 |
| 10 | Reporting (R) | 0.744 |
| 11 | Information sharing (IS) | 0.889 |
| 12 | Management contributions (MCS) | 0.885 |
| 13 | Worker contributions (WC) | 0.605 |
| 14 | Supervisor contributions (SC) | 0.366 |

3.5.9.2. Question with Low Response Rate

The question about the average annual revenue of the construction SMEs had the lowest response rate. According to the feedback from the respondents, this indicated that they did not have the necessary information on the subject and, hence, found it difficult to provide the answer. The main objective of this question was to determine which construction companies in Ghana fall within the classification of construction SME based on the definition by Arthur-Aidoo *et al.* (2018). Only owners of the construction SMEs provided the answer to this particular question. The question concerned was changed to help the respondents to answer. Furthermore, the question about the number of workers employed by the construction SMEs was not answered by all the respondents. Again, only owners were able to answer this question. This might be because the respondents did not have the necessary information to answer the question. This question and the question about average annual revenue were essential for the study. To address the above, a range optional answers was provided in the final questionnaire.

3.5.9.3. Duplicate Questions

One question in Section C that measured the construct of “management contributions” was repeated twice. The duplicated question, “regular safety inspection is expedited”, was removed from the questionnaire for the main study. Some grammatical errors were identified in some of the questions by the respondents and were duly corrected.

3.5.9.4. Response Bias

Most of the questions relating to the practices regarding the positive safety culture of the construction SMEs were rated very high. This could mean that the construction SMEs appear to be more cautious with issues relating to health and safety and practising more positive safety culture within the companies than they are in reality. This is a typical example of response bias. All of these questions were retained as they were for the final study.

3.5.9.5. Misunderstood Questions

There were no misunderstood questions reported by the respondents, except one respondent who made a minor adjustment to one of the questions. This implied that all the questions were well understood by all the respondents.

3.5.9.6. Response Rate

In all, 55 questionnaires were distributed by email and drop-and-collect method. Of these, 21 were retrieved, representing a 38.18% response rate. It was essential to select employees of the construction SMEs who had an influence on, or were involved in, health and safety or operational practices, hence a purposive sampling technique was used as proposed by Campbell *et al.* (2020). This sampling method helps to select appropriate respondents who have enough knowledge about the organisations in which they work. The method also gives the researcher the opportunity to learn about issues of central importance to the factors that affect positive safety culture within the construction SMEs in Ghana. Based on the above, 10 construction sites of projects undertaken by construction SMEs were visited and an average of five questionnaires were distributed on each site. This amounted to a sample size of 55 for the pilot study. Every empirical study that aims to draw conclusions about a population from a sample, as is the case with the current study, must take sample size into consideration. The sample size of this study was decided based on data collection and the requirement for sufficient statistical support to justify the conceptual framework. Neuman (2014) argued that the choice of sample size must rely on the data analysis method that the researcher intends to use, how authentic the sample must be for the researcher's goal, and the characteristics of the population. Neuman (2014) added that a smaller sample size of about 10% is appropriate to be accurate when a researcher is examining small populations while a big sample size is good for fairly large populations. Leedy and Ormrod (2019) proposed the following four guidelines for selecting a sample in order to maximise sample size for research:

- With a population of less than 100 participants, sampling is not necessary.
- With a population size of approximately 500, 50% sample size is appropriate.
- With a population size of approximately 1500, 20% must be sampled;
- With a population size beyond a certain point, (e.g. 5000 or more units), the population size is practically inappropriate and a sample size of 400 should be sufficient

Data analysis for this study was done using Structural Equation Modeling (SEM). A sample size of 450 was chosen. The sample size needed for this study was determined by the framework because it plays a significant role in SEM analysis. Kyriazos (2018) argued that a minimum sample size of 200 is satisfactory for effective research. The current study's sample size complied with the 10% sample size recommendation. Hence, 450 respondents from Ghanaian construction SMEs made up the entire sample, which was consistent with SEM analysis. Considering the 38.18% response rate from the pilot study, it was expected that a minimum of 152 of these questionnaires would be received for analysis in the main study.

3.5.10. Structure of the Final Questionnaire Administered to the Construction SMEs

The final questionnaire (Appendix D1) distributed among the construction SMEs was evolved from the literature reviewed, Delphi consensus method and pilot survey of construction SMEs that took place in Ghana. The questionnaire administered to construction SMEs consisted of four sections. In the cover letter the study was described and instructions were given on how the questionnaires should be answered.

Section A contained the history of the respondents and the construction SMEs for which they were working, such as title of job, years of experience working in the construction industry and the involvement of the respondents with the company. Section B was related to positive safety culture practices of construction SMEs. Questions based on the degree of agreement or disagreement with each leading indicator metric and safety culture statement were administered using a 5-point Likert scale. Finally, in Section C, the questions asked were based on the safety performance of construction SMEs in Ghana, using 5-point Likert Scale ratings which were based on agreement or disagreement with each statement/leading indicator metric.

3.5.11. Administration of the Final Questionnaire to Construction SMEs

The final questionnaire for construction SMEs was developed after the pilot study (Appendix D1). The distribution of the questionnaire among the construction SMEs for the main study was done from 14 November 2021 to 22 January 2022, using a purposive sampling technique of construction SMEs in Ghana. Sampling is a technique used by researchers to methodically choose a smaller number of items or individuals from a pre-defined population to serve as a source of data for an observation or experiment with regards to the objectives of a study. Two key sampling techniques were identified by (Omair, 2014) as: non-probability sampling and probability sampling methods. Probability sampling takes place when every item or person in a population has an equal chance of being chosen for a particular observation or experiment, whereas non-probability sampling is a sampling method in which participants or people are not given an equal chance of being chosen to represent the entire community (Etikan, 2016).

Purposive sampling, often known as judgemental sampling, is a non-probability sampling technique, that allows a researcher to choose participants according to the qualities each participant possesses (Etikan, 2016). Purposive sampling when used in qualitative study, allows the researcher to identify and choose respondents based on their expertise, experience, availability and willingness to participate, as well as capacity to convey their experiences and ideas in a clear, and thoughtful manner (Etikan, 2016). The sampling process of this study began with contacting the office of the Building and Civil Engineering Contractors Association of Ghana to obtain the emails and telephone numbers of member contractors across the country. Members were phoned to confirm their willingness to participation in the study, after which the questionnaire was sent to them by emails and drop and collect method. In addition, over 200 construction sites across various regions in the country were visited by the researcher to distribute the questionnaire among the top management personnel of each construction firm, using a drop and collect arrangement. Follow-up phone calls were made, as well as sending reminders by email to the respondents, to complete and return the questionnaire within the time specified on the questionnaire sent to them. A total of 450 questionnaires was distributed, 350 by drop and collect and 100 by email. After the survey, 284 questionnaires were received, representing a response rate of 63.11%.

3.6. Research Time Horizons

A research time horizon is defined by Alturki (2021) as the specific period of time within which a research study is undertaken, including data collection and analysis. Two different time horizons were identified by Saunders *et al.* (2019) in the research onion: longitudinal and cross-sectional. In this study, a cross-sectional time horizon was adopted because a particular phenomenon was studied within a time constraint. The period within which the qualitative data were gathered from the Delphi survey was between June 2019 and October 2020. The period within which the pilot study was carried out was between June 2021 and November 2021. The period within which the quantitative data were collected, using the survey to evaluate the conceptual framework, was between November 2021 and January 2022.

3.7. The Research Process

The research process of this study was divided into three stages, as shown diagrammatically in Figure 3.3. The research process is the outline of the procedures and techniques used to produce the primary data for the study.

In stage one, the research problem was used to generate the research questions and objectives. The main research aim was to develop a framework for a positive culture of safety that will improve the safety performance of Ghanaian construction SMEs. Based on the findings of the literature review, the core elements or leading indicators of positive safety culture and their measuring scale, known as leading indicator metrics or statements, were identified and a conceptual positive safety culture framework was proposed.

A three-round Delphi technique was adopted in stage two to validate the indicator metrics or statements for their importance and impact when establishing a positive safety culture among construction SMEs. A structured questionnaire survey with open-ended questions was used in Rounds 1 to 3 to validate the elements of the framework.

To test the improved framework created in stage two, the third and final stage involved conducting a pilot questionnaire survey among senior management staff members of construction SMEs prior to the main questionnaire survey. The goal of the current study was to develop a framework for a positive safety culture using the elements/leading indicators and

leading indicator metrics for construction SMEs that would improve their safety performance by lowering the occurrences of accidents, injuries, and fatalities.

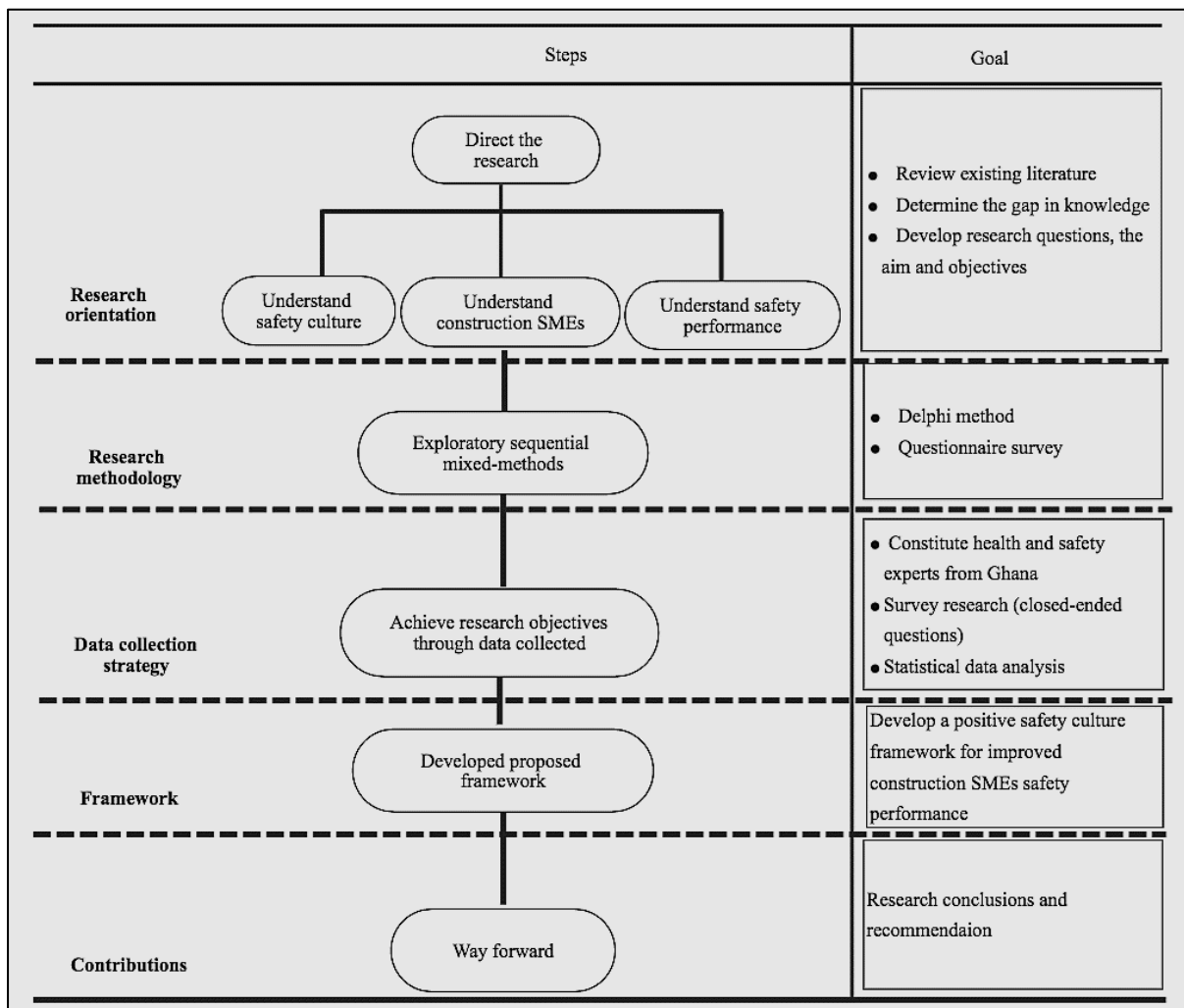


Figure 3.3: Research process

Source: Researcher's construct

3.8. Data Collection Process

Data for particular research can be collected through two major approaches: primary and secondary approaches. The primary data for the current study were collected through quantitative methods. Qualitative data were gathered by using the Delphi method, as explained in the research design section, while quantitative data were collected using questionnaires by a drop and collect method and emails.

The secondary data were collected from existing literature, including journal publications, conference papers, reports and books in the field of study. The questionnaire used for the secondary data collection was based on literature review. The secondary data were collected to help to identify the research gap that led to the formulation of the research questions, aim and objectives. The Delphi method, which featured a panel of Ghanaian health and safety experts, was the most suitable primary research technique for this study.

3.9. Data Analysis

Inferential and descriptive data analyses were carried out. The descriptive analyses included construct descriptive and normality assessment. The inferential analysis comprised correlation analysis, and PLS-SEM analysis which covered confirmatory composite analysis (CCA), structural model testing and importance-performance map analysis. Analysis of the selected demographic variables with the elements of the framework for positive safety culture in construction was conducted.

3.9.1. Descriptive Statistics

This section presented the constructs' descriptive statistics and normality results. The descriptive statistics covers the means and standard deviations for the constructs. There is positive perception of the items when the mean values exceeded the midpoint of 3.2 (Castro & Martins, 2010). Furthermore, normality test was conducted using the Kolmogorov-Smirnov and Shapiro-Wilk method with p -values less than 0.05 indicating the absence of normality (Field, 2013; Osborne & Walters, 2002).

3.9.2. Structural Equation Modelling (SEM)

SEM is a statistical approach used to analyse data where multiple structural equations are estimated simultaneously in order to evaluate the relationships between a set of variables (Silva *et al.*, 2020). Silva *et al.* (2020) indicated further that SEM employs variety of models to illustrate the connections between observed variables, all with the same fundamental aim of providing a quantitative evaluation of a theoretical model that has been hypothesised by a researcher. In other words, different theoretical models can be tested in SEM in which how sets

of variables define constructs and how these constructs are related to one another is hypothesised. The best statistical method for examining correlations between latent and observable variables is SEM. SEM is the most credible multi-variate correlational analysis technique.

SEM is useful in many ways, especially in models with a large number of hidden variables and indicators. In recent years, SEM has been used successfully in a variety of social science fields (Naji *et al.*, 2022). Researchers, like Chen *et al.* (2018), Feng and Trinh,(2019), and Buniya *et al.* (2021), used SEM to develop health and safety models in the construction industry. Accordingly, SEM was considered to be the most suitable method of analysis to test the conceptualised framework in the current study. This is because SEM is the most appropriate method that can be used to analyse and test theoretical models.

Specifically, this study's data non-normality and predictive nature necessitated the adoption of the PLS-SEM approach (using SmartPLS 4; Ringle *et al.*, 2022). The analysis involved measurement model assessment which covers the reliability and validity of latent variables, and the structural model assessment (Hair *et al.*, 2019; Hair Jr., 2021). Thus, results of the convergent validity and reliability of the measures were examined. This was followed by discriminant validity assessment using the Heterotrait-Monotrait (HTMT) ratio (Hair *et al.*, 2019; Henseler *et al.*, 2015). Subsequently, the structural model was examined in addition to IPMA analysis which is a forward-thinking analysis utilised in PLS-SEM, to better comprehend the predictors of the investigated model. Such an evaluation is crucial for prioritising management efforts effectively (Ramayah *et al.*, 2018; Ringle & Sarstedt, 2016; Saari *et al.*, 2021; Sarstedt *et al.*, 2014; Valaei & Jiroudi, 2016). The assessment of the structural paths included the multicollinearity checks, direct and indirect effects, model's fit and explanatory power. The results were obtained from a bootstrapping procedure (5,000 subsamples) (Hair (Jr.) *et al.*, 2017; Hair *et al.*, 2019; Ringle *et al.*, 2020). In this study, IPMA, a forward-thinking analysis utilised in PLS-SEM, is used to better comprehend the predictors of the investigated model. Such an evaluation is crucial for prioritising management efforts effectively (Ramayah *et al.*, 2018; Ringle & Sarstedt, 2016; Saari *et al.*, 2021; Sarstedt *et al.*, 2014; Valaei & Jiroudi, 2016).

3.10. Integration of the Research Objectives

To address the research problem of a poor safety culture among construction SMEs in Ghana, a conceptual framework was developed. The five research objectives were:

- Research Objective 1: To explore the components that shape safety culture within construction SMEs in Ghana;
- Research Objective 2: To evaluate the influences of the components on the safety culture of construction SMEs in Ghana;
- Research Objective 3: To analyse the components that significantly influence the safety culture of construction SMEs in Ghana;
- Research Objective 4: To evaluate how a safety culture influences the safety performance of construction SMEs in Ghana;
- Research Objective 5: To develop a framework that would assist construction SMEs to evolve a positive safety culture to improve safety performance in Ghana.

In this study, the research findings relevant to the first four research objective were used to develop a conceptual framework to address the fifth research objective. Two research strategies were adopted, the Delphi method and a questionnaire survey, as shown in Table 3.5 below. Research Objective 1 was achieved by undertaking a rigorous literature review of conference proceedings, journal articles, government reports, relevant books on health and safety etc. Reports and literature from Ghana, both locally and internationally, were examined. The major aim of this research was to gather data and create a comprehensive understanding of the high accident rates caused by weak safety cultures in construction SMEs. This information was essential to understand the effects of the poor safety culture that has led to the poor safety performance of construction SMEs. It also led to the development of health and safety leading indicator metrics that can be used to establish a positive safety culture. The Delphi method was used to validate the leading indicator metrics which were identified for Objective 1.

The second and third research goals were accomplished using the Delphi technique, which were to evaluate the influences of the shaping components on the safety culture of construction SMEs in Ghana, and to determine the shaping components that significantly influence the safety culture of construction SMEs in Ghana. The Delphi method was used because these two

research objectives were to obtain the opinions of health and safety experts on the factors that would help to establish a positive safety culture among construction SMEs in Ghana. The results and findings from the substantial literature review together with the qualitative Delphi survey were used to achieve the fourth research objective.

To achieve Research Objective 5, an empirical construction SME questionnaire survey was conducted and analysed through Structural Equation Modelling. The conceptual framework developed for Research Objective 5 was tested and validated using the data collected from the questionnaire survey to institute the inter-relationships amidst the leading indicator metrics as well as the constructs. The next section contains more information. To finalise the best fit framework for positive safety culture among construction SMEs in Ghana, the developed framework was validated. Table 3.5 contains summaries of the methodologies adopted to accomplish the research objectives.

Table 3.5: Research procedure adopted to achieve the research objectives

| Stage | Research objective | Data collection method | Data analysis method |
|---|--|-------------------------------|-------------------------------------|
| 1.0 Review of literature | RO1: To identify the components that shape safety culture within construction SMEs in Ghana. | Literature review | |
| 2.0 Delphi technique | RO2: To evaluate the influences of the shaping components on the safety culture of construction SMEs in Ghana. | Delphi method | Descriptive statistics |
| | RO3: To determine the shaping components that significantly influence the safety culture of construction SMEs in Ghana. | | Descriptive statistics |
| | RO4: To evaluate how a safety culture influences the safety performance of construction SMEs in Ghana. | | Descriptive statistics |
| 3.0 Construction SMEs questionnaire survey | RO5: To develop action plans (in the form of a framework) that will assist construction SMEs to evolve a positive safety culture to improve safety performance in Ghana. | Questionnaire survey | Structural Equation Modelling (SEM) |

3.11. Validity and Reliability of the Research Data

The validity and reliability of the questionnaire were essential to test the construct validity and reliability of the safety culture practices and health and safety performance variables. Validity and reliability are connected with the research design, measuring instruments and the overall research findings. The validity and reliability usually indicate the degree to which latent variables measure what they are intended to measure. Therefore, it is necessary to validate any research study if such research has an influence on the overall welfare of the general public, as in the current study. With this understanding, it was important to demonstrate the reliability of the data collection, analysis and findings. All the numerous sub-dimensions must be satisfied to achieve construct validity.

3.11.1. Validity

Validity refers to how precisely a research finding reflects the data collected and analysed. According to Creswell and Clark (2018), validity serves the purpose of checking the quality of data collected, the results, and the researcher's interpretation of the data results. Mollo (2019) argued that validity is used to determine whether the data collection techniques and research design produce the expected output or result to answer the research questions. Validity provides a platform for a researcher to check the extent to which the results of a study are verified against the stated research objectives. According to Creswell and Clark (2018), there are two main types of validity, namely: external validity and internal validity.

Internal validity refers to the extent to which cause-and-effect claims can be made. The validity of the current study was established by ensuring that all the Delphi participants remained completely anonymous throughout the Delphi process which, in effect, helped to eliminate what is termed a "band-wagon" effect, which is one of the key strengths of the Delphi method. Furthermore, internal validity was enhanced during the three rounds of the Delphi survey, when the health and safety participants were given the opportunity to change their ratings or maintain them with a written explanation or argument for changing their views. Another means by which internal validity was ensured was to maintain contact and communication with each participant.

The external validity of a study refers to the extent to which the results of a research can be generalised to other people, settings or times (Creswell & Clark, 2018). However, this is normally determined by the process of selecting participants to participate in a study. In the current study, this was not necessary because the conceptual framework developed was validated using the questionnaire survey. The processes of selecting the expert participants for the Delphi survey guaranteed external validity as a scientific criterion. The experts on the panel involved in the Delphi process were all from Ghana with rich experiences in health and safety matters, as well as in-depth knowledge in construction among workers in SMEs in Ghana. They were selected from all the major cities in Ghana, and had thorough knowledge and sound working experience in both industry and academia. Therefore, the requirements for external validity were fulfilled in the study according to standard research ethics.

Statistically, the data collected from the survey was exposed to validity tests to determine its validity. The convergent validity of the measures was examined using the average variance

extracted ($AVE > 0.50$). This was followed by discriminant validity assessment using the Heterotrait-Monotrait (HTMT) ratio (Hair *et al.*, 2019; Henseler *et al.*, 2015).

3.11.2. Reliability

Reliability refers to the consistency of the results obtained in a research study. It is the extent to which data collected for a study is consistent and stable over time (Creswell & Clark, 2018). Hence, reliability can only be satisfactory when the same research or investigation is carried out by different researchers who arrive at the same conclusions. According to Creswell and Clark (2018), reliability plays very little role in qualitative research because researchers emphasise the value of their subjective interpretations. It was not possible to achieve reliability in the Delphi method used in the current study because another panel of health and safety experts would reach a different consensus based on their knowledge and interests in the subject. Care was taken that credibility was shown through truthfulness, fittingness was exhibited in applicability, auditing ability was shown in response to consistency, and conformability was exhibited in the responses from all participants to attain reliability. Credibility was also demonstrated in selecting the health and safety experts who participated in the Delphi process. All the health and safety participants in the Delphi survey had distinguished themselves based on the criteria set for selection as health and safety experts, and the depth of their knowledge and experience, as presented previously.

Quantitative data were collected using self-administered survey questionnaires. Therefore, statistically, the data collected was exposed to reliability tests to determine its reliability. Cronbach's alpha (α) coefficient and composite reliability were used to determine the reliability and validity of the measurements (Hair *et al.*, 2019; Henseler *et al.*, 2015).

3.12. Ethical considerations

All ethical considerations were adhered to at all times during the collection of both the qualitative and quantitative data. The consent letter that was sent to all the Delphi participants during the qualitative data collection, contained an explanation of ethical considerations and commitment to the privacy and protection of the Delphi participants. During the collection of quantitative data using the questionnaire, the consent letter was attached to the first page of the

questionnaire. The participants were encouraged to participate in the study by their own free will, and were told of their rights not to participate or to withdraw if they so wished. They were also informed about the purpose of the study and the reasons why each had been chosen to participate in the study. In effect, participation in the study was free from deception or stress. Finally, all the participants were guaranteed protection through anonymity, and all information that might reveal their identity was held in strict confidence.

3.13. Chapter Summary

In this chapter, the research methodology used for the study was discussed in detail. A mixed-methods research approach was used and the research design included a Delphi survey and questionnaire survey to achieve the research objectives of the study. The mixed-methods approach was used to integrate the collection of quantitative and qualitative data, as presented in Chapters Four and Five. In the next chapter, the data collected from the Delphi survey are presented.

CHAPTER FOUR: RESULTS OF THE DELPHI SURVEY

4.1. Introduction

The Delphi method was used to obtain input from health and safety experts in Ghana. The results from the Delphi survey are presented in this chapter. The composition of the panel of health and safety experts and the general background to the Delphi survey are described. Descriptive statistics were also provided in this chapter as methods of data analyses for the socio-demographic characteristics and to respond to the research question about the importance of the leading indicator metrics that would establish a positive safety culture among construction SMEs in Ghana. The results from Round 3 of the Delphi survey are discussed in the chapter. The refined conceptual framework that would help to establish a positive safety culture among construction SMEs in Ghana is presented, as well as the final revised hypotheses.

4.2. Demographic Characteristics of the Health and Safety Expert Panel

For this study, a list of health and safety experts from Ghana was compiled. An email was sent to 31 experts, of whom all 31 agreed to participate. In Round 1, 18 participants responded. In the third and final round, 18 experts participated but only 16 returned their responses. This confirmed the argument made by Zartha Sossa *et al.* (2019), Ameyaw *et al.* (2016), and Trevelyan and Robinson (2015) that, as the number of Delphi rounds increases, the more likely it is that participants will begin to withdraw for the successive rounds either because of fatigue, attrition rates, time or cost.

Table 4.1 shows the profiles of all the experts. A total of 31 H&S experts voluntarily agreed to participate in this study but only 16 completed as follows: from Ho (N = 2 = 13%), Kumasi (N = 5 = 31%), Wa (N = 1 = 6%), Takoradi (N = 1 = 6%), Cape Coast (N = 1 = 6%), Accra (N = 3 = 19%), and Tarkwa (N = 3 = 19%). The combination of the experts from across the major cities in Ghana made this study unique because no such research has been done in Ghana using this approach. In selecting the panel of experts, the residency status of the experts was considered to be most important. This is because the experts were recruited based on their thorough understanding of safety in the construction industry across the major cities in Ghana.

The panellists were selected in order to draw a balance between those in academia and their counterpart health and safety practitioners to reduce bias.

The experts included males (78%) and females (22%), indicating the dominance of males in the construction industry. Six percent of the experts held professorial degrees, 33% held doctoral degrees, 55% held master's degree and 6% failed to indicate their academic qualifications. Of the 18 panellists, 50% were academics, lecturing in the leading universities in Ghana, 39% were health and safety practitioners across the country, and 11% did not indicate their professions as illustrated in Table 4.1.

Table 4.1: Profile of experts selected for the Delphi survey

| S/N | Employer | City | Professional affiliation | Academic qualification | Professional category |
|-----|------------------------------------|------------|--------------------------|------------------------|--|
| 1 | Government of Ghana | Kumasi | IET GhIS | Doctorate | <ul style="list-style-type: none"> • Built Environment consultant • Built environment researcher • Professional construction manager |
| 2 | Ho Technical University | Ho | CIOB | Doctorate | <ul style="list-style-type: none"> • Construction H&S researcher • Professional construction manager |
| 3 | University of Education, Winniba | Winniba | GhIS, GOIC | Doctorate | <ul style="list-style-type: none"> • Construction H&S researcher • Built environment researcher • Professional construction manager |
| 4 | University of Mines and Technology | Tarkwa | GhISeP | Doctorate | <ul style="list-style-type: none"> • H&S Consultant • Professional engineer |
| 5 | Cape Coast Technical University | Cape Coast | CIOB (UK) GIOIC | Doctorate | <ul style="list-style-type: none"> • Construction H&S researcher • Built environment consultant |

| | | | | | |
|----|--|----------|-----------------------|-----------|---|
| 6 | Free Lancer | Kumasi | MGhIS | Doctorate | <ul style="list-style-type: none"> • Construction H&S researcher • Professional construction manager |
| 7 | PC | Accra | GhISeP | Master's | <ul style="list-style-type: none"> • H&S Practitioner • Certified safety professional |
| 8 | | Takoradi | IOSH, GhISeP, IRCA | Master's | <ul style="list-style-type: none"> • H&S Practitioner |
| 9 | OLAM Ghana Limited | Accra | GhISeP, IOSH | Master's | <ul style="list-style-type: none"> • H&S Practitioner |
| 10 | Model H&S Limited | Kumasi | GhISeP | Master's | <ul style="list-style-type: none"> • H&S Practitioner • Certified safety professional |
| 11 | SDD University of Business and Integrated development Studies | WA | GhIS | Masters | <ul style="list-style-type: none"> • Built environment researcher |
| 12 | University of Mines and Technology | Tarkwa | GhISeP, OSHAfrica | Master's | <ul style="list-style-type: none"> • H&S Consultant • Construction H&S researcher • Professional construction manager • Professional Engineer |
| 13 | Ho Technical University | Ho | GhIS, CIOB GBCDA | Master's | <ul style="list-style-type: none"> • Construction H&S researcher • Built environment researcher • Professional construction manager |
| 14 | PW Ghana Limited | Accra | | Master's | <ul style="list-style-type: none"> • Construction H&S researcher • Certified safety professional |
| 15 | BCM International | Tarkwa | | Master's | <ul style="list-style-type: none"> • Construction H&S researcher |

4.3. The Delphi Research Question and Results

The main objective of the Delphi method used in this study is stated and the results for the three rounds are presented.

RQ1. What are the health and safety leading indicator metrics/statements catalogued according to different health and safety indicators that are purported to be very important in the establishment of a positive safety culture among construction SMEs in Ghana for improved safety performance?

4.3.1. Delphi Survey Round 1

At the end of each round, median and mean values were calculated to measure the degree of consensus reached amongst the participants regarding the leading indicator metrics that would help to establish a positive safety culture in construction SMEs in Ghana. The results from this analysis formed the basis of Rounds 2 and 3 in this survey. In this survey, a consensus was considered to have been reached when measures attracted final median scores of 5-10 and more than 50% of the respondents rated the leading indicator metrics between 5 and 10 on the importance scale, and the median impact percentage was 50%-100% and more than 50% of respondents rated the indicator metric between 50% and 100% on the impact scale. This was in accordance with the work of Diamond (2014).

In the first round, 31 health and safety experts were approached, and 18 experts responded, representing a 58% response rate. The 13 experts who did not respond in Round 1, did not give any reason for not participating. Some experts asked for further explanation of some of the questions they were finding difficult to understand. The questionnaire in Round 1 was designed based on a summary of the findings of an intensive literature review in which the core elements and the leading indicator metrics were highlighted that were potentially relevant to a positive safety culture in construction SMEs. These core elements and their leading indicator metrics were structured for use in the first round of the Delphi survey. The experts rated each indicator metrics based on their knowledge and experience about health and safety issues within the Ghanaian Construction Industry.

4.3.2. Presentation of Delphi Round 1 Results

4.3.2.1. Management Concerns

Eight leading indicator metrics were identified and used to measure management concerns, as indicated in Table 4.2. Consensus was achieved on all eight leading indicators and they were retained. The median score for importance of these indicators was above 5. Overall, more than 50% of the experts rated each of these indicators as being very important to having a major impact on the establishment of a positive safety culture that will improve safety performance among construction SMEs in Ghana.

4.3.2.2. Worksite Norms

Worksite norms were measured using eight indicator metrics as shown in Table 4.2. None of these indicators were rejected. More than 50% of the experts rated these indicator metrics as being very important to having a major impact on a positive safety culture among construction SMEs in Ghana.

4.3.2.3. Safe Work Procedure

Experts rated all 12 indicators used to measure safe work procedure as being very important to having a major influence on positive safety culture. They believed that, when safe work procedures are established effectively and followed in construction SMEs, this will lead to a considerable reduction in the rates of accidents within construction SMEs in Ghana. More than 50% of the experts rated all the indicator metrics as being very important to having a major impact on a positive safety culture to improve the safety performance of construction SMEs as indicated in Table 4.2.

4.3.2.4. Collective Responsibility

Collective responsibility was measured using seven indicator metrics. Consensus was attained on all seven indicator metrics and they were retained. The experts rated all the indicator metrics as being very important to having a major impact on positive safety culture, with a minimum median score of 7.5. More than 50% of the experts rated all the indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs, as indicated in Table 4.2.

4.3.2.5. Job Satisfaction

Job satisfaction was measured using six leading indicator metrics, as indicated in Table 4.2. Consensus on two indicators was not attained: “work is repetitive and boring” and “work is done purely for salaries and wages”. The medians of their ratings were 5.5 and 6 respectively, which were within the importance threshold of 5-10, and were rated by the experts as being important. These factors were expected to have a median score of less than the 5-10 threshold because of their nature. Accident rates might increase in the construction industry if these two indicators attained a median score of more than 5. As shown in Table 4.2, “work uses skills and talents” was rephrased to “workers use skills and talents”; “achievements and progress is rewarded” was also rephrased to “achievements and progress are rewarded”; and “motivation to improved SWP at work” was changed to “motivation to improve SWP at work”, on all of which consensus was achieved and they were retained. Hence, according to the experts, four out of the six indicator metrics were crucial to establishing a positive safety culture among construction SMEs in Ghana, as 50% of the experts rated all of the indicators.

4.3.2.6. Equipment and Plant

Equipment and plant were measured using three indicators. All three attained consensus and were retained as shown in Table 4.2. Over 94% of the experts rated all three indicators as being very important, with a median score of 9. This meant that, if all equipment and plant were available, well-kept and the operators were well trained, this would lead to improvement in safety culture within construction SMEs. More than 50% of the experts rated all three indicator metrics as being very important to having a major impact on a positive safety culture to improve the safety performance of construction SMEs.

4.3.2.7. Hazards and Risks

Hazards and risks were measured using nine indicator metrics. Consensus was attained on all nine indicator metrics and they were retained. More than 50% of the experts rated all nine indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs, as shown in Table 4.2.

4.3.2.8. Adaptability and Flexibility

Adaptability and flexibility were measured using four indicator metrics. All four indicator metrics were accepted by the experts as being necessary to having greater impact on positive safety culture. This implied that, if managers and employees of construction SMEs were

mindful of safety related issues in their daily activities, safety culture would be upheld firmly in these companies. More than 50% of the experts rated all four indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs, as shown in Table 4.2.

4.3.2.9. Education and Training

Education and training were measured using four indicator metrics. All four indicator metrics were rated by the experts as being very important to having a major impact on positive safety culture. This implied that educating and training of workers are very necessary in addressing the negative health and safety records of construction SMEs in Ghana because educating and training employees will improve their safety behaviours significantly. More than 50% of the experts rated all four-indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs, as shown in Table 4.2.

4.3.2.10. Reporting

Reporting was measured using six indicator metrics. All six indicator metrics were rated very high with a median score of importance of 8 and median score for impact of 80%. Consensus was achieved on all six indicator metrics and they were retained. More than 50% of the experts rated all six indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs, as shown in Table 4.2.

4.3.2.11. Information Sharing

Information sharing was measured using five indicator metrics. Consensus was attained on all five indicator metrics and they were retained. This affirmed the opinions of the experts that, if information sharing were well addressed, it would promote a positive culture of safety within construction SMEs. More than 50% of the experts rated all five indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs, as shown in Table 4.2.

4.3.2.12. Management Contributions

Management contributions were measured using six indicator metrics, as shown in Table 4.2. Of the six indicator metrics, one, “safety equipment is off adequate quality”, was edited to “safety equipment is of adequate quality”. All six indicators were rated within the required

median threshold and were retained. More than 50% of the experts rated all six indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.2.13. *Worker Contributions*

In the case of worker contributions, five indicator metrics were used for measurement, with consensus being attained on three, which were retained, as shown in Table 4.2. Consensus was not attained on two indicator metrics: “workers ignore safety rules” and “workers take short cuts to complete tasks”, and they were dropped. More than 50% of the experts rated all six-indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.2.14. *Supervisor Contributions*

Supervisor contributions were measured using four indicator metrics. Consensus was attained on all four indicator metrics and they were retained. The median importance of these indicators was more than the minimum score of 5 and the median impact was more than the minimum threshold of 50% for this survey. One indicator metric was edited: “supervisors allow safety suggest” was edited to “supervisors allow safety suggestions”. More than 50% of the experts rated all six-indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs, as shown in Table 4.2.

Table 4.2: Important leading indicator metrics

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|--------------------------------|---|-------------------|-----------------|-------------------|
| Management concerns (1) | | | | |
| 1.1 | Safe working conditions enforcement | 83.30 | 7.20 | 7.50 |
| 1.2 | Zero tolerance for safety violations | 77.80 | 7.00 | 7.50 |
| 1.3 | Monitor and correct safety errors | 77.80 | 6.90 | 7.00 |
| 1.4 | Safety first is applied to all at work | 77.80 | 6.90 | 7.00 |
| 1.5 | Safety resources are prioritised | 72.20 | 6.80 | 6.50 |
| 1.6 | Safe operations are prioritised | 77.80 | 7.30 | 7.00 |
| 1.7 | Well-being of workers is prioritised | 94.40 | 7.60 | 8.50 |
| 1.8 | Health of workers is prioritised | 94.40 | 7.80 | 9.00 |

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|---|---|-------------------|-----------------|-------------------|
| Worksite norms (2) | | | | |
| 2.1 | Equipment, tools and plants are used safely | 94.40 | 7.40 | 8.00 |
| 2.2 | Safety is improved continuously | 83.30 | 7.30 | 7.50 |
| 2.3 | Hazard awareness and control are executed | 88.90 | 7.50 | 8.00 |
| 2.4 | Risk awareness and control are executed | 88.90 | 7.40 | 8.00 |
| 2.5 | Accidents and near misses are mitigated | 88.90 | 7.60 | 8.50 |
| 2.6 | Workers make safety suggestions | 83.30 | 7.10 | 7.50 |
| 2.7 | Workers contribute to safety improvement | 83.30 | 7.20 | 8.00 |
| 2.8 | Workers are involved in safety planning | 72.20 | 7.20 | 8.00 |
| Safe work procedure (3) | | | | |
| 3.1 | At-risk work is flagged by co-workers | 88.90 | 6.80 | 6.50 |
| 3.2 | Safety instructions are reinforced on site | 88.90 | 7.60 | 8.00 |
| 3.3 | Unsafe acts are monitored and corrected | 83.30 | 7.60 | 8.00 |
| 3.4 | Unsafe conditions are corrected | 88.90 | 7.60 | 8.50 |
| 3.5 | Fatigue is monitored and managed | 77.80 | 7.00 | 8.00 |
| 3.6 | Work pressure is monitored and managed | 77.80 | 7.10 | 8.00 |
| 3.7 | Safety audits are conducted regularly | 88.90 | 8.00 | 8.50 |
| 3.8 | Safety inspections are conducted regularly | 88.90 | 7.70 | 9.00 |
| 3.9 | Methods statements comply with SWP | 83.30 | 7.00 | 7.50 |
| 3.10 | Task execution complies with SWP | 88.90 | 7.40 | 8.00 |
| 3.11 | Work is completed in a safe manner | 88.90 | 7.90 | 8.50 |
| 3.12 | New workers are taught to follow SWP | 83.30 | 7.80 | 9.00 |
| Collective responsibility (brother's keeper) (4) | | | | |
| 4.1 | Co-workers often discuss safety hazards | 77.80 | 7.20 | 8.00 |
| 4.2 | Co-worker care for the safety of each other | 83.30 | 7.60 | 8.50 |
| 4.3 | Co-workers care about equipment safety | 77.80 | 7.20 | 8.00 |
| 4.4 | Co-workers discuss accident prevention | 77.80 | 6.80 | 8.00 |
| 4.5 | Work pressure must not violate safety | 77.80 | 7.00 | 8.00 |
| 4.6 | Co-workers report safety violations | 77.80 | 7.30 | 8.50 |
| 4.7 | Co-workers raise alert to SWP violations | 83.30 | 7.10 | 7.50 |
| Job satisfaction (5) | | | | |
| 5.1 | <i>Work is repetitive and boring</i> | 50.00 | 4.80 | 5.00 |
| 5.2 | Work is inspiring and fulfilling | 55.60 | 5.60 | 5.00 |
| 5.3 | Workers use skills and talents | 72.20 | 6.40 | 6.50 |
| 5.4 | Achievements and progress are rewarded | 72.20 | 6.50 | 6.50 |
| 5.5 | Motivation to improve SWP is at work | 72.20 | 6.70 | 7.50 |
| 5.6 | <i>Work is done purely for salaries and wages</i> | 66.70 | 6.20 | 6.00 |
| Equipment and plant (6) | | | | |
| 6.1 | Suitable plant and equipment are available | 83.30 | 7.80 | 9.00 |
| 6.2 | Routine upkeep is performed on plant | 83.30 | 7.80 | 9.00 |
| 6.3 | Operators are trained to use equipment | 88.90 | 8.30 | 9.50 |
| Hazards and risk (7) | | | | |
| 7.1 | <i>Safety is ignored to get the job done</i> | 66.70 | 5.00 | 5.50 |
| 7.2 | <i>Prohibited work activities are expedited</i> | 61.10 | 5.30 | 5.00 |
| 7.3 | SWP is violated to get the job done | 55.60 | 5.30 | 5.50 |

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|---|---|-------------------|-----------------|-------------------|
| 7.4 | <i>Drift to safety violation is allowed</i> | 61.10 | 4.90 | 5.00 |
| 7.5 | Safety rules and policies are clear | 88.90 | 7.50 | 8.00 |
| 7.6 | Workplace SWP is understood | 83.30 | 7.40 | 8.50 |
| 7.7 | Unsafe acts and conditions are mitigated | 83.30 | 7.40 | 8.00 |
| 7.8 | Hazard reporting is encouraged on sites | 77.80 | 7.40 | 8.00 |
| 7.9 | The collective undertakes safety analysis | 83.30 | 7.20 | 8.00 |
| Adaptability and flexibility (8) | | | | |
| 8.1 | Workers use SWP to execute tasks | 77.80 | 7.10 | 8.00 |
| 8.2 | Safe equipment and plant are used on sites | 83.30 | 7.80 | 9.00 |
| 8.3 | Safety promotion is embraced on sites | 77.80 | 7.80 | 9.00 |
| 8.4 | Mindfulness in relation to safety exists | 77.80 | 7.60 | 9.00 |
| Education and training (9) | | | | |
| 9.1 | Safety inductions are detailed and timely | 83.30 | 7.60 | 9.00 |
| 9.2 | Tool box talks are enriched with examples | 77.80 | 7.00 | 8.50 |
| 9.3 | Safety information is provided regularly | 77.80 | 7.70 | 9.00 |
| 9.4 | Training covers SWPs and regulations | 83.30 | 7.50 | 8.50 |
| Reporting (10) | | | | |
| 10.1 | Blame game hinders incident reports | 77.80 | 7.20 | 8.00 |
| 10.2 | Reporting lines and systems are clear | 88.90 | 7.40 | 8.00 |
| 10.3 | Reports lead to reviews and improvements | 83.30 | 7.30 | 8.00 |
| 10.4 | Incident reporting is nurtured and rewarded | 77.80 | 6.90 | 7.00 |
| 10.5 | Incident reporting leads to better SWPs | 83.30 | 7.30 | 8.00 |
| 10.6 | Workers are willing to report incidents | 77.80 | 7.10 | 8.00 |
| Information sharing (11) | | | | |
| 11.1 | SWP information is shared timeously | 72.20 | 7.10 | 8.00 |
| 11.2 | Safety information is in multiple languages | 66.70 | 6.10 | 7.00 |
| 11.3 | Voluntary safety information-sharing exists | 72.20 | 6.30 | 7.50 |
| 11.4 | New safety regulations are shared timeously | 72.20 | 6.90 | 8.00 |
| 11.5 | Safety concerns receive timely attention | 72.20 | 7.30 | 8.50 |
| Management contributions (12) | | | | |
| 12.1 | Regular safety inspection is expedited | 72.20 | 7.10 | 8.00 |
| 12.2 | Safety equipment is of adequate quality | 83.30 | 7.40 | 8.00 |
| 12.3 | Safety equipment is accessible and available | 83.30 | 7.60 | 8.50 |
| 12.4 | Safety first is applied during work pressure | 77.80 | 7.10 | 7.50 |
| 12.5 | Overtime work is controlled | 83.30 | 6.90 | 8.00 |
| 12.6 | Blame game because of accidents is prohibited | 83.30 | 7.20 | 8.00 |
| Worker contributions (13) | | | | |
| 13.1 | Workers encourage one another to be safe | 77.80 | 7.20 | 8.00 |
| 13.2 | Workers keep worksite clean | 77.80 | 7.30 | 8.50 |
| 13.3 | <i>Workers ignore safety rules</i> | 66.70 | 5.90 | 6.50 |
| 13.4 | <i>Workers take short cuts to complete tasks</i> | 77.80 | 6.30 | 7.50 |
| 13.5 | Workers use SWPs to get the job done | 77.80 | 7.20 | 8.00 |
| Supervisor contributions (14) | | | | |
| 14.1 | Supervisors allow safety suggestions | 77.80 | 7.40 | 8.50 |
| 14.2 | Supervisors disallow safety violations | 77.80 | 6.80 | 7.00 |

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|------|---|-------------------|-----------------|-------------------|
| 14.3 | Supervisors prioritise productivity | 77.80 | 6.80 | 8.00 |
| 14.4 | Supervisors ignore SWP deviations | 83.30 | 6.10 | 6.50 |

Note: Consensus was attained on all the leading indicator metrics in black and they were retained, but consensus was not attained on the *blue italicised* leading indicator metrics and they were dropped.

4.3.3. Delphi Round 2

The purpose of round two was to give the experts the opportunity to review and compare their ratings with those of the other experts. The experts were also allowed to give reasons if they decided to change their ratings by 2 units more or less than the group median. The round began with 18 experts and ended with 17 experts, representing a 94% response rate. The only absentee gave no reasons for not participating.

4.3.4. Presentation of Delphi Round 2 Results

As shown in Table 4.3, consensus was attained on 87 leading indicator metrics categorised under 14 core elements.

4.3.4.1. Management Concerns

Management concerns were measured using eight indicator metrics. As indicated in Round 1, consensus was attained on all eight indicators and they were retained.

4.3.4.2. Worksite Norms

Worksite norms were measured using eight indicator metrics. None of these indicators were rejected. This concurred with the first-round results. More than 50% of the experts rated these indicator metrics as being very important to having a major impact on positive safety culture among construction SMEs in Ghana.

4.3.4.3. Safe Work Procedure

Safe work procedure was measured using twelve indicators and consensus was attained on all twelve indicator metrics. This confirmed the results from Round 1. More than 50% of the experts rated all the indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.4. Collective Responsibility

Collective responsibility was measured using seven indicator metrics. Consensus was attained on all the seven indicator metrics and they were retained. The experts rated all the indicators as being very important to having a major impact on positive safety culture, with a minimum median score of 8. This concurred with the results in Round 1. More than 50% of the experts rated all the indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.5. Job Satisfaction

Job satisfaction was measured using six leading indicator metrics. Consensus was not attained on two indicators identified to measure job satisfaction: “work is repetitive and boring” and “work is done purely for salaries and wages”. They had median ratings of 6 and 7 respectively, which were within the threshold of 5-10 for importance, and were rated by the experts as being important. These factors were expected to have a median score of less than the 5-10 threshold because of their nature. Accident rates would increase in construction SMEs if these two indicators attained a median score of more than 5. Hence, according to the experts, four of the six indicator metrics were crucial to establishing a positive safety culture among the construction SMEs in Ghana, because 50% of the experts rated all the indicators. This concurred with the results in Round 1.

4.3.4.6. Equipment and Plant

Equipment and plant were measured using three indicators, on all of which consensus was attained and they were retained. Over 94% of the experts rated all three indicators as being very important, with a median value of 9. This meant that, if all equipment and plant were available and well-maintained, and the operators were well trained, this would lead to improvement in the safety culture within construction SMEs in Ghana. This concurred with the results in Round 1. More than 50% of the experts rated all three-indicator metrics as being very important to

having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.7. Hazards and Risks

Hazards and risks were measured using nine indicator metrics. Consensus was achieved on all nine indicator metrics and they were retained. This concurred with the results in Round 1. More than 50% of the experts rated all nine-indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.8. Adaptability and Flexibility

Adaptability and flexibility were measured using four indicator metrics. All four indicator metrics were accepted by the experts as being necessary to having greater impact on a positive safety culture. This implied that, if managers and employees of construction SMEs were mindful of safety-related issues in their daily activities, safety culture would be upheld firmly in these companies. This concurred with the results in Round 1. More than 50% of the experts rated all four indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.9. Education and Training

Education and training were measured using four indicator metrics. All four indicator metrics were rated by the experts as being very important to having a major impact on positive safety culture. This implied that educating and training of workers are very necessary in addressing the negative health and safety records of the construction SMEs in Ghana, because educating and training employees will improve their safety behaviours significantly. This concurred with the results in Round 1. More than 50% of the experts rated all four-indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.10. Reporting

Reporting was measured using six indicator metrics. All six indicator metrics were rated very high, with a median score of 8 for importance and a median score of 80% for impact. Consensus was attained on all six indicator metrics and they were retained. This concurred with the results in Round 1. More than 50% of the experts rated all six-indicator metrics as being very important

to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.11. Information Sharing

Information sharing was measured using five indicator metrics. Consensus was attained on all five indicator metrics and they were retained. This affirmed the opinions of the experts that, if information sharing were addressed well, it would promote a positive safety culture within construction SMEs in Ghana. This concurred with the results in Round 1. More than 50% of the experts rated all five indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.12. Management Contributions

Management contributions were measured using six indicator metrics. All six indicators were rated within the required median score threshold and were retained. This concurred with the results in Round 1. More than 50% of the experts rated all six-indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.13. Worker Contributions

In the case of worker contributions, five indicator metrics were used for measurement, with consensus being attained on three, which were retained. Consensus was not achieved on two indicator metrics: “workers ignore safety rules” and “workers take short cuts to complete tasks” and they were dropped. This concurred with the results in Round 1. More than 50% of the experts rated all six indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.4.14. Supervisor Contributions

Supervisor contributions were measured using four indicator metrics. Consensus was attained on all four-indicator metrics and they were retained. The median score for the importance of these indicators was more than the minimum value of 5 and the median score for impact was more than the minimum 50% threshold for this survey. This concurred with the results in Round 1. More than 50% of the experts rated all six indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

Table 4.3: Important leading indicator metrics

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|---|---|-------------------|-----------------|-------------------|
| Management concerns (1) | | | | |
| 1.1 | Safe working conditions enforcement | 88.20 | 7.60 | 8.00 |
| 1.2 | Zero tolerance for safety violations | 88.20 | 7.60 | 8.00 |
| 1.3 | Monitor and correct safety errors | 88.20 | 7.30 | 8.00 |
| 1.4 | Safety first is applied to all at work | 82.40 | 7.60 | 8.00 |
| 1.5 | Safety resources are prioritised | 82.40 | 7.10 | 7.00 |
| 1.6 | Safe operations are prioritised | 82.40 | 7.60 | 9.00 |
| 1.7 | Well-being of workers is prioritised | 100.00 | 8.10 | 9.00 |
| 1.8 | Health of workers is prioritised | 94.10 | 7.90 | 9.00 |
| Worksite norms (2) | | | | |
| 2.1 | Equipment, tools and plant are used safely | 100.00 | 7.70 | 8.00 |
| 2.2 | Safety is improved continuously | 88.20 | 7.90 | 9.00 |
| 2.3 | Hazard awareness and control are executed | 94.10 | 7.90 | 8.00 |
| 2.4 | Risk awareness and control are executed | 94.10 | 7.90 | 9.00 |
| 2.5 | Accidents and near misses are mitigated | 94.10 | 8.10 | 9.00 |
| 2.6 | Workers make safety suggestions | 82.40 | 7.20 | 8.00 |
| 2.7 | Workers contribute to safety improvement | 88.20 | 7.70 | 9.00 |
| 2.8 | Workers are involved in safety planning | 88.20 | 7.70 | 9.00 |
| Safe work procedure (3) | | | | |
| 3.1 | At-risk work is flagged by co-workers | 94.10 | 7.40 | 7.00 |
| 3.2 | Safety instructions are reinforced on site | 94.10 | 8.10 | 9.00 |
| 3.3 | Unsafe acts are monitored and corrected | 94.10 | 8.20 | 9.00 |
| 3.4 | Unsafe conditions are corrected | 94.10 | 8.10 | 9.00 |
| 3.5 | Fatigue is monitored and managed | 88.20 | 7.50 | 8.00 |
| 3.6 | Work pressure is monitored and managed | 88.20 | 7.60 | 8.00 |
| 3.7 | Safety audits are conducted regularly | 94.10 | 7.80 | 8.00 |
| 3.8 | Safety inspections are conducted regularly | 94.10 | 8.00 | 9.00 |
| 3.9 | Methods statements comply with SWP | 88.20 | 7.10 | 8.00 |
| 3.10 | Task execution complies with SWP | 88.20 | 7.60 | 8.00 |
| 3.11 | Work is completed in a safe manner | 94.10 | 8.20 | 9.00 |
| 3.12 | New workers are taught to follow SWP | 88.20 | 8.30 | 9.00 |
| Collective responsibility (brother's keeper) (4) | | | | |
| 4.1 | Co-workers often discuss safety hazards | 82.40 | 7.80 | 9.00 |
| 4.2 | Co-workers care for the safety of each other | 88.20 | 7.90 | 9.00 |
| 4.3 | Co-workers care about equipment safety | 82.40 | 7.60 | 8.00 |
| 4.4 | Co-workers discuss accident prevention | 82.40 | 7.20 | 9.00 |
| 4.5 | Work pressure must not violate safety | 82.40 | 7.50 | 8.00 |
| 4.6 | Co-workers report safety violations | 88.20 | 7.80 | 9.00 |
| 4.7 | Co-workers raise alert to SWP violations | 94.10 | 7.50 | 8.00 |
| Job satisfaction (5) | | | | |
| 5.1 | <i>Work is repetitive and boring</i> | 58.80 | 4.90 | 6.00 |
| 5.2 | <i>Work is inspiring and fulfilling</i> | 70.60 | 6.20 | 7.00 |
| 5.3 | <i>Workers use skills and talents</i> | 70.60 | 6.40 | 7.00 |

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|---|---|-------------------|-----------------|-------------------|
| 5.4 | Achievements and progress are rewarded | 76.50 | 6.60 | 7.00 |
| 5.5 | Motivation to improve SWP is at work | 76.50 | 7.00 | 8.00 |
| 5.6 | <i>Work is done purely for salaries and wages</i> | 70.60 | 6.20 | 6.00 |
| Equipment and plant (6) | | | | |
| 6.1 | Suitable plant and equipment are available | 82.40 | 7.70 | 9.00 |
| 6.2 | Routine upkeep is performed on plant | 88.20 | 7.90 | 9.00 |
| 6.3 | Operators are trained to use equipment | 94.10 | 8.50 | 9.00 |
| Hazards and risks (7) | | | | |
| 7.1 | <i>Safety is ignored to get the job done</i> | 58.80 | 4.60 | 5.00 |
| 7.2 | <i>Prohibited work activities are expedited</i> | 58.80 | 5.20 | 5.00 |
| 7.3 | SWP is violated to get the job done | 52.90 | 4.90 | 5.00 |
| 7.4 | <i>Drift to safety violation is allowed</i> | 58.80 | 4.60 | 5.00 |
| 7.5 | Safety rules and policies are clear | 94.10 | 8.00 | 9.00 |
| 7.6 | Workplace SWP is understood | 94.10 | 7.70 | 8.00 |
| 7.7 | Unsafe acts and conditions are mitigated | 94.10 | 7.90 | 8.00 |
| 7.8 | Reporting of hazards is encouraged on sites | 82.40 | 7.60 | 9.00 |
| 7.9 | We collectively undertake safety analysis | 88.20 | 7.20 | 8.00 |
| Adaptability and flexibility (8) | | | | |
| 8.1 | Workers use SWP to execute tasks | 88.20 | 7.50 | 8.00 |
| 8.2 | Safe equipment and plant are used on sites | 94.10 | 8.20 | 9.00 |
| 8.3 | Safety promotion is embraced on sites | 88.20 | 8.10 | 9.00 |
| 8.4 | Mindfulness in relation to safety exists | 88.20 | 7.90 | 9.00 |
| Education and training (9) | | | | |
| 9.1 | Safety inductions are detailed and timely | 88.20 | 8.00 | 9.00 |
| 9.2 | Tool box talks are enriched with examples | 88.20 | 8.00 | 9.00 |
| 9.3 | Safety information is provided regularly | 88.20 | 8.00 | 9.00 |
| 9.4 | Training covers SWPs and regulations | 88.20 | 7.80 | 9.00 |
| Reporting (10) | | | | |
| 10.1 | Blame game hinders incident reports | 88.20 | 7.70 | 8.00 |
| 10.2 | Reporting lines and systems are clear | 94.10 | 7.80 | 8.00 |
| 10.3 | Reports lead to reviews and improvements | 94.10 | 7.80 | 9.00 |
| 10.4 | Incident reporting is nurtured and rewarded | 82.40 | 7.50 | 8.00 |
| 10.5 | Incident reporting leads to better SWPs | 88.20 | 7.70 | 8.00 |
| 10.6 | Workers are willing to report incidents | 88.20 | 7.70 | 9.00 |
| Information sharing (11) | | | | |
| 11.1 | SWP information is shared timeously | 76.50 | 7.40 | 9.00 |
| 11.2 | Safety information is in multiple languages | 70.60 | 6.40 | 8.00 |
| 11.3 | Voluntary safety information-sharing exists | 76.50 | 6.60 | 8.00 |
| 11.4 | New safety regulations are shared timeously | 76.50 | 7.40 | 8.00 |
| 11.5 | Safety concerns receive timely attention | 82.40 | 7.90 | 9.00 |
| Management contributions (12) | | | | |
| 12.1 | Regular safety inspection is expedited | 82.40 | 7.70 | 8.00 |
| 12.2 | Safety equipment is of adequate quality | 94.10 | 7.90 | 8.00 |
| 12.3 | Safety equipment is accessible and available | 94.10 | 8.10 | 9.00 |
| 12.4 | Safety first is applied during work pressure | 88.20 | 7.50 | 8.00 |

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|--------------------------------------|---|-------------------|-----------------|-------------------|
| 12.5 | Overtime work is controlled | 94.10 | 7.70 | 8.00 |
| 12.6 | Blame game because of accidents is prohibited | 94.10 | 7.80 | 8.00 |
| Worker contributions (13) | | | | |
| 13.1 | Workers encourage one another to be safe | 82.40 | 7.40 | 8.00 |
| 13.2 | Workers keep worksites clean | 82.40 | 7.50 | 9.00 |
| 13.3 | <i>Workers ignore safety rules</i> | 64.70 | 5.60 | 7.00 |
| 13.4 | <i>Workers take short cuts to complete tasks</i> | 76.50 | 6.10 | 7.00 |
| 13.5 | Workers use SWPs to get the job done | 94.10 | 7.90 | 8.00 |
| Supervisor contributions (14) | | | | |
| 14.1 | Supervisors allow safety suggestions | 82.40 | 7.70 | 9.00 |
| 14.2 | Supervisors disallow safety violations | 88.20 | 7.40 | 8.00 |
| 14.3 | Supervisors prioritise productivity | 88.20 | 7.50 | 8.00 |
| 14.4 | Supervisors ignore SWP deviations | 82.40 | 6.10 | 7.00 |

Note: Consensus was attained on all the leading indicator metrics in black and they were retained, but consensus was not attained on the *blue italicised* leading indicator metrics and they were dropped.

4.3.5. Delphi Round 3

The third Delphi round started with the 17 experts who had completed the second round, and ended with 16 experts, representing a response rate of 94%. No reason was given by the only expert who was not able to complete the round. In this round, the experts were allowed to reflect on their own results in relation to the group median before they repeated the same scoring process as in the second round or changed their minds. Spaces were provided for the experts to give reasons if their rating was 2 units more or less than the group median. The experts were given the opportunity to add to the leading indicator metrics, but none were added. Overall, the experts considered 79 leading indicator metrics to be very important to establishing a positive safety culture to improve the safety performance of construction SMEs in Ghana.

4.3.6. Presentation of Delphi Round 3 Results

Consensus was attained on the same number of indicator metrics as in Rounds 1 and 2. All these indicator metrics were grouped under 14 core elements, as shown in Table 4.4.

4.3.6.1. Management Concerns

Management concerns were measured using eight leading indicator metrics. They were all rated above the minimum threshold accepted for this survey. They were given a median value of 5 and above for importance, and a median percentage of above 50% for impact. In addition, more than 50% of the experts rated each indicator metric within the threshold of 5 to 10 and 50% to 100% on the importance and impact scales respectively. This result concurred with those in Rounds 1 and 2.

4.3.6.2. Worksite Norms

Eight leading indicator metrics were used to measure worksite norms. They were all rated above the minimum median requirement for this survey. They were given a median value of 5 and above for importance, and a median percentage of above 50% for impact. In addition, more than 50% of the experts rated each indicator metric within the threshold of 5 to 10 and 50% to 100% on the importance and impact scales, respectively. This result concurred with those in Rounds 1 and 2.

4.3.6.3. Safe Work Procedure

Safe work procedure was measured using twelve indicator metrics. Consensus was attained on all twelve leading indicator metrics and they were retained. The indicators were rated above the median score of 5 on the importance scale and also above the median score of 50% on the impact scale. This implied that the experts believed that all twelve-indicator metrics were important and would have a major impact on establishing a positive safety culture among construction SMEs.

4.3.6.4. Collective Responsibility

Seven indicator metrics were used to measure collective responsibility. All seven were accepted by the experts as being important to having a major impact on positive safety culture in construction. They were given a median value of 5 and above for importance, and a median percentage of above 50% for impact. In addition, more than 50% of the experts rated each indicator metric within the threshold of 5 to 10 and 50% to 100% on the importance and impact scales, respectively. This result concurred with those in Rounds 1 and 2.

4.3.6.5. Job Satisfaction

Job satisfaction was measured using six leading indicator metrics. Consensus was not attained on two indicators identified to measure job satisfaction: “work is repetitive and boring” and “work is done purely for salaries and wages”. They had median ratings of 5.5 and 6, respectively, which were within the importance threshold of 5-10, and were rated by the experts as being important. These factors were expected to have a median score less than the 5-10 threshold because of their nature. Accident rates would increase in construction SMEs if these two indicators attained a median score of more than 5. Hence, according to the experts, four of the six indicator metrics were crucial to establishing a positive safety culture among the construction SMEs in Ghana, because 50% of the experts rated all the indicators. This concurred with the results in Rounds 1 and 2.

4.3.6.6. Equipment and Plant

Equipment and plant were measured using three indicators, and consensus was attained on all three indicators and they were retained. Over 94% of the experts rated all three indicators as being very important, with a median value of 9. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all three-indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.6.7. Hazards and risks

Hazards and risks were measured using nine indicator metrics. Consensus was attained on six of the nine indicator metrics, which were retained. Consensus was not attained on three indicators: “safety is ignored to get the job done”, “prohibited work activities are expedited”, and “drift to safety violation is allowed”, and they were dropped. One indicator “the collective undertake safety analysis” was edited to “we collectively undertake safety analysis”. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all nine indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.6.8. Adaptability and Flexibility

Adaptability and flexibility were measured using four indicator metrics. All four indicator metrics were accepted by the experts as being necessary to have greater impact on a positive safety culture. This implied that, if managers and employees of construction SMEs were

mindful of safety-related issues in their daily activities, safety culture would be upheld firmly in these companies. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all four indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.6.9. Education and Training

Education and training were measured using four indicator metrics. All four indicator metrics were rated by the experts as being very important to having a major impact on positive safety culture. This implied that educating and training of workers are very necessary in addressing the negative health and safety records of construction SMEs in Ghana because educating and training employees will improve their safety behaviours significantly. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all four indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.6.10. Reporting

Reporting was measured using six indicator metrics. All six indicator metrics were rated very high with a minimum median score of 7 for importance, and a median score of 70% for impact. Consensus was attained on all six indicators and they were retained. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all six indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.6.11. Information Sharing

Information sharing was measured using five indicator metrics. Consensus was attained on all five indicator metrics and they were retained. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all five-indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.6.12. Management Contributions

Management contributions were measured using six indicator metrics. All six indicators were rated within the median threshold and were retained. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all six-indicator metrics as being very important

to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.6.13. Worker Contributions

In the case of worker contributions, five indicator metrics were used for measurement, on three of which consensus was attained and they were retained. Consensus was not attained on two indicator metrics: “workers ignore safety rules” and “workers take short cuts to complete tasks”, and they were dropped. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all six indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.3.6.14. Supervisor Contributions

Supervisor contributions were measured using four indicator metrics. Consensus was attained on all four-indicator metrics and they were retained. The median score for the importance of these indicators was more than the minimum of 5 and the median score for impact was more than the minimum threshold of 50% for this survey. This concurred with the results in Rounds 1 and 2. More than 50% of the experts rated all six indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

Table 4.4: Important leading indicator metrics

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|--------------------------------|---|-------------------|-----------------|-------------------|
| Management concerns (1) | | | | |
| 1.1 | Safe working conditions enforced | 87.50 | 7.60 | 8.00 |
| 1.2 | Zero tolerance for safety violations | 87.50 | 7.30 | 8.00 |
| 1.3 | Monitor and correct safety errors | 81.30 | 6.90 | 7.00 |
| 1.4 | Safety first is applied to all at work | 81.30 | 7.30 | 7.50 |
| 1.5 | Safety resources are prioritised | 81.30 | 6.80 | 7.00 |
| 1.6 | Safe operations are prioritised | 81.30 | 7.30 | 7.50 |
| 1.7 | Well-being of workers is prioritised | 93.80 | 7.70 | 8.00 |
| 1.8 | Health of workers is prioritised | 93.80 | 8.30 | 9.00 |
| Worksite norms (2) | | | | |

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|---|---|-------------------|-----------------|-------------------|
| 2.1 | Equipment, tools and plant are used safely | 100.00 | 7.40 | 8.00 |
| 2.2 | Safety is improved continuously | 87.50 | 7.70 | 8.00 |
| 2.3 | Hazard awareness and control are executed | 93.80 | 7.70 | 8.00 |
| 2.4 | Risk awareness and control are executed | 93.80 | 7.80 | 8.00 |
| 2.5 | Accidents and near misses are mitigated | 93.80 | 7.80 | 8.00 |
| 2.6 | Workers make safety suggestions | 87.50 | 7.50 | 8.00 |
| 2.7 | Workers contribute to safety improvement | 87.50 | 7.60 | 8.00 |
| 2.8 | Workers are involved in safety planning | 87.50 | 7.50 | 8.00 |
| Safe work procedure (3) | | | | |
| 3.1 | At-risk work is flagged by co-workers | 93.80 | 7.20 | 7.00 |
| 3.2 | Safety instructions are reinforced on site | 93.80 | 7.90 | 8.00 |
| 3.3 | Unsafe acts are monitored and corrected | 93.80 | 7.90 | 8.50 |
| 3.4 | Unsafe conditions are corrected | 93.80 | 7.80 | 8.50 |
| 3.5 | Fatigue is monitored and managed | 87.50 | 7.60 | 8.00 |
| 3.6 | Work pressure is monitored and managed | 87.50 | 7.30 | 8.00 |
| 3.7 | Safety audits are conducted regularly | 93.80 | 8.00 | 8.50 |
| 3.8 | Safety inspections are conducted regularly | 93.80 | 8.00 | 9.00 |
| 3.9 | Methods statements comply with SWP | 87.50 | 7.10 | 8.00 |
| 3.10 | Task execution complies with SWP | 93.80 | 7.60 | 8.00 |
| 3.11 | Work is completed in a safe manner | 93.80 | 8.00 | 8.00 |
| 3.12 | New workers are taught to follow SWP | 87.50 | 8.10 | 9.00 |
| Collective responsibility (brother's keeper) (4) | | | | |
| 4.1 | Co-workers often discuss safety hazards | 81.30 | 7.50 | 8.50 |
| 4.2 | Co-workers care for the safety of each other | 87.50 | 7.70 | 8.00 |
| 4.3 | Co-workers care about equipment safety | 81.30 | 7.50 | 8.00 |
| 4.4 | Co-workers discuss accident prevention | 81.30 | 7.10 | 8.00 |
| 4.5 | Work pressure must not violate safety | 81.30 | 7.20 | 8.00 |
| 4.6 | Co-workers report safety violations | 87.50 | 7.60 | 8.00 |
| 4.7 | Co-workers raise alert to SWP violations | 93.80 | 7.30 | 7.50 |
| Job satisfaction (5) | | | | |
| 5.1 | <i>Work is repetitive and boring</i> | 62.50 | 5.00 | 5.50 |
| 5.2 | <i>Work is inspiring and fulfilling</i> | 75.0 | 6.4 | 7.00 |
| 5.3 | <i>Workers use skills and talents</i> | 81.3 | 6.4 | 6.50 |
| 5.4 | <i>Achievements and progress are rewarded</i> | 87.5 | 6.5 | 6.50 |
| 5.5 | <i>Motivation to improve SWP is at work</i> | 75.0 | 6.7 | 7.00 |
| 5.6 | <i>Work is done purely for salaries and wages</i> | 75.0 | 6.0 | 6.00 |
| Equipment and plant (6) | | | | |
| 6.1 | Suitable plant and equipment are available | 93.80 | 7.90 | 9.00 |
| 6.2 | Routine upkeep is performed on plant | 100.00 | 8.10 | 8.50 |
| 6.3 | Operators are trained to use equipment | 93.80 | 8.30 | 8.50 |
| Hazards and risks (7) | | | | |
| 7.1 | <i>Safety is ignored to get the job done</i> | 56.30 | 4.70 | 5.00 |
| 7.2 | <i>Prohibited work activities are expedited</i> | 62.50 | 5.10 | 5.00 |
| 7.3 | <i>SWP is violated to get the job done</i> | 43.80 | 4.80 | 4.00 |
| 7.4 | <i>Drift to safety violation is allowed</i> | 56.30 | 4.60 | 5.00 |

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|---|---|-------------------|-----------------|-------------------|
| 7.5 | Safety rules and policies are clear | 93.80 | 7.70 | 8.00 |
| 7.6 | Workplace SWP is understood | 93.80 | 7.60 | 7.50 |
| 7.7 | Unsafe acts and conditions are mitigated | 93.80 | 7.60 | 8.00 |
| 7.8 | Reporting of hazards is encouraged on sites | 81.30 | 7.30 | 8.00 |
| 7.9 | We collectively undertake safety analysis | 87.50 | 7.00 | 7.50 |
| Adaptability and flexibility (8) | | | | |
| 8.1 | Workers use SWP to execute tasks | 87.50 | 7.20 | 7.50 |
| 8.2 | Safe equipment and plant are used on sites | 100.00 | 7.80 | 8.00 |
| 8.3 | Safety promotion is embraced on sites | 87.50 | 7.70 | 8.00 |
| 8.4 | Mindfulness in relation to safety exists | 87.50 | 7.80 | 8.50 |
| Education and training (9) | | | | |
| 9.1 | Safety inductions are detailed and timely | 87.50 | 8.10 | 9.00 |
| 9.2 | Tool box talks are enriched with examples | 87.50 | 7.90 | 9.00 |
| 9.3 | Safety information is provided regularly | 87.50 | 7.90 | 9.00 |
| 9.4 | Training covers SWPs and regulations | 87.50 | 7.60 | 8.50 |
| Reporting (10) | | | | |
| 10.1 | Blame game hinders incident reports | 93.80 | 7.90 | 8.00 |
| 10.2 | Reporting lines and systems are clear | 93.80 | 7.60 | 8.00 |
| 10.3 | Reports lead to reviews and improvements | 93.80 | 7.40 | 8.00 |
| 10.4 | Incident reporting is nurtured and rewarded | 81.30 | 7.40 | 7.00 |
| 10.5 | Incident reporting leads to better SWPs | 87.50 | 7.60 | 8.00 |
| 10.6 | Workers are willing to report incidents | 87.50 | 7.60 | 8.00 |
| Information sharing (11) | | | | |
| 11.1 | SWP information is shared timeously | 75.00 | 7.20 | 8.00 |
| 11.2 | Safety information is in multiple languages | 75.00 | 6.70 | 7.50 |
| 11.3 | Voluntary safety information-sharing exists | 75.00 | 6.50 | 7.50 |
| 11.4 | New safety regulations are shared timeously | 75.00 | 7.20 | 8.00 |
| 11.5 | Safety concerns receive timely attention | 81.30 | 7.60 | 8.50 |
| Management contributions (12) | | | | |
| 12.1 | Regular safety inspection is expedited | 81.30 | 7.30 | 8.00 |
| 12.2 | Safety equipment is of adequate quality | 93.80 | 7.70 | 8.00 |
| 12.3 | Safety equipment is accessible and available | 93.80 | 7.70 | 8.00 |
| 12.4 | Safety first is applied during work pressure | 87.50 | 7.10 | 7.50 |
| 12.5 | Overtime work is controlled | 93.80 | 7.60 | 8.00 |
| 12.6 | Blame game because of accidents is prohibited | 93.80 | 7.70 | 8.00 |
| Worker contributions (13) | | | | |
| 13.1 | Workers encourage one another to be safe | 81.30 | 7.30 | 8.00 |
| 13.2 | Workers keep worksites clean | 87.50 | 7.90 | 8.50 |
| 13.3 | <i>Workers ignore safety rules</i> | 56.30 | 5.30 | 5.50 |
| 13.4 | <i>Workers take short cuts to complete tasks</i> | 68.80 | 5.80 | 6.50 |
| 13.5 | Workers use SWPs to get the job done | 93.80 | 7.40 | 8.00 |
| Supervisor contributions (14) | | | | |
| 14.1 | Supervisors allow safety suggestions | 81.30 | 7.40 | 8.00 |
| 14.2 | Supervisors disallow safety violations | 87.50 | 7.00 | 7.00 |
| 14.3 | Supervisors prioritise productivity | 75.00 | 6.60 | 7.00 |

| S/N | Positive safety culture core elements and their leading indicator metrics | % Response (5-10) | Importance Mean | Importance Median |
|------|---|-------------------|-----------------|-------------------|
| 14.4 | Supervisors ignore SWP deviations | 75.00 | 5.60 | 6.00 |

Note: Consensus was attained on all the leading indicator metrics in black and they were retained, but consensus was not attained on the *blue italicised* leading indicator metrics and they were dropped.

4.4. Discussion of Delphi Results Based on Round 3

Eighty-seven leading indicators were identified from the findings of a rigorous literature review to constitute the questions of the Delphi Round 1, which were sent by email to 31 health and safety experts in the major cities of Ghana. These 87 leading indicator metrics were categorised under 14 core health and safety elements, namely: management concerns, worksite norms, safe work procedure, collective responsibility (brother/s keeper), job satisfaction, equipment and plant, hazards and risks, adaptability and flexibility, education and training, reporting, information sharing, management contributions, worker contributions and supervisor contributions. In Round 1, consensus was attained on 83 of the 87 indicators and they were retained for Round 2, while two indicators were edited and accepted. In Round 2, consensus was attained on 80 indicators and they were retained. In Round 3, one leading indicator metric was found to have been repeated and was removed. At the end of the Delphi process, consensus was attained on 80 indicators, which were retained. Seven factors, “work is repetitive and boring”, “work is done purely for salaries and wages” that measured job satisfaction, “safety is ignored to get the job done”, “prohibited work activities are expedited”, “drift to safety violations is allowed” that measured hazards and risks, and “workers ignore safety rules” and “workers take short cuts to complete tasks” that measured workers contributions, were dropped because consensus was not attained. The 80 indicators were accepted by the experts as being necessary to establish a positive safety culture among construction SMEs in Ghana to improve safety performance. Table 4.5 contains a summary of the results from Round 1 to Round 3 of the Delphi survey.

4.4.1. Management Concerns

Management concerns were identified as playing a major role in the establishment of positive safety culture among construction SMEs. According to Deepak and Mahesh (2022), for construction SMEs to establish and maintain a strong positive safety culture, management concerns and knowledge about safety within the company are important. All the eight leading indicator metrics intended to measure management concerns were rated by the experts as being very important to having a major impact on safety culture among construction SMEs and were retained. The ratings of the experts during the Delphi study supported the idea that management concerns about safety culture are necessary to promote a positive safety culture among construction SMEs in Ghana. Mian *et al.* (2021) indicated that, without management concerns and supervision, it is difficult for a positive safety culture to evolve in any organisation.

4.4.2. Worksite Norms

According to Naji *et al.* (2022), the settings, standards, models or patterns within which construction workers work, have significant effects on their safety performance on a worksite. This implies that worksite norms have a major impact on positive safety culture. This was confirmed by the experts when they rated all the indicators that measured worksite norms as being very important to having a major impact on establishing a positive safety culture to improve the safety performance of construction SMEs. This finding concurred with the results obtained from Rounds 1 and 2 of the Delphi survey.

4.4.3. Safe Work Procedure

Safe work procedure was measured using twelve leading indicator metrics. All twelve indicators were accepted by the experts as being necessary to having an impact on safety culture. This result concurred with the assertion by Emuze (2022) that safe work procedure is one of the most important elements of promoting the safety of workers on construction sites. Emuze (2022) stated further that one of the major causes of poor or negative safety culture among construction SMEs is continuous deviations from safe work procedures on site. When safe work procedures are followed, construction workers are motivated to make fewer errors, hence reducing the rates of accidents. Thus, for the experts to have accepted all twelve indicators to measure safe work procedures was a step towards establishing a positive safety

culture among construction SMEs in Ghana. This result concurred with the results in the Delphi Rounds 1 and 2.

4.4.4. Collective Responsibility

Collective responsibility was measured using seven leading indicators, which were rated by the experts as being very important to having a major impact on positive safety culture. This result supported the calls by several scholars (Adaku *et al.*, 2021; Schulman, 2020; Guasta & Lauriski, 2019; Loosemore & Malouf, 2019) who advocated that, when there is health and safety co-operation between managers and employees and between employees themselves, it creates a sense of collective responsibility for safe work among construction workers. This motivates every worker to work in a safe atmosphere, knowing that everybody cares about each other's safety, which is a sign of positive safety culture. This result also concurred with the results of Rounds 1 and 2 of the Delphi survey where more than 50% of the experts rated all the indicator metrics as being very important to having a major impact on positive safety culture to improve the safety performance of construction SMEs.

4.4.5. Job Satisfaction

Six leading indicators were used to measure job satisfaction. The findings from the Delphi survey indicated that consensus was not attained on two indicators: “work is repetitive and boring” and “work is done purely for salaries and wages”, and they were rejected. Overall, four indicators were rated with median values within the median threshold for this survey and were retained. The accepted indicators were edited as follows: “work uses skills and talents” was rephrased to “workers use skills and talents”; “achievements and progress is rewarded” was also rephrased to “achievements and progress are rewarded”; and “motivation to improved SWP at work” was changed to “motivation to improve SWP at work”, on all of which consensus was achieved and they were retained. This confirmed the claim made by Hutajulu *et al.* (2021) and Siuta *et al.* (2022) that there is a positive relationship between positive safety culture and job satisfaction in that, when workers of construction SMEs enjoy the existence of positive safety culture, they are satisfied with their jobs and work with less errors in order to avoid accidents.

4.4.6. Equipment and Plant

Equipment and plant were measured using three leading indicator metrics. More than 94% of the experts rated all three as being very important to having a major impact on safety culture, with a median value of 9. These findings concurred with the claims by Durdyev *et al.* (2018) that construction equipment and plant are the essentials of any construction project since they are needed to transform any architect's drawings into a complete building. Agyekum *et al.* (2021) also reported that unsafe operation, poor maintenance and the wrong use of equipment and plant undermine any safety performance programme among construction SMEs, leading to a negative safety culture. Well-maintained equipment and plant, with well-trained operators, and the availability of equipment and plant when needed, would not only lead to an improved safety culture, but would also lead to increased productivity within construction SMEs (Aadal *et al.*, 2014). This result also concurred with the results of Rounds 1 and 2 of the Delphi survey.

4.4.7. Hazards and risks

Hazards and risks were measured using nine leading indicators, on six of which consensus was attained and they were retained. Three indicator metrics were given a median score of 5, which was within the median threshold of 5-10 set for the survey. Although only 44% of the experts rated "SWP is violated to get the job done" with a median value of 4, it was retained. If "safety is ignored to get the job done", "prohibited work activities are expedited" and "drift to safety violation is allowed", this would create more risk of accidents within construction SMEs, and result in a negative safety culture. According to Bavafa *et al.* (2018), construction sites are hazardous because of the nature of the work environment, extensive use of sophisticated plant, heavy equipment, and the multiplicity of operations that account for the existence of a negative safety culture among construction SMEs. This implies that construction SMEs must establish a positive safety culture among their employees to help them to identify risks and hazardous situations on construction sites in order to avoid injuries, accidents and fatalities.

4.4.8. Adaptability and Flexibility

Four leading indicators were used to measure adaptability and flexibility. Consensus was attained on all four indicators and they were retained as being necessary to having a major impact on a positive culture of safety among construction SMEs in Ghana. This implied that, if

managers and employees of construction SMEs were mindful of safety-related issues in their daily activities, safety culture would be upheld firmly in these companies.

4.4.9. Education and Training

The quality of health and safety of workers in construction SMEs is the product of acceptable levels of successful education and training that each has undergone (Claxton *et al.*, 2022). Williams *et al.* (2020) argued that providing education and training for workers in construction SMEs is a positive move towards improving the state of safety culture in a firm. All four indicators that measured education and training were rated by the experts as being very important with a median score of 9. These results concurred with the findings from the literature reviewed that education and training of workers is very necessary in addressing the negative health and safety records of construction SMEs in Ghana, because educating and training employees significantly improves the safety behaviours of these employees (Wu *et al.*, 2010). This result also concurred with the results of Rounds 1 and 2 of the Delphi survey.

4.4.10. Reporting

Six indicators were used to measure reporting. Consensus was attained on all six indicators and they were retained. These indicators were given a high median score of 7-8, confirming the opinions and judgements of the experts that, if accidents and near misses were reported early and actions were taken at the right time, this would lead to considerable reductions in accidents on construction sites. According to Deepak and Mahesh (2022), there should be a robust accident reporting system among construction SMEs to eliminate the “fear of blame” in order to improve safety culture in construction SMEs. This indicated that, when construction workers are aware of their responsibilities to report injuries, accidents and fatalities on construction sites, they are motivated to keep the sites safe to establish a strong safety culture. Williams *et al.* (2020) supported this finding by stating that, when there is no concern for why accidents occur on construction sites and why these accidents are not reported, this hinders how these accidents must be prevented which is a sign of a negative safety culture among construction SMEs. Therefore, it is necessary to ensure that there is an effective accident reporting framework within construction SMEs to eliminate the occurrences of injuries, accidents and fatalities (Boadu *et al.*, 2021).

4.4.11. Information Sharing

Health and safety information-sharing was measured using five leading indicators that would help to establish a positive safety culture among construction SMEs. Findings of previous research have proven that, when employees of construction SMEs have greater access to a suitable health and safety information-sharing system, a positive safety culture would be upheld firmly in the companies (Deepak & Mahesh, 2022). Yorio *et al.* (2019) advocated that, whenever there is lack of safety information-sharing among workers of construction SMEs, workers would have low interest in safety culture programmes within the firms because this would reduce the trust among co-workers. Consensus was attained on all five indicators that measured information-sharing and they were retained. More than 75% of the experts acknowledged that these indicators are very important, with median values between 7 and 8. This affirmed the opinions of the experts that, if information-sharing were well addressed, it would promote a positive culture of safety within the construction industry. This result also concurred with the results of Rounds 1 and 2 of the Delphi survey.

4.4.12. Management Contributions

According to Bieder and Callari (2020), management contributions to safety performance among construction SMEs is crucial because it is management's responsibility to develop safety procedures that are consistent, clear and easy to follow by all the construction workers, to create uniform safety instructions and ensure their enforcement at all levels within the company, to develop safety attitudes among the workers through meetings, training, bulletins and safety walks, and also to provide every worker with enough safety information about the expectations regarding everybody's safety responsibilities in the company. This affirmed the opinion of the experts when they rated all six indicators that measured management contributions as being very important for the safety performance of construction SMEs. The indicator, "safety equipment is off adequate quality" was edited to "safety equipment is of adequate quality". The high rating of all six indicators by the experts was a confirmation of the importance of management's contributions towards enhancing safety performance among construction SMEs. This result also concurred with the results of Rounds 1 and 2 of the Delphi survey.

4.4.13. Worker Contributions

In the case of worker contributions, five indicators were used to measure this core element, on three of which consensus was attained and they were retained. Consensus was not attained on two indicators: “workers ignore safety rules” and “workers take short cuts to complete tasks”, and, therefore, they were dropped even though they had median scores within the acceptable range. These results meant that, if workers ignore safety rules and take short cuts in completing tasks on construction sites, it would undermine the safety performance of construction SMEs. The result supported the calls by Awais-E-Yazdan and Hassan (2022) that workers of construction SMEs must attend the required health and safety training, they must be responsible in making construction sites free from hazards, follow all health and safety regulations and procedures, participate voluntarily in health and safety-related matters, and wear the appropriate personal protective equipment (PPE) for a specific task in order to improve the health and safety performances of construction SMEs. This result also concurred with the results of Rounds 1 and 2 of the Delphi survey.

4.4.14. Supervisor Contributions

Four indicators were used to measure supervisor contributions and all four were rated by the experts as being very important. The indicator “supervisors allow safety suggest” was edited to “supervisors allow safety suggestions”. Therefore, the experts confirmed that the involvement of supervisors in safety performance by allowing safety suggestions from workers, and employees disallowing safety violations on construction sites would increase safety performance significantly among construction SMEs in Ghana. Haas (2020) argued that supervisors on construction sites must motivate workers to comply with health and safety practices by rewarding compliance and punishing non-compliance by workers, by sharing knowledge among workers, and provide emotional support for workers in stress to improve the health and safety performance among the workforce and the company at large.

Table 4.5: Combined results of Delphi survey R1, R2 and R3 of importance

| S/N | Positive safety culture core elements and their leading indicator metrics | Importance Median | % response (50-100) | Importance Median | % response (50-100) | Importance Median | % response (50-100) |
|-----|---|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|
| | | R1 | R1 | R2 | R2 | R3 | R3 |
| | Management concerns (1) | | | | | | |
| 1.1 | Safe working conditions enforcement | 7.50 | 83.30 | 8.00 | 88.20 | 8.00 | 87.50 |
| 1.2 | Zero tolerance for safety violations | 7.50 | 77.80 | 8.00 | 88.20 | 8.00 | 87.50 |
| 1.3 | Monitor and correct safety errors | 7.00 | 77.80 | 8.00 | 88.20 | 7.00 | 81.30 |
| 1.4 | Safety first is applied to all at work | 7.00 | 77.80 | 8.00 | 82.40 | 7.50 | 81.30 |
| 1.5 | Safety resources are prioritised | 6.50 | 72.20 | 7.00 | 82.40 | 7.00 | 81.30 |
| 1.6 | Safe operations are prioritised | 7.00 | 77.80 | 9.00 | 82.40 | 7.50 | 81.30 |
| 1.7 | Well-being of workers is prioritised | 8.50 | 94.40 | 9.00 | 100.00 | 8.00 | 93.80 |
| 1.8 | Health of workers is prioritised | 9.00 | 94.40 | 9.00 | 94.10 | 9.00 | 93.80 |
| | Worksite norms (2) | | | | | | |
| 2.1 | Equipment, tools and plant are used safely | 8.00 | 94.40 | 8.00 | 100.00 | 8.00 | 100.00 |
| 2.2 | Safety is improved continuously | 7.50 | 83.30 | 9.00 | 88.20 | 8.00 | 87.50 |
| 2.3 | Hazard awareness and control are executed | 8.00 | 88.90 | 8.00 | 94.10 | 8.00 | 93.80 |
| 2.4 | Risk awareness and control are executed | 8.00 | 88.90 | 9.00 | 94.10 | 8.00 | 93.80 |
| 2.5 | Accidents and near misses are mitigated | 8.50 | 88.90 | 9.00 | 94.10 | 8.00 | 93.80 |
| 2.6 | Workers make safety suggestions | 7.50 | 83.30 | 8.00 | 82.40 | 8.00 | 87.50 |
| 2.7 | Workers contribute to safety improvement | 8.00 | 83.30 | 9.00 | 88.20 | 8.00 | 87.50 |
| 2.8 | Workers are involved in safety planning | 8.00 | 72.20 | 9.00 | 88.20 | 8.00 | 87.50 |
| | Safe work procedure (3) | | | | | | |
| 3.1 | At-risk work is flagged by co-workers | 6.50 | 88.90 | 7.00 | 94.10 | 7.00 | 93.80 |
| 3.2 | Safety instructions are reinforced on site | 8.00 | 88.90 | 9.00 | 94.10 | 8.00 | 93.80 |
| 3.3 | Unsafe acts are monitored and corrected | 8.00 | 83.30 | 9.00 | 94.10 | 8.50 | 93.80 |
| 3.4 | Unsafe conditions are corrected | 8.50 | 88.90 | 9.00 | 94.10 | 8.50 | 93.80 |
| 3.5 | Fatigue is monitored and managed | 8.00 | 77.80 | 8.00 | 88.20 | 8.00 | 87.50 |
| 3.6 | Work pressure is monitored and managed | 8.00 | 77.80 | 8.00 | 88.20 | 8.00 | 87.50 |
| 3.7 | Safety audits are conducted regularly | 8.50 | 88.90 | 8.00 | 94.10 | 8.50 | 93.80 |
| 3.8 | Safety inspections are conducted regularly | 9.00 | 88.90 | 9.00 | 94.10 | 9.00 | 93.80 |
| 3.9 | Methods statements comply with SWP | 7.50 | 83.30 | 8.00 | 88.20 | 8.00 | 87.50 |

| S/N | Positive safety culture core elements and their leading indicator metrics | Importance Median | % response (50-100) | Importance Median | % response (50-100) | Importance Median | % response (50-100) |
|------|---|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|
| 3.10 | Task execution complies with SWP | 8.00 | 88.90 | 8.00 | 88.20 | 8.00 | 93.80 |
| 3.11 | Work is completed in a safe manner | 8.50 | 88.90 | 9.00 | 94.10 | 8.00 | 93.80 |
| 3.12 | New workers are taught to follow SWP | 9.00 | 83.30 | 9.00 | 88.20 | 9.00 | 87.50 |
| | Collective responsibility (brother's keeper) (4) | | | | | | |
| 4.1 | Co-workers often discuss safety hazards | 8.00 | 77.80 | 9.00 | 82.40 | 8.50 | 81.30 |
| 4.2 | Co-workers care for the safety of each other | 8.50 | 83.30 | 9.00 | 88.20 | 8.00 | 87.50 |
| 4.3 | Co-workers care about equipment safety | 8.00 | 77.80 | 8.00 | 82.40 | 8.00 | 81.30 |
| 4.4 | Co-workers discuss accident prevention | 8.00 | 77.80 | 9.00 | 82.40 | 8.00 | 81.30 |
| 4.5 | Work pressure must not violate safety | 8.00 | 77.80 | 8.00 | 82.40 | 8.00 | 81.30 |
| 4.6 | Co-workers report safety violations | 8.50 | 77.80 | 9.00 | 88.20 | 8.00 | 87.50 |
| 4.7 | Co-workers raise alert to SWP violations | 7.50 | 83.30 | 8.00 | 94.10 | 7.50 | 93.80 |
| | Job satisfaction (5) | | | | | | |
| 5.1 | <i>Work is repetitive and boring</i> | 5.00 | 50.00 | 6.00 | 58.80 | 5.50 | 62.50 |
| 5.2 | Work is inspiring and fulfilling | 5.00 | 55.60 | 7.00 | 70.60 | 7.00 | 75.0 |
| 5.3 | Workers use skills and talents | 6.50 | 72.20 | 7.00 | 70.60 | 6.50 | 81.3 |
| 5.4 | Achievements and progress are rewarded | 6.50 | 72.20 | 7.00 | 76.50 | 6.50 | 87.5 |
| 5.5 | Motivation to improve SWP is at work | 7.50 | 72.20 | 8.00 | 76.50 | 7.00 | 75.0 |
| 5.6 | <i>Work is done purely for salaries and wages</i> | 6.00 | 66.70 | 6.00 | 70.60 | 6.00 | 75.0 |
| | Equipment and plant (6) | | | | | | |
| 6.1 | Suitable plant and equipment are available | 9.00 | 83.30 | 9.00 | 82.40 | 9.00 | 93.80 |
| 6.2 | Routine upkeep is performed on plant | 9.00 | 83.30 | 9.00 | 88.20 | 8.50 | 100.00 |
| 6.3 | Operators are trained to use equipment | 9.50 | 88.90 | 9.00 | 94.10 | 8.50 | 93.80 |
| | Hazards and risks (7) | | | | | | |
| 7.1 | <i>Safety is ignored to get the job done</i> | 5.50 | 66.70 | 5.00 | 58.80 | 5.00 | 56.30 |
| 7.2 | <i>Prohibited work activities are expedited</i> | 5.00 | 61.10 | 5.00 | 58.80 | 5.00 | 62.50 |
| 7.3 | SWP is violated to get the job done | 5.50 | 55.60 | 5.00 | 52.90 | 4.00 | 43.80 |
| 7.4 | <i>Drift to safety violation is allowed</i> | 5.00 | 61.10 | 5.00 | 58.80 | 5.00 | 56.30 |
| 7.5 | Safety rules and policies are clear | 8.00 | 88.90 | 9.00 | 94.10 | 8.00 | 93.80 |
| 7.6 | Workplace SWP is understood | 8.50 | 83.30 | 8.00 | 94.10 | 7.50 | 93.80 |

| S/N | Positive safety culture core elements and their leading indicator metrics | Importance Median | % response (50-100) | Importance Median | % response (50-100) | Importance Median | % response (50-100) |
|---|---|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|
| 7.7 | Unsafe acts and conditions are mitigated | 8.00 | 83.30 | 8.00 | 94.10 | 8.00 | 93.80 |
| 7.8 | Hazard reporting is encouraged on sites | 8.00 | 77.80 | 9.00 | 82.40 | 8.00 | 81.30 |
| 7.9 | We collectively undertake safety analysis | 8.00 | 83.30 | 8.00 | 88.20 | 7.50 | 87.50 |
| Adaptability and flexibility (8) | | | | | | | |
| 8.1 | Workers use SWP to execute tasks | 8.00 | 77.80 | 8.00 | 88.20 | 7.50 | 87.50 |
| 8.2 | Safe equipment and plant are used on sites | 9.00 | 83.30 | 9.00 | 94.10 | 8.00 | 100.00 |
| 8.3 | Safety promotion is embraced on sites | 9.00 | 77.80 | 9.00 | 88.20 | 8.00 | 87.50 |
| 8.4 | Mindfulness in relation to safety exists | 9.00 | 77.80 | 9.00 | 88.20 | 8.50 | 87.50 |
| Education and training (9) | | | | | | | |
| 9.1 | Safety inductions are detailed and timely | 9.00 | 83.30 | 9.00 | 88.20 | 9.00 | 87.50 |
| 9.2 | Tool box talks are enriched with examples | 8.50 | 77.80 | 9.00 | 88.20 | 9.00 | 87.50 |
| 9.3 | Safety information is provided regularly | 9.00 | 77.80 | 9.00 | 88.20 | 9.00 | 87.50 |
| 9.4 | Training covers SWPs and regulations | 8.50 | 83.30 | 9.00 | 88.20 | 8.50 | 87.50 |
| Reporting (10) | | | | | | | |
| 10.1 | Blame game hinders incident reports | 8.00 | 77.80 | 8.00 | 88.20 | 8.00 | 93.80 |
| 10.2 | Reporting lines and systems are clear | 8.00 | 88.90 | 8.00 | 94.10 | 8.00 | 93.80 |
| 10.3 | Reports lead to reviews and improvements | 8.00 | 83.30 | 9.00 | 94.10 | 8.00 | 93.80 |
| 10.4 | Incident reporting is nurtured and rewarded | 7.00 | 77.80 | 8.00 | 82.40 | 7.00 | 81.30 |
| 10.5 | Incident reporting leads to better SWPs | 8.00 | 83.30 | 8.00 | 88.20 | 8.00 | 87.50 |
| 10.6 | Workers are willing to report incidents | 8.00 | 77.80 | 9.00 | 88.20 | 8.00 | 87.50 |
| Information sharing (11) | | | | | | | |
| 11.1 | SWP information is shared timeously | 8.00 | 72.20 | 9.00 | 76.50 | 8.00 | 75.00 |
| 11.2 | Safety information is in multiple languages | 7.00 | 66.70 | 8.00 | 70.60 | 7.50 | 75.00 |
| 11.3 | Voluntary safety information-sharing exists | 7.50 | 72.20 | 8.00 | 76.50 | 7.50 | 75.00 |

| S/N | Positive safety culture core elements and their leading indicator metrics | Importance Median | % response (50-100) | Importance Median | % response (50-100) | Importance Median | % response (50-100) |
|------|---|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|
| 11.4 | New safety regulations are shared timeously | 8.00 | 72.20 | 8.00 | 76.50 | 8.00 | 75.00 |
| 11.5 | Safety concerns receive timely attention | 8.50 | 72.20 | 9.00 | 82.40 | 8.50 | 81.30 |
| | Management contributions (12) | | | | | | |
| 12.1 | Regular safety inspection is expedited | 8.00 | 72.20 | 8.00 | 82.40 | 8.00 | 81.30 |
| 12.2 | Safety equipment is of adequate quality | 8.00 | 83.30 | 8.00 | 94.10 | 8.00 | 93.80 |
| 12.3 | Safety equipment is accessible and available | 8.50 | 83.30 | 9.00 | 94.10 | 8.00 | 93.80 |
| 12.4 | Safety first is applied during work pressure | 7.50 | 77.80 | 8.00 | 88.20 | 7.50 | 87.50 |
| 12.5 | Overtime work is controlled | 8.00 | 83.30 | 8.00 | 94.10 | 8.00 | 93.80 |
| 12.6 | Blame game because of accidents is prohibited | 8.00 | 83.30 | 8.00 | 94.10 | 8.00 | 93.80 |
| | Worker contributions (13) | | | | | | |
| 13.1 | Workers encourage one another to be safe | 8.00 | 77.80 | 8.00 | 82.40 | 8.00 | 81.30 |
| 13.2 | Workers keep worksite clean | 8.50 | 77.80 | 9.00 | 82.40 | 8.50 | 87.50 |
| 13.3 | <i>Workers ignore safety rules</i> | 6.50 | 66.70 | 7.00 | 64.70 | 5.50 | 56.30 |
| 13.4 | <i>Workers take short cuts to complete tasks</i> | 7.50 | 77.80 | 7.00 | 76.50 | 6.50 | 68.80 |
| 13.5 | Workers use SWPs to get the job done | 8.00 | 77.80 | 8.00 | 94.10 | 8.00 | 93.80 |
| | Supervisor contributions (14) | | | | | | |
| 14.1 | Supervisors allow safety suggestions | 8.50 | 77.80 | 9.00 | 82.40 | 8.00 | 81.30 |
| 14.2 | Supervisors disallow safety violations | 7.00 | 77.80 | 8.00 | 88.20 | 7.00 | 87.50 |
| 14.3 | Supervisors prioritise productivity | 8.00 | 77.80 | 8.00 | 88.20 | 7.00 | 75.00 |
| 14.4 | Supervisors ignore SWP deviations | 6.50 | 83.30 | 7.00 | 82.40 | 6.00 | 75.00 |

Note: Consensus was attained on all the leading indicator metrics in black and they were retained, but consensus was not attained on the *blue italicised* leading indicator metrics and they were dropped

4.5. Conceptual Framework for Positive Safety Culture for Construction SMEs

The conceptual framework for the study is presented in Figure 4.1. The refined conceptual framework for positive safety culture was developed with five constructs. All five constructs were retained, namely: safety commitment, safety information, safety adaptability, safety awareness and safety behaviour. No new constructs were added at the end of the Delphi survey.

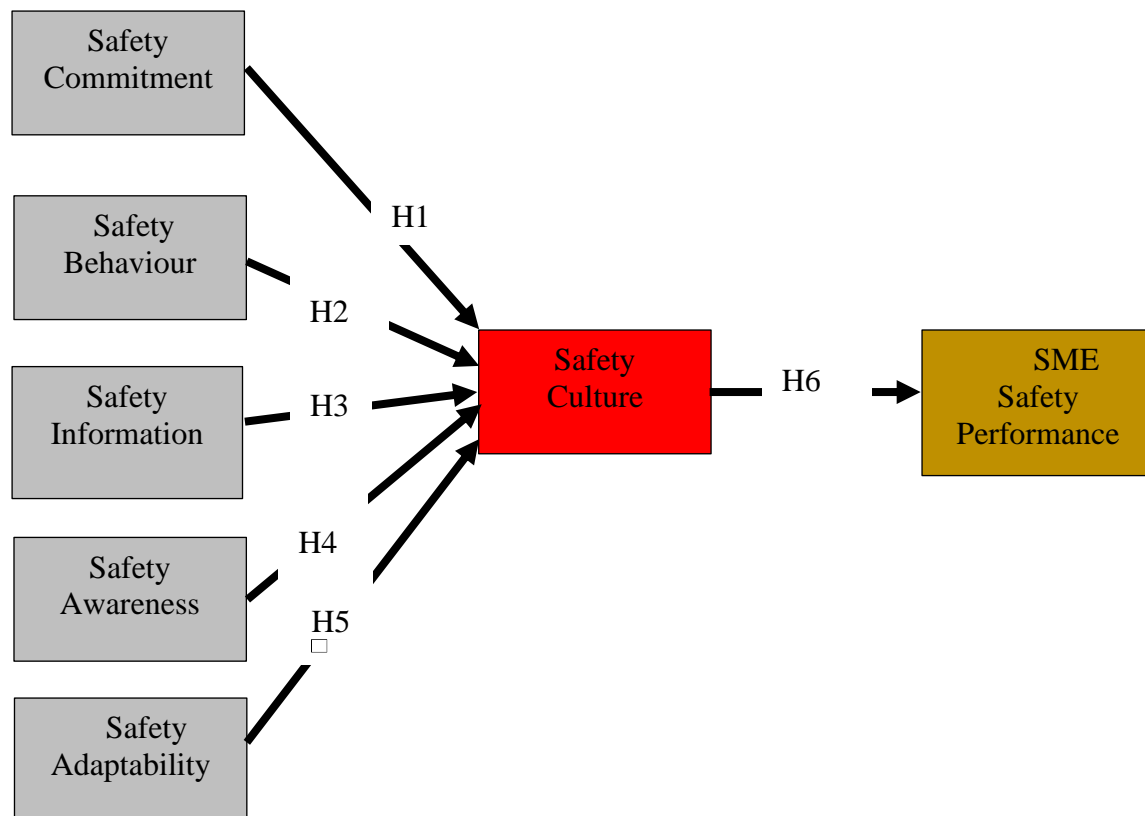


Figure 4.1: Refined conceptual framework for positive safety culture

4.6. Summary of Revised Hypotheses

H1: Safety commitment positively influences the safety culture of construction SMEs

H2: Safety behaviour positively influences the safety culture of construction SMEs

H3: Safety information positively influences the safety culture of construction SMEs

H4: Safety awareness positively influences the safety culture of construction SMEs

H5: Safety adaptability positively influences the safety culture of construction SMEs

H6: Safety culture positively influences the safety performance of construction SMEs

4.7. Chapter Summary

This chapter began with the demographic characteristics of the health and safety experts that constituted the Delphic panel. The results of the three-round Delphi survey were also presented. The results from Round 3 of the Delphi survey were discussed in the chapter. Overall, 87 leading indicator metrics that were grouped under 14 core elements, were discussed. The refined conceptual framework for a positive safety culture that would improve the safety performance of construction SMEs was proposed for validation among construction SMEs. The validation of the refined conceptual framework is discussed in the following chapter.

CHAPTER FIVE: RESULTS OF THE SURVEY OF CONSTRUCTION SMEs

5.1. Introduction

In the previous chapter, the conceptual framework was discussed and presented. This conceptual framework was compiled after the Delphi survey. The theory behind the hypothesised framework for positive safety culture was based on the findings of a literature review and on the opinions of health and safety experts obtained during the Delphi survey. In this chapter, the results of the quantitative survey conducted among construction SMEs are presented.

The analysis of data about construction SMEs was undertaken in the following three stages:

- Descriptive data analysis;
- Multi-variate correlational data analysis, including Confirmatory Composite Analysis (CCA);
- Analysis of the influence of demographic variables.

5.2. Descriptive Statistics

The specific demographics of the respondents are discussed in this section. The background information of the respondents, including their personal information and the information about the company for which they worked, were examined using descriptive statistics such as percentages, means, and standard deviations. A total of 450 questionnaires were distributed among construction SMEs, 350 using drop and collect, and 100 by email. After the survey, a total of 284 questionnaires were received, representing a response rate of 63.11%.

5.2.1. Demographic Profile of the Respondents

Table 5.1: Position in the company

| Position | Frequency | Percentage (%) |
|-------------------------|-----------|----------------|
| Owner | 29 | 10.2 |
| Managing Director | 48 | 16.9 |
| Owner/Managing Director | 24 | 8.5 |
| Project Manager | 89 | 31.3 |
| Others | 94 | 33.1 |

Table 5.1 shows that 10.2% of the respondents were owners, 16.9% were managing directors, 31.3% were project managers, while 8.5% were owners/managing directors. Most of the respondents, representing 33.1%, occupied different positions in the construction SMEs such as architects, procurement officers, site managers and many more.

Table 5.2: Responsibility

| Position | Frequency | Percentage (%) |
|-----------------|-----------|----------------|
| Owner | 17 | 6.0 |
| Safety Officer | 181 | 63.7 |
| Site Agent | 34 | 12.0 |
| Project Manager | 39 | 13.7 |
| Others | 13 | 4.6 |

Table 5.2 shows that health and safety responsibilities were assigned to different categories of employees within the construction SMEs: 63.7% of the respondents were safety officers, 13.7% were project managers, 12.0% were site agents and 6.0% of the respondents were operating as owners responsible for health and safety at the same time as managing the company.

Table 5.3: Experience in the construction industry

| Years in the construction industry | Frequency | Percentage (%) |
|------------------------------------|-----------|----------------|
| 1-5 years | 59 | 20.8 |
| 6-10 years | 93 | 32.7 |
| 11-15 years | 71 | 25.0 |
| 16-20 years | 32 | 11.3 |
| 21-25 years | 12 | 4.2 |
| 26-30 years | 11 | 3.9 |
| 31-35 years | 1 | 0.4 |
| 36 years and above | 5 | 1.8 |

It can be seen from Table 5.3, that 32.7% of the respondents had 6-10 years' experience working in the construction industry and only 1.8% had worked for over 36 years in the construction industry. It can also be seen that 20.8% had less than 6 years' experience working in the construction industry.

Table 5.4: Number of years in the current construction SME

| Years in the current construction SME | Frequency | Percentage (%) |
|--|------------------|-----------------------|
| 1-5 years | 144 | 50.7 |
| 6-10 years | 91 | 32.0 |
| 11-15 years | 31 | 10.9 |
| 16-20 years | 9 | 3.2 |
| 21-25 years | 4 | 1.4 |
| 26-30 years | 1 | 0.4 |
| 36 years and above | 4 | 1.4 |

As shown in Table 5.4, 50.7% of the respondents had been working in the same construction SME for approximately 5 years. Only 1.4% had worked in the same construction SME for more than 36 years.

Table 5.5: Highest education qualification

| Highest education qualification | Frequency | Percentage (%) |
|--|------------------|-----------------------|
| No Qualification | 2 | 0.7 |
| WASSCE Certificate | 4 | 1.4 |
| HND/Diploma | 72 | 25.4 |
| BSc. Degree | 111 | 39.1 |
| Master's Degree | 88 | 31.0 |
| Doctorate Degree | 5 | 1.8 |
| Other | 1 | 0.4 |

As shown in Table 5.5, 39.1% of the respondents had BSc. Degrees, 31.0% had Master's Degrees, 25.4% had an HND/Diploma, while 0.7% of the respondents had no educational qualification.

5.2.2. Company Demography Profiles

Table 5.6: Registration of company

| Company registered | Frequency | Percentage (%) |
|--------------------|-----------|----------------|
| Yes | 281 | 98.9 |
| No | 2 | 0.7 |

It can be seen from Table 5.6 that 281 of the construction SMEs, representing 98.9%, were registered with the Registrar General Department, while 0.7% were not yet registered.

Table 5.7: Company category

| Company category | Frequency | Percentage (%) |
|-------------------|-----------|----------------|
| Limited liability | 223 | 78.5 |
| Partnership | 9 | 3.2 |
| An enterprise | 49 | 17.3 |

Table 5.7 shows that 78.5% of the construction SMEs were registered as limited liability companies, 17.3% were registered as enterprises and 3.2% as partnerships.

Table 5.8: Company classification

| Company classification | Frequency | Percentage (%) |
|------------------------|-----------|----------------|
| D1K1 | 87 | 30.6 |
| D2K2 | 121 | 42.6 |
| D3K3 | 54 | 19.0 |
| D4K4 | 17 | 6.0 |

Table 5.8 shows that 121 of the construction SMEs, representing 42.6%, were classified as D2K2, 30.6% as D1K1, 19% as D3K3, and 6% as D4K4 which represents the lowest classification in the Ghanaian construction industry.

Table 5.9: Average annual total number of workers over the past three years

| Number of workers | Frequency | Percentage (%) |
|-------------------|-----------|----------------|
| Below 10 | 26 | 9.2 |
| 10-29 | 87 | 30.6 |
| 30-40 | 87 | 30.6 |
| Above 40 | 78 | 27.5 |

Table 5.9 shows that 30.6% of construction SMEs employed a total number of workers between 10 and 40, 27.5% employed above 40, while 9.2% employed below 10 workers.

Table 5.10: Annual turnover of construction SMEs over the past three years

| Total turnover over the past 3 years | Frequency | Percentage (%) |
|---|------------------|-----------------------|
| Below \$10,000.00 | 38 | 13.4 |
| \$10,000.00-\$50,000.00 | 68 | 23.9 |
| \$50,000.00-\$100,000.00 | 58 | 20.4 |
| Above \$100,000.00 | 69 | 24.3 |

Table 5.10 shows that the annual turnover of 24.3% of the construction SMEs was above \$100,000.00, while that of 13.4% was below \$10,000.00, the annual turnover of 23.9% and 20.4% was between \$10,000.00-\$50,000.00 and \$50,000.00-\$100,000.00. respectively.

Table 5.11: Types of construction SMEs

| Types of construction SMEs | Frequency | Percentage (%) |
|-----------------------------------|------------------|-----------------------|
| General contractor | 227 | 79.9 |
| Specialist contractor | 12 | 4.2 |
| Sub-contractor | 36 | 12.7 |
| Other | 3 | 1.1 |

Table 5.11 shows that 227 of the construction SMEs, representing 79.9%, operated in the Ghanaian construction industry as general contractors, 12.7% operated as sub-contractors, 4.2% operated as specialist contractors and only 1.1% operated as consultants.

5.3. Descriptive and Normality Analyses of Constructs

The results of the descriptive and normality statistics of the constructs are presented in this section. The descriptive statistics include the means and standard deviations for the constructs. Furthermore, normality tests were conducted using the Kolmogorov-Smirnov and Shapiro-Wilk methods (Field, 2013). The results are presented in Table 5.12

Table 5.12: Descriptive and normality results for Constructs

| Constructs | Descriptive Statistics | | Tests of Normality | | | | | |
|--|------------------------|----------------|---------------------------------|-----------|-------|--------------|-----------|-------|
| | Mean | Std. Deviation | Kolmogorov-Smirnov ^a | | | Shapiro-Wilk | | |
| | | | Statistic | <i>df</i> | Sig. | Statistic | <i>df</i> | Sig. |
| SCom | 4.03 | 0.613 | 0.109 | 282.000 | 0.000 | 0.926 | 282.000 | 0.000 |
| SI | 3.95 | 0.592 | 0.080 | 282.000 | 0.000 | 0.968 | 282.000 | 0.000 |
| SA | 3.94 | 0.587 | 0.096 | 282.000 | 0.000 | 0.964 | 282.000 | 0.000 |
| SB | 4.04 | 0.561 | 0.120 | 282.000 | 0.000 | 0.951 | 282.000 | 0.000 |
| SAw | 3.97 | 0.590 | 0.088 | 282.000 | 0.000 | 0.967 | 282.000 | 0.000 |
| SC | 3.99 | 0.543 | 0.126 | 282.000 | 0.000 | 0.945 | 282.000 | 0.000 |
| SP | 3.86 | 0.541 | 0.078 | 282.000 | 0.000 | 0.982 | 282.000 | 0.002 |
| a. Lilliefors Significance Correction | | | | | | | | |

Note: *SCom* (Safety commitment); *SB* (Safety behaviour); *SAw* (Safety awareness); *SI* (Safety information); *SA* (Safety adaptability); *SC* (Safety culture); *SP* (Safety performance)

The results in Table 5.12 show that the mean scores range from 3.86 to 4.04. Thus, most respondents had a positive perception of all the constructs, as the mean values exceeded the midpoint of 3.2 (Castro & Martins, 2010). Furthermore, the results presented in Table 5.13 established that all the constructs had *p*-values less than 0.05 ($p < 0.05$), which suggested the absence of normality of the data. Consequently, non-parametric statistical analytical techniques, such as the PLS-SEM, should be used for subsequent analysis (Hair *et al.*, 2019; Hair Jr, 2020; Mishra *et al.*, 2019).

5.4. Spearman Correlation Analysis

Table 5.13: Spearman Correlation matrix

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|-----------------------------------|---------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|----|
| 1. Responsibility | -- | | | | | | | | | | | | |
| 2. Industry Experience | 0.011 | -- | | | | | | | | | | | |
| 3. Experience in construction SME | -0.077 | .678** | -- | | | | | | | | | | |
| 4. Education | 0.067 | -.233** | -.292** | -- | | | | | | | | | |
| 5. No. of Employees | 0.041 | 0.053 | 0.109 | -.172** | -- | | | | | | | | |
| 6. Annual Turnover | 0.048 | 0.042 | .143* | -.193** | .661** | -- | | | | | | | |
| 7. Safety Commitment | -.201** | 0.025 | -0.032 | -0.063 | .243** | .244** | -- | | | | | | |
| 8. Safety Information | -.174** | 0.026 | -0.081 | 0.064 | 0.037 | 0.117 | .757** | -- | | | | | |
| 9. Safety Adaptability | -.197** | 0.029 | -0.007 | -0.066 | 0.087 | .169** | .780** | .784** | -- | | | | |
| 10. Safety Behaviour | -.177** | 0.031 | -0.024 | -0.070 | .139* | .201** | .838** | .732** | .772** | -- | | | |
| 11. Safety Awareness | -.224** | 0.029 | -0.049 | -0.054 | 0.064 | 0.128 | .778** | .775** | .798** | .759** | -- | | |
| 12. Overall Safety Culture | -.210** | 0.033 | -0.042 | -0.045 | 0.103 | .165* | .909** | .890** | .910** | .893** | .904** | -- | |
| 13. Overall Safety Perf. | -.210** | 0.031 | -0.074 | 0.038 | 0.043 | 0.094 | .604** | .692** | .644** | .605** | .613** | .682** | -- |

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed)

5.5. PLS-SEM Analysis

The non-normality and predictive nature of the data in this study necessitated the adoption of the PLS-SEM approach using SmartPLS 4 (Ringle *et al.*, 2020). The analysis involves measurement framework assessment, which covers the validity and reliability of latent variables, and the structural framework assessment (Hair *et al.*, 2019; Hair, 2020). Consequently, an analysis of the reliability and convergent validity of the measures was examined. Then, discriminant validity was assessed using the Heterotrait-Monotrait (HTMT) ratio (Hair *et al.*, 2019; Henseler *et al.*, 2015) Subsequently, the structural framework was examined in addition to IPMA analysis.

5.5.1. Measurement Framework Assessment (Confirmatory Composite Analysis)

As indicated earlier, the measurement framework assessment is focused on the validity and reliability of latent variables (Hair *et al.*, 2019; Hair, 2020). Thus, results of the reliability and convergent validity of the measures was examined and reported in Table 5.14. This was followed by discriminant validity assessment using the Heterotrait-Monotrait (HTMT) ratio (Hair *et al.*, 2019; Henseler *et al.*, 2015) reported in Table 5.15.

Table 5.14: Reliability and convergent validity results

| Constructs | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|------------------------|------------------|-------------------------------|-------------------------------|----------------------------------|
| Safety Adaptability | 0.883 | 0.887 | 0.909 | 0.588 |
| Safety Awareness | 0.728 | 0.757 | 0.844 | 0.644 |
| Safety Behaviour | 0.769 | 0.798 | 0.850 | 0.588 |
| Safety Commitment | 0.903 | 0.912 | 0.923 | 0.600 |
| Safety Information | 0.822 | 0.842 | 0.871 | 0.533 |
| Overall Safety Culture | 0.861 | 0.861 | 0.906 | 0.706 |
| SME Safety Performance | 0.847 | 0.859 | 0.887 | 0.568 |

The results shown in Table 5.14 proved that all the constructs had acceptable levels of construct reliability as well as convergent validity. Explicitly, each construct had reliability values above 0.70 (Cronbach's alpha ranges from 0.728 to 0.903; rho_a ranges from 0.757 to 0.912; rho_c varies from 0.844 to 0.923), and the AVEs are more than the threshold value of 0.50 (ranging from 0.533 to 0.706). Thus, it was evident that all the constructs displayed fitting construct reliability and convergent validity (Hair *et al.*, 2019; Shmueli *et al.*, 2019).

Table 5.15: Discriminant validity by HTMT criterion

| Constructs | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---------------------------|-------|-------|-------|-------|-------|-------|---|
| 1. SME Safety Performance | | | | | | | |
| 2. Safety Adaptability | 0.812 | | | | | | |
| 3. Safety Awareness | 0.827 | 0.721 | | | | | |
| 4. Safety Behaviour | 0.803 | 0.809 | 0.847 | | | | |
| 5. Safety Commitment | 0.792 | 0.697 | 0.792 | 0.759 | | | |
| 6. Safety Culture | 0.873 | 0.816 | 0.801 | 0.757 | 0.778 | | |
| 7. Safety Information | 0.859 | 0.794 | 0.838 | 0.856 | 0.777 | 0.869 | |

Discriminant validity of the constructs is reported using HTMT values, which are listed in Table 5.15. Each HTMT score was below the cut-off value of 0.90. This established that all of

the variables were distinct from one another, which is a necessary condition for discriminant validity (Hair *et al.*, 2019; Shmueli *et al.*, 2019).

5.5.2. Structural Framework Assessment (Hypotheses Testing)

Having established adequate reliability and validity of the measurement framework, the assessment of the structural paths is carried out in this section of the PLS-SEM analysis, including the multi-collinearity checks, direct and indirect effects, model's fit and explanatory power. The results, which are presented in Table 5.16 and Figure 5.1, were obtained from a bootstrapping procedure (5,000 sub-samples) (Hair, 2017; Hair *et al.*, 2019; Ringle *et al.*, 2020).

Table 5.16: Structural model results

| Paths | β | SE | <i>t</i> -statistics | <i>p</i> -values | VIF | Confidence Interval | |
|-------------------------|----------------------|-------------------------------|---------------------------------|------------------|-------|---------------------|-------|
| | | | | | | 2.5% | 97.5% |
| Direct Effects | | | | | | | |
| SCom => SC | 0.205 | 0.053 | 3.846 | 0.000 | 2.327 | 0.106 | 0.312 |
| SB => SC | -0.004 | 0.060 | 0.061 | 0.951 | 2.490 | -0.116 | 0.113 |
| SI => SC | 0.320 | 0.056 | 5.700 | 0.000 | 2.765 | 0.210 | 0.430 |
| SAw => SC | 0.137 | 0.058 | 2.373 | 0.018 | 2.178 | 0.021 | 0.246 |
| SA=> SC | 0.288 | 0.054 | 5.348 | 0.000 | 2.358 | 0.181 | 0.392 |
| SC => SP | 0.756 | 0.028 | 27.180 | 0.000 | 1.000 | 0.692 | 0.804 |
| Indirect Effects | | | | | | | |
| SCom => SC => SP | 0.155 | 0.041 | 3.767 | 0.000 | - | 0.072 | 0.231 |
| SB => SC => SP | -0.003 | 0.045 | 0.061 | 0.952 | - | -0.085 | 0.090 |
| SI => SC => SP | 0.242 | 0.042 | 5.738 | 0.000 | - | 0.162 | 0.326 |
| SAw => SC => SP | 0.104 | 0.044 | 2.361 | 0.018 | - | 0.016 | 0.187 |
| SA=> SC => SP | 0.218 | 0.042 | 5.162 | 0.000 | - | 0.140 | 0.304 |
| Model's Summary | | | | | | | |
| Constructs | R² | R² adjusted | Framework Fit using SRMR | | | | |
| SP | 0.571 | 0.570 | Saturated framework | | | | 0.059 |
| SC | 0.673 | 0.667 | Estimated framework | | | | 0.075 |

As presented in Table 5.16, the results demonstrated no multi-collinearity concerns, as all the VIF values were below 3, ranging from 1.000 to 2.765 (Hair *et al.*, 2019). Furthermore, the structural framework exhibited a good fit, as the SRMR values were less than 0.08 (Hu & Bentler, 1999). The R^2 values revealed that the structural model explained 57.1% and 67.3% of variation in safety performance and safety culture, respectively. Thus, the model demonstrated substantial explanatory power in predicting safety performance and safety culture (Hair *et al.*, 2019).

Regarding the direct effects, five out of the six direct paths (i.e. hypotheses) were significantly positive. Precisely, as demonstrated in Table 5.17 and Figure 5.1, safety commitment ($\beta = 0.205$; $SE = 0.053$; $t = 3.846$; $p = 0.000$; 95%CI [0.106; 0.312]) and safety information ($\beta = 0.320$; $SE = 0.056$; $t = 5.700$; $p = 0.000$; 95%CI [0.210; 0.430]) positively influenced safety culture significantly. Similarly, safety awareness ($\beta = 0.137$; $SE = 0.058$; $t = 2.373$; $p = 0.018$; 95%CI [0.021; 0.246]) and safety adaptability ($\beta = 0.288$; $SE = 0.054$; $t = 5.348$; $p = 0.000$; 95%CI [0.181; 0.392]) positively influenced safety culture significantly. However, safety behaviour ($\beta = -0.004$; $SE = 0.060$; $t = 0.061$; $p = 0.951$; 95%CI [-0.116; 0.113]) failed to predict safety culture significantly positively. Thus, hypotheses H1, H3, H4 and H5 were accepted. The last hypothesis (i.e. H6) was also supported because safety culture ($\beta = 0.756$; $SE = 0.028$; $t = 27.180$; $p = 0.000$; 95%CI [0.692; 0.804]) positively influenced safety performance significantly.

With the exception of safety behaviour, the results revealed further significant indirect effects of safety commitment ($\beta = 0.155$; $SE = 0.041$; $t = 3.767$; $p = 0.000$; 95% CI [0.072; 0.231]), safety information ($\beta = 0.242$; $SE = 0.042$; $t = 5.738$; $p = 0.000$; 95%CI [0.162; 0.326]), safety awareness ($\beta = 0.104$; $SE = 0.044$; $t = 2.361$; $p = 0.018$; 95%CI [0.016; 0.187]) and safety adaptability ($\beta = 0.218$; $SE = 0.042$; $t = 5.162$; $p = 0.000$; 95%CI [0.140; 0.304]) on safety performance through safety culture. These results suggested that safety culture mediates the influence of safety commitment, safety information, safety awareness and safety adaptability on safety performance. Thus, considering the presence of both significant direct and indirect effects, safety culture partially mediates the effects of safety commitment, safety information, safety awareness and safety adaptability on safety performance (Carrión *et al.*, 2017; Nitzl *et al.*, 2016).

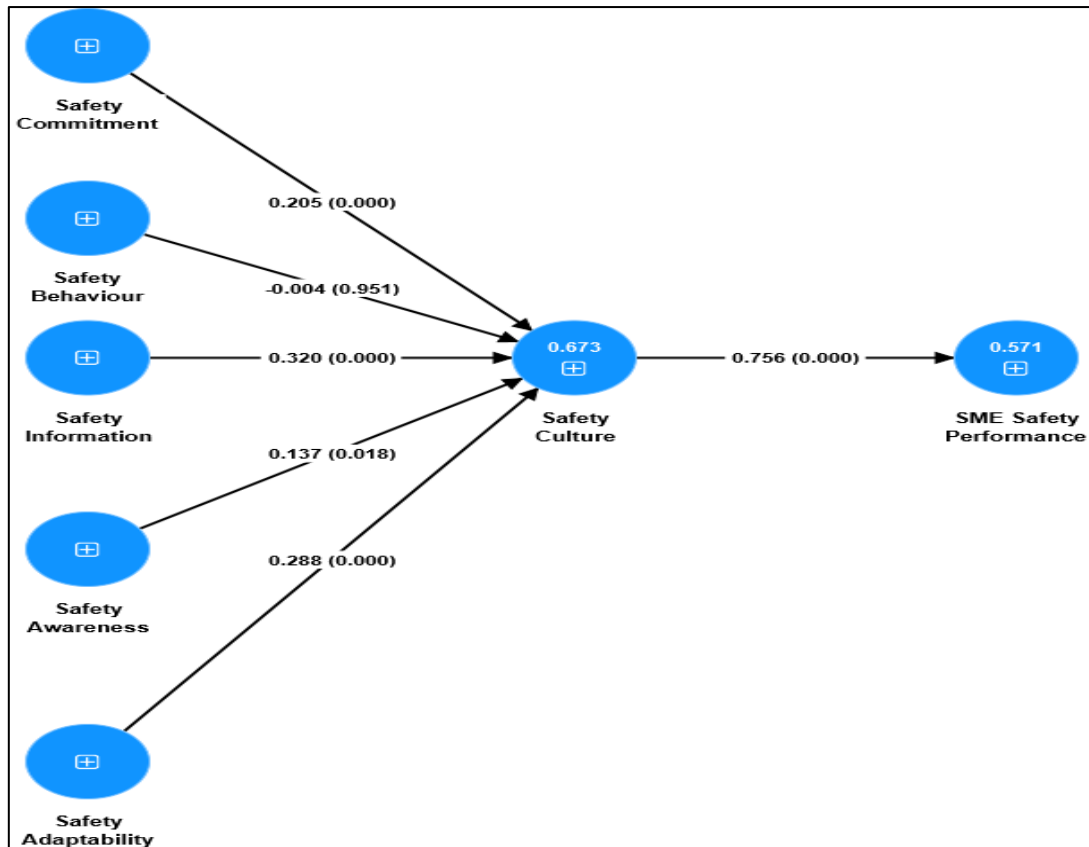


Figure 5.1: Structural framework results

5.5.3. Importance-Performance Map Analysis (IPMA)

In this study, IPMA, a forward-thinking analysis used in PLS-SEM, was used to comprehend the predictors of the investigated model better. Such an evaluation is crucial for prioritising management efforts effectively (Ramayah *et al.*, 2017; Ringle & Sarstedt, 2016; Saari *et al.*, 2021; Sarstedt *et al.*, 2014; Valaei & Jiroudi, 2016). Thus, the significance and efficacy of all predictors on the outcome measures of safety culture (Table 5.17 and Figure 5.2) and safety performance (Table 5.18 and Figure 5.3) are analysed in this section.

Table 5.17: IPMA for safety culture

| Predictors | Performance Index | Importance Index |
|---------------------|-------------------|------------------|
| Safety Adaptability | 71.304 | 0.288 |
| Safety Awareness | 75.832 | 0.137 |
| Safety Behaviour | 73.093 | -0.004 |
| Safety Commitment | 76.662 | 0.205 |
| Safety Information | 74.422 | 0.320 |

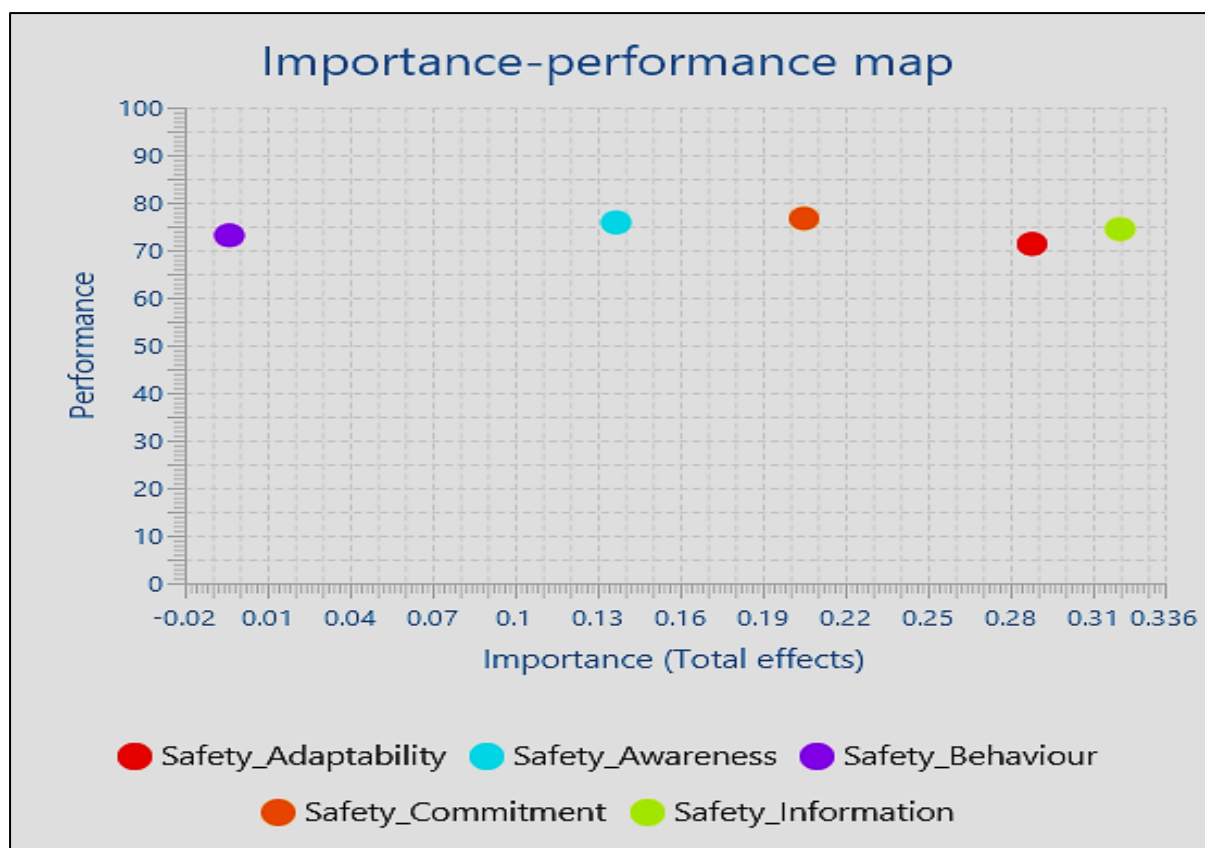


Figure 5.2: IPMA results for safety culture

As demonstrated in Table 5.17 and Figure 5.2, the importance and performance indices revealed that safety information (importance index of 0.320) and safety adaptability (importance index of 0.288) were the topmost predictors of safety culture, but these factors yielded low performance values of 74.422 and 71.304, respectively. Thus, priority must be given to safety information and safety adaptability in facilitating safety culture.

Table 5.18: IPMA for safety performance

| Predictors | Performance Index | Importance Index |
|---------------------|-------------------|------------------|
| Safety Adaptability | 71.304 | 0.218 |
| Safety Awareness | 75.832 | 0.104 |
| Safety Behaviour | 73.093 | -0.003 |
| Safety Commitment | 76.662 | 0.155 |
| Safety Culture | 73.492 | 0.756 |
| Safety Information | 74.422 | 0.242 |

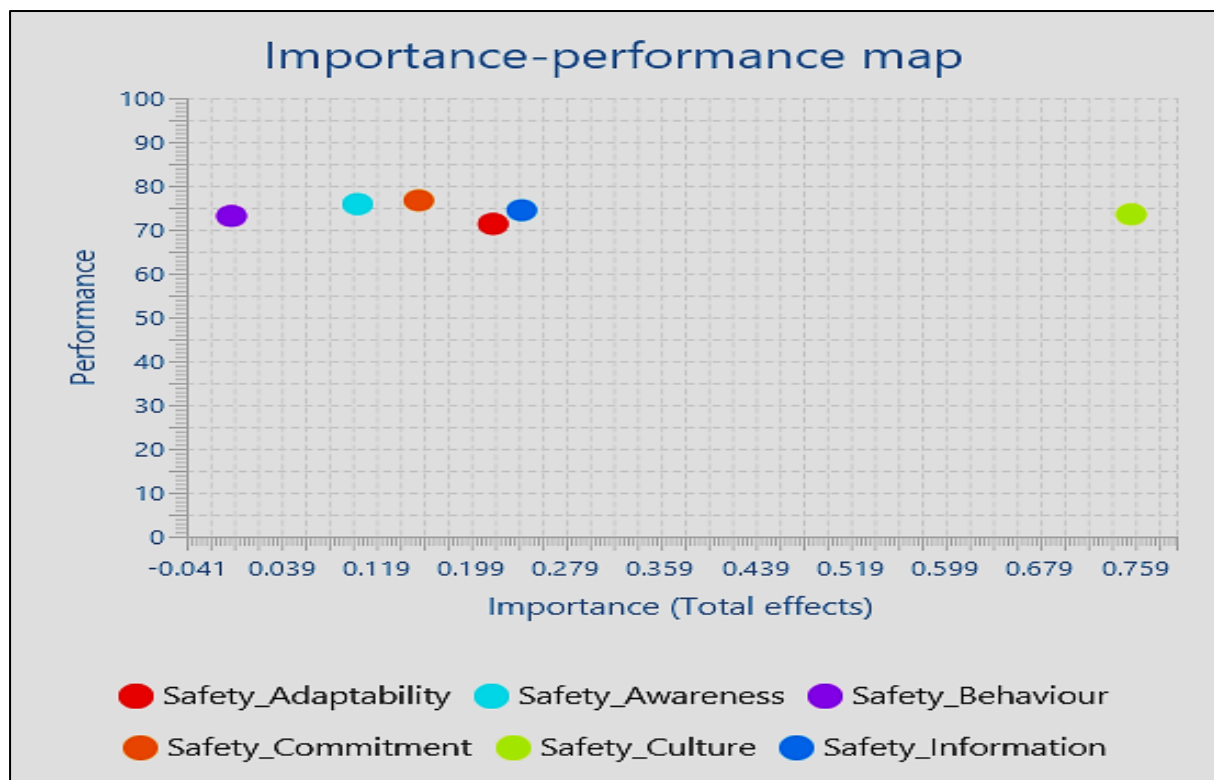


Figure 5.3: IPMA results for safety performance

The importance and performance results shown in Table 5.18 and Figure 5.3 revealed that safety culture (importance index of 0.756), safety information (importance index of 0.242) and safety adaptability (importance index of 0.218) were the topmost predictors of safety performance. However, these factors produced low performance values of 73.492, 74.422 and 71.304, respectively. This suggested that preference must be given to safety culture by

promoting safety information and safety adaptability to enhance the safety performance of construction SMEs.

5.6. Chapter Summary

In this chapter, the descriptive statistics of the senior employees of construction SMEs were discussed. Spearman Correlation analysis was carried out to establish the relationships between the respondents and the constructs. The descriptive statistics provided the means and standard deviations for the constructs. In addition, normality tests were conducted using the Kolmogorov-Smirnov and Shapiro-Wilk methods. PLS-SEM analysis, involving measurement framework assessment which examines the validity and reliability of latent variables, and the structural framework assessment were carried out. Consequently, an analysis of the reliability and convergent validity of the measures was examined. Six hypotheses were tested and five of them were accepted and one was rejected.

CHAPTER SIX: DISCUSSION

6.1. Introduction

In this chapter, the structural framework result was discussed based on 6 hypotheses. The results from structural equation modelling analysis, confirmed five significant relationships and one non-significant relationship between the independent variables (commitment, information, adaptability, behaviour, and awareness), intervening variables (safety culture), and dependent variable (safety performance). This implies the hypotheses which state safety commitment positively influences safety culture, safety information positively influences safety culture, safety adaptability positively influences safety culture, and safety awareness positively influences safety culture among construction SMEs could not be rejected. They are accepted. In addition, the hypothesis, which says safety culture positively influences safety performance could not be rejected. However, one (1) hypothesis which states, safety behaviour positively influences safety culture was rejected. Considering these hypotheses, the discussion section will be organized according to the Figure 6.1.

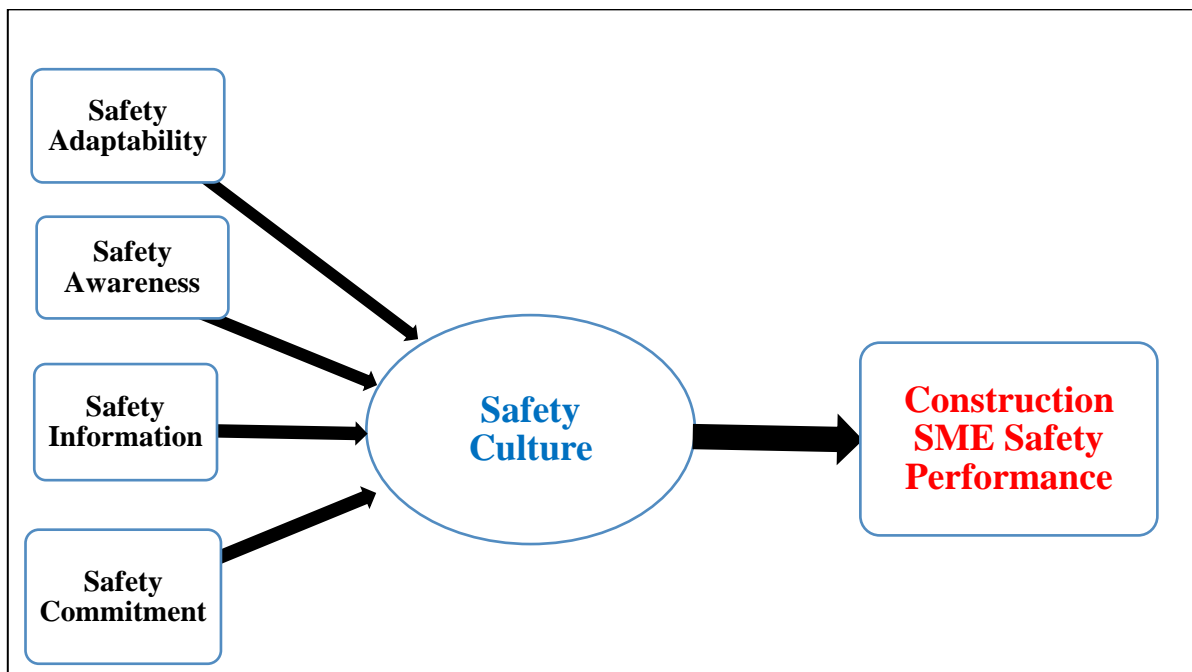


Figure 6.1: Developed framework for a positive safety culture to improve the safety performance of construction SMEs in Ghana

6.2. Safety Commitment and Culture of Construction SMEs

Safety commitment has positive and significant influence on positive safety culture among construction SMEs in Ghana. This implies that, when management and employees of construction SMEs are commitment to health and safety within their respective construction companies, the rates of occurrences of injuries, accidents, and fatalities will be reduced. This finding concurred with the findings of Boukhris *et al.*, (2020), who purported that safety commitment behaviour has the potential to reduce the rate of injuries, accidents, and fatalities on construction sites, hence management of construction SMEs must encourage their employees to demonstrate safety commitment in a way that will display a positive safety culture. Delegach *et al.*, (2017) found that effective commitment to health and safety by construction SMEs must be seen in their ability to support and invest in the safety of construction sites as these provide a visible platform for positive safety culture in construction SMEs. Therefore, it can be concluded that, when construction SMEs in Ghana implement the identified leading indicator metrics effectively, this will lead to a positive safety culture in construction that will lead to positive impacts on their safety performance.

6.3. Safety Information and Culture of Construction SMEs

The findings indicated that safety information positively and significantly influences positive safety culture in construction SMEs. This proved that the availability of safety information to the right employees at the right time has a positive impact on the safety performance of construction SMEs. This finding was supported by the study of Pi *et al.*, (2019), who stated that complete, timely, and accurate safety information is the foundation of a strong safety culture in construction SMEs, hence managers of construction SMEs must pay close attention to the timeliness and accuracy of safety information throughout the whole scope of their respective companies. Min *et al.*, (2020) also advocated the establishment of mechanisms to communicate safety information within the construction industry, specifically in construction SMEs, to enable a strong, positive safety culture in construction SMEs.

6.4. Safety Adaptability and Safety Culture among Construction SMEs

The relationship between safety adaptability and positive safety culture in construction SMEs was found to be significant. This finding was confirmed by Kurien *et al.*, (2018) that construction workers have some levels of adaptability and flexibility that assist them in carrying out their work. The dedication of workers in construction SMEs to health and safety and their well-being are supported by adaptability which, in turn, ensures an improvement in a positive safety culture. In other words, this indicates that a key element in the efficacy of construction employees in promoting workplace safety and welfare is their ability to adapt to health and safety procedures. As a result, the sooner construction employees adopt safety procedures in their workplaces, the safer and healthier they will be, and vice versa. This is a foundation on which owners and managing directors of construction SMEs can build to foster a culture of safety in construction that will improve health and safety performance.

6.5. Safety Awareness and Safety Culture among Construction SMEs

The causal relationship between safety awareness and positive safety culture in construction SMEs was positive and significant. This finding concurred with that of Buniya *et al.* (2021) and Li *et al.* (2019), who concluded that the safety awareness of employees of construction SMEs positively influences positive safety culture. Low safety awareness among construction SMEs, combined with inadequate knowledge about safety, is the major contributor to injuries, accidents and fatalities in the industry. Adequate safety awareness among construction SMEs is a key to achieving a positive safety culture in construction SMEs.

6.6. Safety Culture and Performance of Construction SMEs

The causal relationship between the intervening variable (safety culture) and the dependent variable (safety performance) was positive and significant, hence the hypothesis was accepted. This finding concurred with the assertion made by researchers, such as Boughaba *et al.* (2014), Cooper (2000, 2019), Feng *et al.* (2014), Stemm *et al.* (2019), Zohar (2000), that safety culture has a direct and major impact on safety performance. Olcay *et al.* (2021) purported that only when construction SMEs have a strong positive safety culture, 98% of injuries, accidents and fatalities will be avoided in construction SMEs, because the absence of a safety culture in a

construction SMEs creates risks of mistakes and safety rule violations, exposing the shortcomings of the efforts of management to protect construction employees. According to Sanni-Anibire *et al.* (2020), safety performance in construction SMEs can be enhanced through proactive or reactive means. Proactive means rely on evaluating the safety climate of construction SMEs, their safety culture, and danger identification and observation. Reactive means are focused on the rates of injuries, accidents and fatalities and the cost of compensating accident victims. These are all key indicators of improvement in safety performance. Therefore, it can be argued that the only way that construction SMEs within the Ghanaian construction industry can improve their safety performances is to establish a strong positive safety culture by adapting the core elements and leading indicator metrics identified in this study.

6.7. Safety Behaviour and Culture of Construction SMEs

The relationship between safety behaviour and safety culture was not positive, but negative. Therefore, this hypothesis was rejected in this study. This finding was contrary to Uzuntarla *et al.* (2020), who reported that approximately 90% of accidents on construction sites are because of unsafe behaviour of construction workers. Ajmal *et al.* (2020) suggested that the behaviour and attitude of employees contribute to safety commitment which has a direct impact on safety culture. According to Xia *et al.* (2020), human-related factors, particularly the dangerous behaviour of construction workers, are to blame for approximately 70% of accidents that occur on construction sites. Xia *et al.* (2020) stated also that the dangerous behaviours of most construction employees are the main reason for accidents, injuries, and fatalities in the sector. It is argued that employees of construction SMEs are the frontline workers who are immediately exposed to building site dangers, injuries, accidents, and fatalities. The primary contributors to accidents and fatalities in construction SMEs, according to Kim *et al.* (2022), and Yap and Lee (2020) are risky behaviours on the part of construction employees. The dangerous behaviours of workers on construction sites alone contributed to approximately 80% of accidents, according to Khoshnava *et al.* (2020).

This unexpected finding of this study, which indicated that safety behaviour does not significantly influence safety culture among construction SMEs in Ghana can be justified as follows.

- Firstly, we must consider the unique characteristics of the construction industry in Ghana, which differs significantly from other contexts in which previous research has

been conducted. As such, it is plausible that safety culture in this specific industry may be more significantly influenced by other factors. For example, it is often characterised by a high degree of informality, which could mean that established safety protocols are not consistently enforced or adhered to, thus attenuating the potential impact of safety behaviours on the overall safety culture.

- In addition, we must consider the potential influence of societal and cultural norms prevalent in Ghana. Given the collectivist nature of Ghanaian society, it is possible that community and group dynamics play a more substantial role in shaping safety culture than individual safety behaviours. Also, in the Ghanaian context, respect for authority figures is highly ingrained, and these figures often have a profound influence on the overall culture of a workplace. As such, leadership and management practices may exert a stronger influence on safety culture than individual safety behaviours.
- Furthermore, the construction industry is often project-based with temporary and fluid workforce, which may mean that the safety culture is less stable and less likely to be influenced by consistent safety behaviours over time. Lastly, it is also crucial to consider the possible limitations associated with the measurement tools used in the study. Although the tools employed have been validated in other contexts, there may have been some elements of the local culture or industry specifics that were not fully captured.
- In light of these factors, the lack of a significant relationship between safety behaviour and safety culture in this study underscores the need for further research to understand the unique dynamics of safety culture within the construction industry in Ghana. Moreover, it highlights the importance of considering contextual and cultural factors when applying findings from other contexts.

6.8. Implications of the Demographic Variables on the Framework

A Spearman correlation matrix was used to analyse the demographic variables in order to establish their significant relationships with safety commitment, safety information, safety adaptability, safety awareness, safety behaviour, and overall safety culture and safety performance. The results from the analysis indicated that there was a significant relationship between the officer in charge of health and safety responsibilities and the safety commitment of employees of construction SMEs. It was indicated further that whoever is in charge of health

and safety has significant influence over how safety information is reported and shared among workers, how workers adapt to safety issues, how workers behave towards themselves and other co-workers, how aware workers are of health and safety, the existence of a positive safety culture in construction SMEs and, finally, the overall safety performance of construction SMEs. This implies that if construction SMEs employ health and safety officers in their companies, this will help to promote a positive safety culture to improve safety performance.

There were no statistically significant relationships between industry experience, number of years that a respondent spent in the construction industry, number of years a respondent spent in the same construction SME, respondents' educational level, number of workers employed by construction SMEs and annual turnover of the construction SMEs with the constructs of the framework for positive safety culture (safety commitment, safety information, safety awareness, safety behaviour, safety adaptability, overall safety culture, and safety performance).

Furthermore, the results revealed statistical relationships between the independent variables (safety commitment, safety information, safety behaviour, safety information, and safety adaptability) and the intervening variable (safety culture) and the overall safety performance of construction SMEs in Ghana. It is further indicated that there was statistical relationship between safety culture and safety performance of construction SMEs working in the Ghanaian Construction Industry. The results concurred with the study by Piers *et al.*, (2009) that commitment, behaviour, information, adaptability and awareness are the major components of positive safety culture in construction. It can be suggested that construction SMEs must pay urgent attention to the demographic variables that have positive influences on the elements of the framework for positive safety culture in order to improve safety performance.

6.9. Chapter Summary

The proposed hypotheses of the conceptual framework were discussed in this chapter. The relationships between the independent variables and the intervening variable, as well as the relationship between the intervening variable and the dependent variable were also discussed. The relationships between the demographic variables and the constructs of positive safety

culture in construction SMEs were also discussed in this chapter. Finally, the relationships of the selected demographic variables with safety culture and safety performance were discussed.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

7.1. Introduction

In order to accomplish the overall goal of this study, a mixed-methods approach was used, which included a thorough literature review, a Delphi survey, and a questionnaire survey of construction SMEs that was then analysed using Structural Equation Modelling (SEM). To validate the Delphi survey, with regard to the core elements and their leading indicator metrics, a survey of construction SMEs was conducted. The main conclusions based on the aim of the study are outlined in this chapter together with their implications for the ability of construction SMEs to establish a positive safety culture to improve safety performance. From these results, several conclusions are made. In the following sections, conclusions based on the study, and contributions and limitations of the study are discussed, and recommendations for future research are offered in relation to the goals of the study.

7.2. Overview of the Study

It is clear that construction SMEs are essential for economic development in most developing countries. In spite of this, the sector is bedevilled by a negative safety culture that has resulted in the occurrences of injuries, accidents and fatalities. There is a need for construction SMEs to improve their safety performance if they want to remain competitive in business. It is maintained that the only means by which they can improve is to establish a positive safety culture. Therefore, based on this study, a number of leading indicator metrics have been identified by using the Delphi method that will help construction SMEs to establish a positive safety culture. Based on the study, some recommendations have been made that will help construction SMEs to establish a positive safety culture that will help them to protect the lives of their much-needed workers.

For construction SMEs to continue to improve their safety performance, they must demonstrate firm commitment to the health and safety of their workers, train their workers to be aware of risks and hazards before, during and after work, report health and safety-related issues quickly and share the information among the right employees at the right time, and be able to accept

and prepared to correct safety violations timeously. In this study, it is suggested further that the leading indicator metrics identified and used in developing the framework are reliable practices that will help construction SMEs to establish a positive safety culture to improve safety performance. This finding is timely, especially in a country, such as Ghana, where there is no legislation governing health and safety that regulates the activities of construction SMEs and their larger counterparts. A conceptual framework for positive safety culture among construction SMEs has been formulated in this study to provide a reference for researchers who will study positive safety culture in the near future. The following objectives helped to achieve the main aim of the study:

- To explore the components that shape the safety culture within construction SMEs in Ghana;
- To evaluate the influences of the components on the safety culture of construction SMEs in Ghana;
- To analyse the components that significantly influence the safety culture of construction SMEs in Ghana;
- To evaluate how a safety culture influences the safety performance of construction SMEs in Ghana; and
- To develop a framework that would assist construction SMEs to evolve a positive safety culture to improve safety performance in Ghana

7.2.1. What are the Components that Shape the Safety Culture of Construction SMEs?

This was addressed in Objective 1: to explore the components that shape the safety culture within construction SMEs in Ghana. This objective was pursued through an extensive literature review conducted on research about safety culture. As indicated in Chapter Six, five major components: safety commitment, safety behaviour, safety awareness, safety information, and safety adaptability, were identified as the major components of positive safety culture for construction SMEs. This implies that management of construction SMEs do not demonstrate appropriate commitment, behaviour, awareness, information, and adaptability towards positive safety culture resulting in high rates of accidents. It was reported that positive safety culture is a way to curtail the occurrences of accidents within construction SMEs in Ghana. The issues of positive safety culture are a serious concern among construction SMEs in Ghana, as it was

noted by many researchers that to establish a positive safety culture, construction SMEs must firmly uphold these five, major, shaping components of safety culture. Therefore, it is important for both employees and managers of construction SMEs to focus on positive safety culture that will enhance safety performance. Therefore, Research Objective 1 was achieved.

7.2.2. How do the Components Influence the Safety Culture of Construction SMEs in Ghana?

This was addressed in Objective 2: to evaluate the influences of the components on the safety culture of construction SMEs in Ghana. A Delphi method was used to achieve this objective. Based on the findings, 14 core elements/factors were identified with their respective 87 leading indicator metrics that were considered to be important in establishing a positive safety culture among construction SMEs in Ghana. A panel of 31 health and safety experts in Ghana were invited by email to participate in a three-round Delphi survey during which 16 completed the final round. After the final round, consensus was attained on 79 of the 87 leading indicator metrics identified from the literature review and were retained. These leading indicator metrics were converted into a questionnaire, using a 5-point Likert Scale, that was distributed among construction SMEs in Ghana. The results were collected and analysed to determine the influences of each of the components on positive safety culture. The findings were that four out of the five components (safety commitment, safety awareness, safety information and safety adaptability) have positive influences on the positive safety culture of construction SMEs in Ghana, while one component (safety behaviour) has no positive influence on positive safety culture. Furthermore, positive safety culture is assured if there is a consideration of these factors in the development of construction SMEs in Ghana to improve safety performance. These components were considered collectively for the development of a framework for positive safety culture. Therefore, Research Objective 2 was achieved.

7.2.3. Which Components Significantly Influence the Safety Culture of Construction SMEs in Ghana?

This was addressed in the third Objective: to analyse the components that significantly influence the safety culture of construction SMEs in Ghana. The results from the Delphi survey were converted into a questionnaire, using a 5-point Likert Scale, that was distributed among construction SMEs after a pilot study. The results of the survey of construction SMEs were

analysed using PLS-SEM to establish statistical relationships between the shaping components and safety culture. The analysis indicated that four of the five components have positive and significant influences on the positive safety culture of construction SMEs in Ghana. The components include, safety commitment, safety information, safety awareness, and safety adaptability. Therefore, construction SMEs in Ghana must implement these four components with their respective leading indicator metrics in order to establish a positive safety culture that will enhance their safety performances for significant reduction in the occurrences of accidents. Therefore, Research Objective 3 was achieved.

7.2.4. How does a Safety Culture Influence the Safety Performance of Construction SMEs in Ghana?

This was addressed in Objective 4: to evaluate how a safety culture influences the safety performance of construction SMEs in Ghana. A Delphi survey and a survey of construction SMEs were conducted in order to achieve this objective. The findings indicated that construction SMEs can improve their safety performance only if they establish a positive safety culture among their respective firms. This implies that there is a positive relationship between positive safety culture and safety performance. The findings indicated further that there was a statistically significant influence of positive safety culture on the safety performance of construction SMEs. Findings from the Delphi survey further revealed 79 leading indicator metrics, grouped under 14 core elements, that are necessary for construction SMEs to implement in order to establish a positive safety culture to improve safety performance. The findings from the survey of construction SMEs confirmed that these leading indicator metrics are vital in the establishment of a positive safety culture that will enhance the safety performance of construction SMEs in Ghana. Therefore, Research Objective 4 was achieved.

7.2.5. Which Plans would Assist Construction SMEs to Evolve a Positive Safety Culture to Improve Safety Performance in Ghana?

This was addressed in Objective 5: to develop a framework that would assist construction SMEs to evolve a positive safety culture to improve safety performance in Ghana. A combination of a literature review, a Delphi survey and a questionnaire survey was used to achieve this objective. In the conceptual framework it was theorised that a framework for positive safety culture is a seven-factor construct. These factors were: safety commitment,

safety behaviour, safety information, safety adaptability, safety awareness, positive safety culture and safety performance of construction SMEs. A questionnaire survey was conducted, and its results were analysed using the PLS-SEM programme EQS, Version 6.2, to validate the hypotheses of the framework. A Confirmatory Composite Analysis (CCA) was used to analyse the proposed seven components of the theoretical framework.

The factor analysis of the theoretical, seven-component framework indicated that four factors or components have a positive and significant influence on the establishment of a positive safety culture within construction SMEs to improve safety performance. These factors/components are: safety commitment, safety information, safety awareness and safety adaptability. The findings revealed further that positive safety culture has significant influence on the safety performance of construction SMEs in Ghana. It is firmly accepted that construction SMEs that establish a positive safety culture have the potential to reduce the occurrences of injuries, accidents and fatalities. However, one factor/component, safety behaviour, has no significant influence on the safety performance of construction SMEs in Ghana. These results supported the conceptually integrated framework developed using data from the Delphi survey and the literature review. Therefore, Research Objective 5 was achieved.

7.3. Contributions of the Study

The contributions of this study can be viewed on two levels: the methodological and practical levels of the research findings.

7.3.1. Methodological Contribution

Most researchers do not validate their instrument, rather they focus on construct validity through the use of exploratory factor analysis (EFA). In order to adhere to the requirements for rigorous research, a novel approach was adopted in this study by using content validity and construct validity to validate the instrument used. A three-round Delphi survey was completed by 16 health and safety experts from across Ghana to ensure the content validity of the leading indicator metrics, and an additional pilot study was carried out with 21 senior employees of construction SMEs. Confirmatory Composite Analysis (CCA) was used as a validation test to

attain construct validity through Structural Equation Modelling (SEM). The use of SEM in the current research made it possible to identify the components of positive safety culture in construction SMEs, which have substantial impact and consequently influence the safety culture and safety performance of construction SMEs. SEM was used to establish the relationships between the independent, intervening and dependent variables of the refined conceptualised framework, while SPSS was used to determine the relationships between the demographic variables and the health and safety core elements of the refined conceptualised framework. Ultimately, a framework for positive safety culture was developed to improve the safety performance of construction SMEs.

7.3.2. Practical Contribution

A number of practical implications have emerged from this study that are critical in assisting construction SMEs in Ghana to improve their safety performance. In the conceptual framework that was developed and validated, four key factors have been identified that are necessary for the implementation of a positive safety culture by construction SMEs. These proactive factors or indicators include: safety commitment, safety information, safety awareness, and safety adaptability. During the Delphi survey, it was indicated that Ghana has no specific legislation governing health and safety in construction SMEs in the country. Therefore, it can be argued, as confirmed by the Delphi survey, that construction SMEs in Ghana have not realised the importance of their commitment to health and safety. However, construction SMEs are likely to implement leading indicator metrics of positive safety culture that will enable them to establish a positive safety culture to improve safety performance.

Additionally, construction SMEs in Ghana could find the developed questionnaire very beneficial for internal auditing of their safety performance and comparing that with their counterpart contractors. Furthermore, construction SMEs may use the developed framework to plan, manage, co-ordinate and regulate issues in all areas of positive safety culture within their respective companies in order to reduce high accident rates. The findings will help the Ministry of Water Resources, Works and Housing (MWRWH) to formulate health and safety programmes that will help construction SMEs to prevent accidents. The framework will also serve as a valuable tool for MWRWH in developing appropriate health and safety policies and regulations in the country. In the absence of well documented health and safety regulations in the country, MWRWH should provide an enabling atmosphere for construction SMEs to use

the developed framework as a working document to establish a positive safety culture among their firms that will protect the lives of their workforces.

7.4. Limitations of the Study

The following are the acknowledged limitations in the study:

- The first limitation is that the study was conducted in only some of the major cities of Ghana because of the concentration of construction SMEs in these major cities. It was logistically impossible to conduct this research in all the cities across Ghana.
- The use of additional items or constructs could improve the reliability and validity of the measures used.
- An inherent limitation of questionnaire survey research is the inability to probe for more information based on the responses. An interview section would have made it possible to probe for more information for the study.
- The occurrence of non-significant correlation among one of the constructs in the framework is another limitation. This was a drawback because the hypothesis was rejected.
- Finally, this study was focused on a small number of health and safety management practices that are representative of positive safety culture in construction SMEs. Some of the leading indicator metrics which could be useful were dropped during the Delphi survey because consensus was not attained. Even with the use of the Delphi approach, more useful techniques such as observation or interviews with construction SMEs could help to emphasise more important findings.

7.5. Recommendations for Future Research

The following suggestions for further studies have been identified and proposed:

- It is recommended that further studies should be conducted using different populations with different samples and sizes in the remaining cities in Ghana.

- Further research should also be carried out using the mixed-methods (questionnaire survey and the Delphi method) together with interviews to probe further into the data collected through the methods used in this study.
- It is recommended that a similar study should be carried out in any other developing countries to improve the establishment of positive safety culture among construction SMEs.
- Other studies could also be carried out on the leading indicator metrics in order to establish additional improvement in the framework to enhance safety performance, as the current study was focused only on exploratory and confirmatory factor analysis in selecting the leading indicator metrics.
- A purposive sampling technique was used in this study where only senior members of construction SMEs were selected. It is recommended that future studies include all employees of construction SMEs (all trades).
- A further study should be carried out on the rejected hypothesis (H2: safety behaviour positively influences safety culture of construction SMEs) to ascertain the reasons why safety behaviour did not positively influence the safety culture of construction SMEs.

7.6. Chapter Summary

It can be concluded that the recommendations made in this study are very necessary and helpful. However, the research findings are limited to cases in construction SMEs in Ghana. Therefore, the results cannot be generalised statistically beyond the sampled population, although analytic generalisation is possible.

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Appendix A

Appendix A1: Sample of Delphi Survey Introductory Letter



23 May 2020

Dear Sir/Madam,

Re: Request to participate in a study entitled ‘Developing a framework for a positive safety culture towards improved construction SMEs safety performance in Ghana’

We write to humbly request your participation by completing a Delphi technique based questionnaire as part of data collection process for an ongoing doctoral study being carried out by Eric K. Adzivor under the supervision of Prof. Fidelis Emuze at the Central University of Technology, Free State, South Africa.

A Delphi technique is used to elicit the perceptions of experts. A three round Delphi survey will be conducted of which you will be required to participate in all the three rounds. The survey questionnaire for the first round is attached to this letter and we are kindly requesting your assistance in filling the questionnaire.

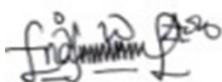
Your participation in this research will be highly appreciated. We would like to confirm that your response will be treated with outmost confidentiality and shall be used for academic purposes only. The research outputs will be shared with you upon request.

Upon completion of the questionnaire, could you kindly return same via email to either mapputo2@yahoo.com or femuze@cut.ac.za

If you have any questions regarding this study, please feel free to contact Mr Adzivor and Prof Emuze through the same email addresses provided above respectively.

Thank you for your attention. We are looking forward to your favourable contributions.

Sincerely,



Mr Eric Adzivor (Doctoral Candidate)



Prof FA Emuze (Research Supervisor)

Appendix A2: Sample of Survey Questionnaire for Recruiting Panel of Health and Safety Experts

Table 1: Experts qualification criteria

| GENERAL INFORMATION | |
|---|--|
| 1. This survey is to ascertain the status of safety culture among construction SMEs | |
| 2. Please provide feedback based on your lived experiences. | |
| 3. Please fill and return the questionnaire within two weeks of receipt. | |
| 4. Please type your response or use “X” as required. | |
| 5. Kindly return the completed questionnaire to <u>mapputo2@yahoo.com</u> | |
| PERSONAL INFORMATION | |
| Professional affiliation | |
| Current employer | |
| Position | |
| City | |
| State | |
| Country | |
| ACADEMIC INFORMATION | |
| <i>Kindly tick off your highest academic qualification</i> | |
| Diploma | |
| Associate | |
| Bachelor | |
| Masters | |
| Doctorate | |
| PROFESSIONAL CATEGORY | |
| <i>Please tick off the category that mostly align to your professional practice</i> | |
| Health and Safety Consultant (e.g. agent) | |
| Health and Safety Practitioner (e.g. officer) | |
| Construction Health and Safety Researcher | |
| Built Environment Consultant | |
| Built Environment Researcher | |
| Others (please specify) | |
| <i>Please kindly indicate any professional registration</i> | |
| Professional Construction Manager | |
| Professional Construction Project Manager | |
| Certified Safety Professional | |
| Associated Risk Manager | |
| Professional Engineer | |
| Others (please specify) | |

Appendix B

Appendix B1: Sample of Delphi Questionnaire Round 1

Round 1-Delphi Survey

INSTRUCTION: Please rate the level of importance of the following statements based on your experience and judgement on a scale of 1 to 10 using a point scale as the example shown below.

Scale of Importance

| Unimportant.....Very important | | | | | | | | | |
|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| 0-10% | 11-20% | 21-30% | 31-40% | 41-50% | 51-60% | 61-70% | 71-80% | 81-90% | 91-100% |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| X | | | | | | | | | |

SECTION A

How important are the following factors or elements in relation to safety culture among construction SMEs in Ghana?

| | | (Importance scale) | | | | | | | | | |
|-----|---|---------------------------|---|---|---|---|---|---|---|---|----|
| 1. | | Management Concerns | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1.1 | Safe working condition enforcement | | | | | | | | | | |
| 1.2 | Zero tolerance for safety violations | | | | | | | | | | |
| 1.3 | Monitor and correct safety errors | | | | | | | | | | |
| 1.4 | Safety first is applied to all at work | | | | | | | | | | |
| 1.5 | Safety resources are prioritised | | | | | | | | | | |
| 1.6 | Safe operations are prioritised | | | | | | | | | | |
| 1.7 | Wellbeing of workers are prioritised | | | | | | | | | | |
| 1.8 | Health of workers are prioritised | | | | | | | | | | |
| 2. | | Worksite Norms | | | | | | | | | |
| 2.1 | Equipment, tools and plants are used safely | | | | | | | | | | |
| 2.2 | Safety is improved continuously | | | | | | | | | | |
| 2.3 | Hazard awareness and control are executed | | | | | | | | | | |
| 2.4 | Risk awareness and control are executed | | | | | | | | | | |
| 2.5 | Accidents and near misses are mitigated | | | | | | | | | | |
| 2.6 | Workers make safety suggestions | | | | | | | | | | |
| 2.7 | Workers contribute to safety improvement | | | | | | | | | | |
| 2.8 | Workers are involved in safety planning | | | | | | | | | | |
| 3. | | Safe Work Procedure (SWP) | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|-----------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 3.1 | At-risk work is flagged by co-workers | | | | | | | | | | | | | | | | | | |
| 3.2 | Safety instructions are reinforced on site | | | | | | | | | | | | | | | | | | |
| 3.3 | Unsafe acts are monitored and corrected | | | | | | | | | | | | | | | | | | |
| 3.4 | Unsafe conditions are corrected | | | | | | | | | | | | | | | | | | |
| 3.5 | Fatigue is monitored and managed | | | | | | | | | | | | | | | | | | |
| 3.6 | Work pressure is monitored and managed | | | | | | | | | | | | | | | | | | |
| 3.7 | Safety audits are conducted regularly | | | | | | | | | | | | | | | | | | |
| 3.8 | Safety inspections are conducted regularly | | | | | | | | | | | | | | | | | | |
| 3.9 | Methods statements comply to SWP | | | | | | | | | | | | | | | | | | |
| 3.10 | Tasks execution complies to SWP | | | | | | | | | | | | | | | | | | |
| 3.11 | Work is completed in a safe manner | | | | | | | | | | | | | | | | | | |
| 3.12 | New workers are taught to follow SWP | | | | | | | | | | | | | | | | | | |
| 4. | Collective Responsibility (Brother's Keeper) | | | | | | | | | | | | | | | | | | |
| 4.1 | Co-workers often discuss safety hazards | | | | | | | | | | | | | | | | | | |
| 4.2 | Co-worker care for the safety of each other | | | | | | | | | | | | | | | | | | |
| 4.3 | Co-workers care about equipment safety | | | | | | | | | | | | | | | | | | |
| 4.4 | Co-workers discuss accident prevention | | | | | | | | | | | | | | | | | | |
| 4.5 | Work pressure must not violate safety | | | | | | | | | | | | | | | | | | |
| 4.6 | Co-workers report safety violations | | | | | | | | | | | | | | | | | | |
| 4.7 | Co-workers raise alert to SWP violation | | | | | | | | | | | | | | | | | | |
| 5 | Job Satisfaction | | | | | | | | | | | | | | | | | | |
| 5.1 | Work is repetitive and boring | | | | | | | | | | | | | | | | | | |
| 5.2 | Work is inspiring and fulfilling | | | | | | | | | | | | | | | | | | |
| 5.3 | Work use skills and talents | | | | | | | | | | | | | | | | | | |
| 5.4 | Achievements and progress is rewarded | | | | | | | | | | | | | | | | | | |
| 5.5 | Motivation to improve SWP is at work | | | | | | | | | | | | | | | | | | |
| 5.6 | Work is done purely for salaries and wages | | | | | | | | | | | | | | | | | | |
| 6. | Equipment and Plant | | | | | | | | | | | | | | | | | | |
| 6.1 | Suitable plant and equipment is available | | | | | | | | | | | | | | | | | | |
| 6.2 | Routine upkeep is performed on plants | | | | | | | | | | | | | | | | | | |
| 6.3 | Operators are trained to use equipment | | | | | | | | | | | | | | | | | | |
| 7. | Hazard and Risk | | | | | | | | | | | | | | | | | | |
| 7.1 | Safety is ignored to get the job done | | | | | | | | | | | | | | | | | | |
| 7.2 | Prohibited work activities are expedited | | | | | | | | | | | | | | | | | | |
| 7.3 | SWP is violated to get the job done | | | | | | | | | | | | | | | | | | |
| 7.4 | Drift to safety violation is allowed | | | | | | | | | | | | | | | | | | |
| 7.5 | Safety rules and policies are clear | | | | | | | | | | | | | | | | | | |
| 7.6 | Workplace SWP is understood | | | | | | | | | | | | | | | | | | |
| 7.7 | Unsafe acts and conditions are mitigated | | | | | | | | | | | | | | | | | | |
| 7.8 | Hazard reporting is encouraged on sites | | | | | | | | | | | | | | | | | | |
| 7.9 | The collective undertake safety analysis | | | | | | | | | | | | | | | | | | |

| 8. | Adaptability and Flexibility | | | | | | | | | | | | | | | | | | |
|------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 8.1 | Workers use SWP to execute tasks | | | | | | | | | | | | | | | | | | |
| 8.2 | Safe equipment and plants are used on sites | | | | | | | | | | | | | | | | | | |
| 8.3 | Safety promotions is embraced on sites | | | | | | | | | | | | | | | | | | |
| 8.4 | Mindfulness in relation to safety exist | | | | | | | | | | | | | | | | | | |
| 9. | Education and Training | | | | | | | | | | | | | | | | | | |
| 9.1 | Safety inductions are detailed and timely | | | | | | | | | | | | | | | | | | |
| 9.2 | Tool box talks are enriched with examples | | | | | | | | | | | | | | | | | | |
| 9.3 | Safety information are provided regularly | | | | | | | | | | | | | | | | | | |
| 8.4 | Training covers SWPs and regulations | | | | | | | | | | | | | | | | | | |
| 10. | Reporting | | | | | | | | | | | | | | | | | | |
| 10.1 | Blame game hinders incident reports | | | | | | | | | | | | | | | | | | |
| 10.2 | Reporting lines and systems are clear | | | | | | | | | | | | | | | | | | |
| 10.3 | Reports leads to reviews and improvements | | | | | | | | | | | | | | | | | | |
| 10.4 | Incident reporting is nurtured and rewarded | | | | | | | | | | | | | | | | | | |
| 10.5 | Incident reporting leads to better SWPs | | | | | | | | | | | | | | | | | | |
| 10.6 | Workers are willing to report incidents | | | | | | | | | | | | | | | | | | |
| 11. | Information Sharing | | | | | | | | | | | | | | | | | | |
| 11.1 | SWP information is shared timely | | | | | | | | | | | | | | | | | | |
| 11.2 | Safety information is in multiple languages | | | | | | | | | | | | | | | | | | |
| 11.3 | Voluntary safety information sharing exist | | | | | | | | | | | | | | | | | | |
| 11.4 | New safety regulations are shared timely | | | | | | | | | | | | | | | | | | |
| 11.5 | Safety concerns receive timely attention | | | | | | | | | | | | | | | | | | |

SECTION B

How important are the following factors or elements in relation to safety performance among construction SME contractors in Ghana?

| | | (Importance scale) | | | | | | | | | |
|------------|--|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| 12. | Management Contributions | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 12.1 | Regular safety inspection is expedited | | | | | | | | | | |
| 12.2 | Safety equipment is off adequate quality | | | | | | | | | | |
| 12.3 | Safety equipment is accessible and available | | | | | | | | | | |
| 12.4 | Safety first is applied during work pressure | | | | | | | | | | |
| 12.5 | Overtime work is controlled | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 12.6 | Blame game is prohibited due to accidents | | | | | | | | | | | | | | | | | | |
| 13. | Worker Contributions | | | | | | | | | | | | | | | | | | |
| 13.1 | Workers encourage one another to be safe | | | | | | | | | | | | | | | | | | |
| 13.2 | Workers keep worksite clean | | | | | | | | | | | | | | | | | | |
| 13.3 | Workers ignore safety rules | | | | | | | | | | | | | | | | | | |
| 13.4 | Workers take short cut to complete tasks | | | | | | | | | | | | | | | | | | |
| 13.5 | Workers use SWPs to get the job done | | | | | | | | | | | | | | | | | | |
| 14. | Supervisor Contributions | | | | | | | | | | | | | | | | | | |
| 14.1 | Supervisors allow safety suggests | | | | | | | | | | | | | | | | | | |
| 14.2 | Supervisors disallow safety violations | | | | | | | | | | | | | | | | | | |
| 14.3 | Supervisor prioritise productivity | | | | | | | | | | | | | | | | | | |
| 14.4 | Supervisors ignores SWP deviations | | | | | | | | | | | | | | | | | | |

14. Please do you have any general comments, or concerns you would like to share?

Comments/Concerns:

—The End—

Thank you very much for taking time to complete the questionnaire

Appendix B2: Sample of Delphi questionnaire Round 2

Round 2-Delphi Survey

DELPHI INSTRUCTIONS FOR ROUND 2 WITH GROUP MEDIAN

DELPHI SURVEY – ROUND 2

We thank you for participating in Round 1 of the Delphi Survey. We are grateful for the valuable time you have invested in completing Round 1 of the Delphi Survey. This Round 2 survey continues the Delphi process for this study. The purpose of Round 2 is to provide you with the opportunity to change your response, **if desired**, given the median group response for each **statement**, calculated using 10-point scale. This Round 2 is intended to take approximately 30 minutes. Please email your response to either mapputo2@yahoo.com or femuze@cut.ac.za within 2 weeks upon receiving this email.

INSTRUCTIONS AND DIRECTIONS

With each statement, you will see **two values**; group median from Round 1 Survey which is indicated in the last Column to your Right of each table and your Round 1 Survey Response indicated with a Yellow Coloured Box. Kindly take One of the following Three Actions for each statement.

1. **Accept the group Median response by leaving your statement rating totally unchanged;**
2. **Maintain your original response by placing an “X” in the Box that has been Coloured which is the box indicating your Round 1 response;**
3. **Indicate a New Response by placing an “X” in the appropriate box.**

NB: In a situation where your response in action 2 or 3 above is more than Two Units above or below the provided group Median of each statement, you may provide reason(s) for the variation at the end of the table. For example, assume a group Median of 5 and your response is 2 or 8 this response is Two Units below or above the group Median respectively.

INSTRUCTION: Please rate the level of importance of the following statements based on your experience and judgement on a scale of 1 to 10 using a point scale as the example shown below.

Scale of Importance

| Unimportant.....Very important | | | | | | | | | |
|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| 0-10% | 11-20% | 21-30% | 31-40% | 41-50% | 51-60% | 61-70% | 71-80% | 81-90% | 91-100% |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | X | | | | | |

SECTION A

How important are the following factors or elements in relation to safety culture among construction SMEs in Ghana?

| | | (Importance scale) | | | | | | | | | | |
|-----------|---|---------------------------|---|---|---|---|---|---|---|---|----|------------|
| 1. | Management Concerns | | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Med ian |
| 1.1 | Safe working condition enforcement | | | | | | x | | | | | 7.5 |
| 1.2 | Zero tolerance for safety violations | | | | | | x | | | | | 7.5 |
| 1.3 | Monitor and correct safety errors | | | | | x | | | | | | 7 |
| 1.4 | Safety first is applied to all at work | | | | x | | | | | | | 7 |
| 1.5 | Safety resources are prioritised | | | x | | | | | | | | 6.5 |
| 1.6 | Safe operations are prioritised | | | x | | | | | | | | 7 |
| 1.7 | Wellbeing of workers are prioritised | | | | | x | | | | | | 8.5 |
| 1.8 | Health of workers are prioritised | | | | | x | | | | | | 9 |
| 2. | Worksite Norms | | | | | | | | | | | |
| 2.1 | Equipment, tools and plants are used safely | | | | | x | | | | | | 8 |
| 2.2 | Safety is improved continuously | | | | x | | | | | | | 7.5 |
| 2.3 | Hazard awareness and control are executed | | | | x | | | | | | | 8 |
| 2.4 | Risk awareness and control are executed | | | x | | | | | | | | 8 |
| 2.5 | Accidents and near misses are mitigated | | | x | | | | | | | | 8.5 |
| 2.6 | Workers make safety suggestions | x | | | | | | | | | | 7.5 |
| 2.7 | Workers contribute to safety improvement | x | | | | | | | | | | 8 |
| 2.8 | Workers are involved in safety planning | x | | | | | | | | | | 8 |
| 3. | Safe Work Procedure (SWP) | | | | | | | | | | | |
| 3.1 | At-risk work is flagged by co-workers | | | x | | | | | | | | 6.5 |
| 3.2 | Safety instructions are reinforced on site | | | x | | | | | | | | 8 |
| 3.3 | Unsafe acts are monitored and corrected | | | | x | | | | | | | 8 |

| 9. Reporting | | | | | | | | | | | | |
|--------------------------------|---|--|--|--|--|--|--|--|--|--|--|------------|
| 9.1 | Blame game hinders incident reports | | | | | | | | | | | 8 |
| 9.2 | Reporting lines and systems are clear | | | | | | | | | | | 8 |
| 9.3 | Reports leads to reviews and improvements | | | | | | | | | | | 8 |
| 9.4 | Incident reporting is nurtured and rewarded | | | | | | | | | | | 7 |
| 9.5 | Incident reporting leads to better SWPs | | | | | | | | | | | 8 |
| 9.6 | Workers are willing to report incidents | | | | | | | | | | | 8 |
| 10. Information Sharing | | | | | | | | | | | | |
| 10.1 | SWP information is shared timely | | | | | | | | | | | 8 |
| 10.2 | Safety information is in multiple languages | | | | | | | | | | | 7 |
| 10.3 | Voluntary safety information sharing exist | | | | | | | | | | | 7.5 |
| 10.4 | New safety regulations are shared timely | | | | | | | | | | | 8 |
| 10.5 | Safety concerns receive timely attention | | | | | | | | | | | 8.5 |

SECTION B

How important are the following factors or elements in relation to safety performance among construction SMEs in Ghana?

| (Importance scale) | | | | | | | | | | | | |
|-------------------------------------|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------|
| 11. Management Contributions | | | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Median |
| 11.1 | Regular safety inspection is expedited | | | | | | | | | | | 8 |
| 11.2 | Safety equipment is off adequate quality | | | | | | | | | | | 8 |
| 11.3 | Safety equipment is accessible and available | | | | | | | | | | | 8.5 |
| 11.4 | Safety first is applied during work pressure | | | | | | | | | | | 7.5 |
| 11.5 | Overtime work is controlled | | | | | | | | | | | 8 |

Appendix B3: Sample of Delphi Questionnaire Round 3

Round 3-Delphi Survey

DELPHI INSTRUCTIONS FOR ROUND 3 WITH GROUP MEDIAN

DELPHI SURVEY – ROUND 3

We thank you for participating in Round 2 of the Delphi Survey. We are grateful for the valuable time you have invested in completing Round 2 of the Delphi Survey. This Round 3 survey concludes the Delphi process for this study. The purpose of Round 3 is to provide you with a final opportunity to change your response, **if desired**, given the median group response for each **statement**, calculated using 10-point scale. This Round 3 is intended to take approximately 30 minutes. Please email your response to either mapputo2@yahoo.com or femuze@cut.ac.za within 2 weeks upon receiving this email.

INSTRUCTIONS AND DIRECTIONS

The instructions for the Round 3 survey are almost the same as that of the Round 2 survey. The only difference here is that you are given an opportunity to provide an additional statement that will promote positive safety culture towards improved construction SMEs safety performance. In Round 2, all participants were asked to provide reasons if their responses were more than two units above or below the group median of each statement. Please review the reasons provided by other expert participants and consider them in your final response. Please provide reason(s) if your response is 2 units below or above the group median.

With each statement, you will see two values; group median from Round 2 Survey which is indicated in the last Column to your Right of each table and your Round 2 Survey Response indicated with a Yellow Coloured Box. Kindly take One of the following Three Actions for each statement.

4. **Accept the group Median response by leaving your statement rating totally unchanged;**
5. **Maintain your original response by placing an “X” in the Box that has been Coloured which is the box indicating your Round 1 response;**
6. **Indicate a New Response by placing an “X” in the appropriate box.**

NB: In a situation where your response in action 2 or 3 above is more than Two Units above or below the provided group Median of each statement, you may provide reason(s) for the variation at the end of the table. For example, assume a group Median of 5 and your response is 2 or 8 this response is Two Units below or above the group Median respectively.

INSTRUCTION: Please rate the level of importance of the following statements based on your experience and judgement on a scale of 1 to 10 using a point scale as the example shown below.

Scale of Importance

| Unimportant.....Very important | | | | | | | | | |
|--------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| 0-10% | 11-20% | 21-30% | 31-40% | 41-50% | 51-60% | 61-70% | 71-80% | 81-90% | 91-100% |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | X | | | | | |

SECTION A

How important are the following factors or elements in relation to safety culture among construction SMEs in Ghana?

| | | (Importance scale) | | | | | | | | | | |
|-----|---|--------------------|---|---|---|---|---|---|---|---|----|--------|
| 1. | Management Concerns | | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Median |
| 1.1 | Safe working condition enforcement | | | | | | | | | | | 7 |
| 1.2 | Zero tolerance for safety violations | | | | | | | | | | | 7 |
| 1.3 | Monitor and correct safety errors | | | | | | | | | | | 7 |
| 1.4 | Safety first is applied to all at work | | | | | | | | | | | 7 |
| 1.5 | Safety resources are prioritised | | | | | | | | | | | 6 |
| 1.6 | Safe operations are prioritised | | | | | | | | | | | 7 |
| 1.7 | Wellbeing of workers are prioritised | | | | | | | | | | | 8 |
| 1.8 | Health of workers are prioritised | | | | | | | | | | | 9 |
| 2. | Worksite Norms | | | | | | | | | | | |
| 2.1 | Equipment, tools and plants are used safely | | | | | | | | | | | 8 |
| 2.2 | Safety is improved continuously | | | | | | | | | | | 7.5 |
| 2.3 | Hazard awareness and control are executed | | | | | | | | | | | 8 |
| 2.4 | Risk awareness and control are executed | | | | | | | | | | | 8 |
| 2.5 | Accidents and near misses are mitigated | | | | | | | | | | | 8 |
| 2.6 | Workers make safety suggestions | | | | | | | | | | | 7 |
| 2.7 | Workers contribute to safety improvement | | | | | | | | | | | 8 |
| 2.8 | Workers are involved in safety planning | | | | | | | | | | | 7 |

| 3. | Safe Work Procedure (SWP) | | | | | | | | | | |
|------|--|--|--|--|--|--|--|--|--|--|-----|
| 3.1 | At-risk work is flagged by co-workers | | | | | | | | | | 6 |
| 3.2 | Safety instructions are reinforced on site | | | | | | | | | | 8 |
| 3.3 | Unsafe acts are monitored and corrected | | | | | | | | | | 8 |
| 3.4 | Unsafe conditions are corrected | | | | | | | | | | 8 |
| 3.5 | Fatigue is monitored and managed | | | | | | | | | | 8 |
| 3.6 | Work pressure is monitored and managed | | | | | | | | | | 8 |
| 3.7 | Safety audits are conducted regularly | | | | | | | | | | 8 |
| 3.8 | Safety inspections are conducted regularly | | | | | | | | | | 8.5 |
| 3.9 | Methods statements comply to SWP | | | | | | | | | | 7 |
| 3.10 | Tasks execution complies to SWP | | | | | | | | | | 7 |
| 3.11 | Work is completed in a safe manner | | | | | | | | | | 8 |
| 3.12 | New workers are taught to follow SWP | | | | | | | | | | 8 |
| 4. | Collective Responsibility (Brother's Keeper) | | | | | | | | | | |
| 4.1 | Co-workers often discuss safety hazards | | | | | | | | | | 7.5 |
| 4.2 | Co-worker care for the safety of each other | | | | | | | | | | 8 |
| 4.3 | Co-workers care about equipment safety | | | | | | | | | | 8 |
| 4.4 | Co-workers discuss accident prevention | | | | | | | | | | 6.5 |
| 4.5 | Work pressure must not violate safety | | | | | | | | | | 7.5 |
| 4.6 | Co-workers report safety violations | | | | | | | | | | 8 |
| 4.7 | Co-workers raise alert to SWP violation | | | | | | | | | | 6.5 |

| | | | | | | | | | | | | |
|-----------|--|--|--|--|--|--|--|--|--|--|--|------------|
| 5. | Job Satisfaction | | | | | | | | | | | |
| 5.1 | Work is repetitive and boring | | | | | | | | | | | 4 |
| 5.2 | Work is inspiring and fulfilling | | | | | | | | | | | 4.5 |
| 5.3 | Work use skills and talents | | | | | | | | | | | 6 |
| 5.4 | Achievements and progress is rewarded | | | | | | | | | | | 6 |
| 5.5 | Motivation to improve SWP is at work | | | | | | | | | | | 7 |
| 5.6 | Work is done purely for salaries and wages | | | | | | | | | | | 6 |
| 5. | Equipment and Plant | | | | | | | | | | | |
| 5.1 | Suitable plant and equipment is available | | | | | | | | | | | 9 |
| 5.2 | Routine upkeep is performed on plants | | | | | | | | | | | 8.5 |
| 5.3 | Operators are trained to use equipment | | | | | | | | | | | 8.5 |
| 6. | Hazard and Risk | | | | | | | | | | | |
| 6.1 | Safety is ignored to get the job done | | | | | | | | | | | 5.5 |
| 6.2 | Prohibited work activities are expedited | | | | | | | | | | | 5 |
| 6.3 | SWP is violated to get the job done | | | | | | | | | | | 4.5 |
| 6.4 | Drift to safety violation is allowed | | | | | | | | | | | 5 |
| 6.5 | Safety rules and policies are clear | | | | | | | | | | | 8 |
| 6.6 | Workplace SWP is understood | | | | | | | | | | | 7 |
| 6.7 | Unsafe acts and conditions are mitigated | | | | | | | | | | | 8 |
| 6.8 | Hazard reporting is encouraged on sites | | | | | | | | | | | 7.5 |
| 6.9 | The collective undertake safety analysis | | | | | | | | | | | 7 |
| 7. | Adaptability and Flexibility | | | | | | | | | | | |
| 7.1 | Workers use SWP to execute tasks | | | | | | | | | | | 7.5 |

SECTION B

How important are the following factors or elements in relation to safety performance among construction SMEs in Ghana?

| (Importance scale) | | | | | | | | | | | | |
|--------------------|--|---|---|---|---|---|---|---|---|---|----|--------|
| 11. | Management Contributions | | | | | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Median |
| 11.1 | Regular safety inspection is expedited | | | | | | | | | | | 7.5 |
| 11.2 | Safety equipment is off adequate quality | | | | | | | | | | | 8 |
| 11.3 | Safety equipment is accessible and available | | | | | | | | | | | 7.5 |
| 11.4 | Safety first is applied during work pressure | | | | | | | | | | | 7 |
| 11.5 | Overtime work is controlled | | | | | | | | | | | 7.5 |
| 11.6 | Blame game is prohibited due to accidents | | | | | | | | | | | 7.5 |
| 12. | Worker Contributions | | | | | | | | | | | |
| 12.1 | Workers encourage one another to be safe | | | | | | | | | | | 7.5 |
| 12.2 | Workers keep worksite clean | | | | | | | | | | | 8.5 |
| 12.3 | Workers ignore safety rules | | | | | | | | | | | 6 |
| 12.4 | Workers take short cut to complete tasks | | | | | | | | | | | 6.5 |
| 12.5 | Workers use SWPs to get the job done | | | | | | | | | | | 7.5 |
| 13. | Supervisor Contributions | | | | | | | | | | | |
| 13.1 | Supervisors allow safety suggests | | | | | | | | | | | 8 |
| 13.2 | Supervisors disallow safety violations | | | | | | | | | | | 7 |
| 13.3 | Supervisor prioritise productivity | | | | | | | | | | | 7 |
| 13.4 | Supervisors ignores SWP deviations | | | | | | | | | | | 6 |

Reason(s) for the difference between the group median and your response:

- Most organisations have an adequate safety management system in place.
- The difference in the variation is due to my understanding now of the response I was to give. It was not clear earlier.

- The variation in my response to group mean may probably be due to individual professional experience and the level of importance each respondent attached to crucial elements of safety culture. For example, the safety curve indicates that the first of safety has to do with enforcement. Thus, enforcement of safety measures at the early stages of a programme is crucial for the development of safety culture and this cannot be compromised. How the group mean score 7.5 out of 10 baffles me.
- Am now working at Newmont Ghana Site. So, we following the client (Newmont) rich safety culture. In fact, Newmont Ghana Akyem Project site is drifting from safety culture to safety climate where workers behave safely on their own even if no one is watching them.

Please provide additional statement(s), if any, that will promote positive construction safety culture for improved SME contractor performance:

.....
.....
.....
.....

Please provide reason(s) for changing your responses:

.....
.....
.....
.....

Appendix C

Appendix C1: Sample Construction SMES Pilot Survey Questionnaire

SECTION A

Construction SMEs Pilot Survey Questionnaire



10th June 2021

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

Re: Request to participate in a study entitled ‘Developing a framework for a positive safety culture towards improved construction SMEs safety performance in Ghana’

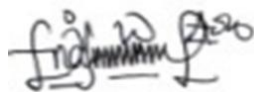
We write to humbly request your participation by completing a Delphi technique-based questionnaire as part of data collection process for an ongoing doctoral study being carried out by Eric K. Adzivor under the supervision of Prof. Fidelis Emuze at the Central University of Technology, Free State, South Africa. As part of this research work, we are required to test the validity of the measures we are using to improve health and safety among construction SMEs in Ghana.

Your participation in this research will be highly appreciated. We would like to confirm that your response will be treated with outmost confidentiality and shall be used for academic purposes only. The research outputs will be shared with you upon request.

Upon completion of the questionnaire, could you kindly return same via email to either mapputo2@yahoo.com or femuze@cut.ac.za

If you have any questions regarding this study, please feel free to contact Mr Adzivor and Prof Emuze through the same email addresses provided above respectively. Thank you for your attention. We are looking forward to your favourable contributions.

Sincerely,



Mr Eric Kodzo Adzivor (Doctoral Candidate)



Prof FA Emuze (Research Supervisor)

POSITIVE SAFETY CULTURE SURVEY

The purpose of this study is to develop a framework for a positive safety culture which will lead to improvement in health and safety performance among construction Small and Medium Sized Enterprises (SMEs) in Ghana. You are invited to participate in this study by completing the following questionnaire which should take approximately **20 minutes** to complete. The questionnaire is divided into three sections i.e. **section A** is on demographic information for statistical purposes, **section B** is on management measures/actions to instill positive construction safety culture and **section C** is on health and safety performance.

SECTION A (Demographic information)

Please tick the appropriate box or fill in the blank space when answering the questions.

1. What position do you hold in your company?
 Owner Managing Director Owner/Managing Director
 Project Manager Other
 If other specify...Project Engineer.....

2. Who is responsible for health and safety in your company?
 Owner Safety officer Site agent Project manager
 Other
 If other specify.....

3. How many years have you been running this construction firm? (Answer only if you are the owner) year(s)
4. How many years you been involved in the construction industry?.....year(s)
5. How many years have you been involved in this particular company?.....year(s)
6. What is your highest qualification?
 Doctorate Degree Master's Degree HND/Diploma
 WASSCE Certificate BECE Certificate No Qualification
7. Is the company registered with Registrar General Department?
 Yes No
8. In which category does your company fall?
 Limited Liability Partnership An Enterprise
9. In which class does your company fall?
 DIKI D2K2 D3K3 D4K4
10. What is the average annual total number of workers you have employed to work in your company over the last 3 years?
11. What is the average annual revenue of your company within the last 3 years?
 Below \$75,000.00
 \$75,000-\$200,000
 \$200,000-\$500,000
 Above \$500,000

12. Which category below best describe the nature of your business activity?
 General contractor Subcontractor Specialist Contractor
 Other
 If other specify.....

SECTION B (POSITIVE SAFETY CULTURE SURVEY)

13. Please rate your **level** of agreement if you **undertake** the following **actions** in your company to establish positive safety culture using a 5-point Likert scale; where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.

| Actions | | Strongly disagree | Disagree | Neutral | Agree | Strongly Agree |
|----------------------------------|---|--------------------------|-----------------|----------------|--------------|-----------------------|
| Management Concerns (MC) | | | | | | |
| MC1 | Safe working condition enforcement | | | | | |
| MC2 | Zero tolerance for safety violations | | | | | |
| MC3 | Monitor and correct safety errors | | | | | |
| MC4 | Safety first is applied to all at work | | | | | |
| MC5 | Safety resources are prioritised | | | | | |
| MC6 | Safe operations are prioritised | | | | | |
| MC7 | Wellbeing of workers are prioritised | | | | | |
| MC8 | Health of workers are prioritised | | | | | |
| Worksite Norms (WN) | | | | | | |
| WN1 | Equipment, tools and plants are used safely | | | | | |
| WN2 | Safety is improved continuously | | | | | |
| WN3 | Hazard awareness and control are executed | | | | | |
| WN4 | Risk awareness and control are executed | | | | | |
| WN5 | Accidents and near miss incidents are mitigated | | | | | |
| WN6 | Workers make safety suggestions | | | | | |
| WN7 | Workers contribute to safety improvement | | | | | |
| WN8 | Workers are involved in safety planning | | | | | |
| Safe Work Procedure (SWP) | | | | | | |
| SWP1 | At-risk work is flagged by co-workers | | | | | |
| SWP2 | Safety instructions are reinforced on site | | | | | |
| SWP3 | Unsafe acts are monitored and corrected | | | | | |
| SWP4 | Unsafe conditions are corrected | | | | | |
| SWP5 | Fatigue is monitored and managed | | | | | |
| SWP6 | Work pressure is monitored and managed | | | | | |
| SWP7 | Safety audits are conducted regularly | | | | | |
| SWP8 | Safety inspections are conducted regularly | | | | | |

| | | | | | | |
|--|--|--|--|--|--|--|
| SWP9 | Methods statements comply to SWP | | | | | |
| SWP10 | Tasks execution complies to SWP | | | | | |
| SWP11 | Work is completed in a safe manner | | | | | |
| SWP12 | New workers are taught to follow SWP | | | | | |
| Collective Responsibility (Brother's Keeper) (CR) | | | | | | |
| CR1 | Co-workers often discuss safety hazards | | | | | |
| CR2 | Co-workers care for the safety of each other | | | | | |
| CR3 | Co-workers care about equipment safety | | | | | |
| CR4 | Co-workers discuss accident prevention | | | | | |
| CR5 | Work pressure must not violate safety | | | | | |
| CR6 | Co-workers report safety violations | | | | | |
| CR7 | Co-workers raise alert to SWP violation | | | | | |
| Job Satisfaction (JS) | | | | | | |
| JS1 | Work is inspiring and fulfilling | | | | | |
| JS2 | Work use skills and talents | | | | | |
| JS3 | Achievements and progress are rewarded | | | | | |
| JS4 | Motivation to improve SWP is at work | | | | | |
| Equipment and Plant (EP) | | | | | | |
| EP1 | Suitable plant and equipment are available | | | | | |
| EP2 | Routine upkeep is performed on plants | | | | | |
| EP3 | Operators are trained to use equipment | | | | | |
| Hazard and Risk (HR) | | | | | | |
| HR1 | Safety rules and policies are clear | | | | | |
| HR2 | Workplace SWP is understood | | | | | |
| HR3 | Unsafe acts and conditions are mitigated | | | | | |
| HR4 | Hazard reporting is encouraged on sites | | | | | |
| HR5 | SWP is violated to get the job done | | | | | |
| HR6 | We collectively undertake safety analysis | | | | | |
| Adaptability and Flexibility (AF) | | | | | | |
| AF1 | Workers use SWP to execute tasks | | | | | |
| AF2 | Safe equipment and plants are used on sites | | | | | |

| | | | | | | |
|------------------------------------|---|--|--|--|--|--|
| AF3 | Safety promotions is embraced on sites | | | | | |
| AF4 | Mindfulness in relation to safety exist | | | | | |
| Education and Training (ET) | | | | | | |
| ET1 | Safety inductions are detailed and timely | | | | | |
| ET2 | Tool box talks are enriched with examples | | | | | |
| ET3 | Safety information are provided regularly | | | | | |
| ET4 | Training covers SWPs and regulations | | | | | |
| Reporting (R) | | | | | | |
| R1 | Blame game hinders incident reports | | | | | |
| R2 | Reporting lines and systems are clear | | | | | |
| R3 | Reports leads to reviews and improvements | | | | | |
| R4 | Incident reporting is nurtured and rewarded | | | | | |
| R5 | Incident reporting leads to better SWPs | | | | | |
| R6 | Workers are willing to report incidents | | | | | |
| Information Sharing (IS) | | | | | | |
| IS1 | SWP information is shared timely | | | | | |
| IS2 | Safety information is in multiple languages | | | | | |
| IS3 | Voluntary safety information sharing exists | | | | | |
| IS4 | New safety regulations are shared timely | | | | | |
| IS5 | Safety concerns receive timely attention | | | | | |

SECTION C: HEALTH AND SAFETY PERFORMANCE

14. Please rate your **level** of agreement of the following in respect of health and safety performance of your construction company using a 5-point Likert scale of agreement where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.

| Actions | | Strongly disagree | Disagree | Neutral | Agree | Strongly agree |
|---------------------------------------|--|--------------------------|-----------------|----------------|--------------|-----------------------|
| Management Contributions (MCS) | | | | | | |
| MCS1 | Regular safety inspection is expedited | | | | | |
| MCS2 | Safety equipment are functional | | | | | |

| | | | | | | |
|--------------------------------------|--|--|--|--|--|--|
| MCS3 | Safety equipment is accessible and available | | | | | |
| MCS4 | Safety first is applied during work pressure | | | | | |
| MCS5 | Overtime work is controlled | | | | | |
| MCS6 | Blame game is prohibited | | | | | |
| MCS7 | Regular safety inspection is expedited | | | | | |
| Worker Contributions (WC) | | | | | | |
| WC1 | Workers encourage one another to be safe | | | | | |
| WC2 | Workers keep worksite clean | | | | | |
| WC3 | Workers use SWPs to get the job done | | | | | |
| Supervisor Contributions (SC) | | | | | | |
| SC1 | Supervisors allow safety suggestions | | | | | |
| SC2 | Supervisors disallow safety violations | | | | | |
| SC3 | Supervisor prioritise productivity | | | | | |
| SC4 | Supervisors ignores SWP deviations | | | | | |

Thank you for your contribution towards positive safety culture among construction SMEs in Ghana.

Appendix D

Appendix D1: Sample Construction SMES Survey Questionnaire

Construction SMEs Survey Questionnaire



14th November 2021

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

Re: Request to participate in a study entitled ‘Developing a framework for a positive construction safety culture towards improved construction SMEs safety performance in Ghana’

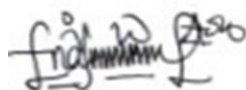
We write to humbly request your participation by completing a Delphi technique-based questionnaire as part of data collection process for an ongoing doctoral study being carried out by Eric K. Adzivor under the supervision of Prof. Fidelis Emuze at the Central University of Technology, Free State, South Africa. As part of this research work, we are required to test the validity of the measures you are using to improve health and safety.

Your participation in this research will be highly appreciated. We would like to confirm that your response will be treated with outmost confidentiality and shall be used for academic purposes only. The research outputs will be shared with you upon request.

Upon completion of the questionnaire, could you kindly return same via email to either mapputo2@yahoo.com or femuze@cut.ac.za

If you have any questions regarding this study, please feel free to contact Mr Adzivor and Prof Emuze through the same email addresses provided above respectively or call **0206585533/0542698810**. Thank you for your attention. We are looking forward to your favourable contributions.

Sincerely,



Mr Eric Kodzo Adzivor (Doctoral Candidate)



Prof FA Emuze (Research Supervisor)

POSITIVE SAFETY CULTURE SURVEY

The purpose of this study is to develop a framework for positive construction safety culture which will lead to improvement in health and safety performance among construction Small and Medium Sized (SMEs) in Ghana. You are invited to participate in this study by completing the following questionnaire which should take approximately **20 minutes** to complete. The questionnaire is divided into three sections i.e. **section A** is on demographic information for statistical purposes, **section B** is on management measures/actions to install positive construction safety culture and **section C** is on health and safety performance.

SECTION A (Demographic information)

Please tick the appropriate box or fill in the blank space when answering the questions.

1. What position do you hold in your company?
 Owner Managing Director Owner/Managing Director
 Project Manager Other
 If other specify...Project Engineer.....

2. Who is responsible for health and safety in your company?
 Owner Safety officer Site agent Project manager
 Other
 If other specify.....

3. How many years have you been running this construction firm? (Answer only if you are the owner) year(s)
4. How many years you been involved in the construction industry?.....year(s)
5. How many years have you been involved in this particular company?.....year(s)
6. What is your highest qualification?
 Doctorate Degree Master's Degree HND/Diploma
 WASSCE Certificate BECE Certificate No Qualification
7. Is the company registered with Registrar General Department?
 Yes No
8. In which category does your company fall?
 Limited Liability Partnership An Enterprise
9. In which class does your company fall?
 DIKI D2K2 D3K3 D4K4
10. What is the average annual total number of workers you have employed to work in your company over the last 3 years?
11. What is the average annual revenue of your company within the last 3 years?
 Below \$75,000.00
 \$75,000-\$200,000
 \$200,000-\$500,000
 Above \$500,000

12. Which category below best describe the nature of your business activity?
 General contractor Subcontractor Specialist Contractor
 Other
 If other specify.....

SECTION B (POSITIVE SAFETY CULTURE SURVEY)

13. Please rate your **level** of agreement if you **undertake** the following **actions** in your company to establish positive safety culture using a 5-point Likert scale; where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.

| Actions | | Strongly disagree | Disagree | Neutral | Agree | Strongly Agree |
|----------------------------------|---|--------------------------|-----------------|----------------|--------------|-----------------------|
| Management Concerns (MC) | | | | | | |
| MC1 | Safe working condition enforcement | | | | | |
| MC2 | Zero tolerance for safety violations | | | | | |
| MC3 | Monitor and correct safety errors | | | | | |
| MC4 | Safety first is applied to all at work | | | | | |
| MC5 | Safety resources are prioritised | | | | | |
| MC6 | Safe operations are prioritised | | | | | |
| MC7 | Wellbeing of workers are prioritised | | | | | |
| MC8 | Health of workers are prioritised | | | | | |
| Worksite Norms (WN) | | | | | | |
| WN1 | Equipment, tools and plants are used safely | | | | | |
| WN2 | Safety is improved continuously | | | | | |
| WN3 | Hazard awareness and control are executed | | | | | |
| WN4 | Risk awareness and control are executed | | | | | |
| WN5 | Accidents and near miss incidents are mitigated | | | | | |
| WN6 | Workers make safety suggestions | | | | | |
| WN7 | Workers contribute to safety improvement | | | | | |
| WN8 | Workers are involved in safety planning | | | | | |
| Safe Work Procedure (SWP) | | | | | | |
| SWP1 | At-risk work is flagged by co-workers | | | | | |
| SWP2 | Safety instructions are reinforced on site | | | | | |
| SWP3 | Unsafe acts are monitored and corrected | | | | | |
| SWP4 | Unsafe conditions are corrected | | | | | |
| SWP5 | Fatigue is monitored and managed | | | | | |
| SWP6 | Work pressure is monitored and managed | | | | | |

| | | | | | | |
|--|---|--|--|--|--|--|
| SWP7 | Safety audits are conducted regularly | | | | | |
| SWP8 | Safety inspections are conducted regularly | | | | | |
| SWP9 | Methods statements comply to SWP | | | | | |
| SWP10 | Task execution complies to SWP | | | | | |
| SWP11 | Work is completed in a safe manner | | | | | |
| SWP12 | New workers are taught to follow SWP | | | | | |
| Collective Responsibility (Brother's Keeper) (CR) | | | | | | |
| CR1 | Co-workers often discuss safety hazards | | | | | |
| CR2 | Co-workers care for the safety of each other | | | | | |
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| CR6 | Co-workers report safety violations | | | | | |
| CR7 | Co-workers raise alert to SWP violation | | | | | |
| Job Satisfaction (JS) | | | | | | |
| JS1 | Work is inspiring and fulfilling | | | | | |
| JS2 | Workers use skills and talents | | | | | |
| JS3 | Safety achievements and progress are rewarded | | | | | |
| JS4 | Motivation to improve SWP is at work | | | | | |
| Equipment and Plant (EP) | | | | | | |
| EP1 | Suitable plant and equipment are available | | | | | |
| EP2 | Routine upkeep is performed on plants | | | | | |
| EP3 | Operators are trained to use equipment | | | | | |
| Hazard and Risk (HR) | | | | | | |
| HR1 | Safety rules and policies are clear | | | | | |
| HR2 | Workplace SWP is understood | | | | | |
| HR3 | Unsafe acts and conditions are mitigated | | | | | |
| HR4 | Hazard reporting is encouraged on | | | | | |

| | | | | | | |
|--|---|--|--|--|--|--|
| | sites | | | | | |
| HR5 | SWP is violated to get the job done | | | | | |
| HR6 | We collectively undertake safety analysis | | | | | |
| Adaptability and Flexibility (AF) | | | | | | |
| AF1 | Workers use SWP to execute tasks | | | | | |
| AF2 | Safe equipment and plants are used on sites | | | | | |
| AF3 | Safety promotions is embraced on sites | | | | | |
| AF4 | Mindfulness in relation to safety exists | | | | | |
| Education and Training (ET) | | | | | | |
| ET1 | Safety inductions are detailed and timely | | | | | |
| ET2 | Tool box talks are enriched with examples | | | | | |
| ET3 | Safety information are provided regularly | | | | | |
| ET4 | Training covers SWPs and regulations | | | | | |
| Reporting (R) | | | | | | |
| R1 | Blame game hinders incident reports | | | | | |
| R2 | Reporting lines and systems are clear | | | | | |
| R3 | Reports lead to reviews and improvements | | | | | |
| R4 | Incident reporting is nurtured and rewarded | | | | | |
| R5 | Incident reporting leads to better SWPs | | | | | |
| R6 | Workers are willing to report incidents | | | | | |
| Information Sharing (IS) | | | | | | |
| IS1 | SWP information is shared timely | | | | | |
| IS2 | Safety information is in multiple languages | | | | | |
| IS3 | Voluntary safety information sharing exists | | | | | |
| IS4 | New safety regulations are shared timely | | | | | |
| IS5 | Safety concerns receive timely attention | | | | | |

SECTION C: HEALTH AND SAFETY PERFORMANCE

14. Please rate your **level** of agreement of the following in respect of health and safety performance of your construction company using a 5-point Likert scale of agreement where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.

| Actions | | Strongly disagree | Disagree | Neutral | Agree | Strongly Agree |
|---------------------------------------|--|--------------------------|-----------------|----------------|--------------|-----------------------|
| Management Contributions (MCS) | | | | | | |
| MCS1 | Regular safety inspection is expedited | | | | | |
| MCS2 | Safety equipment are functional | | | | | |
| MCS3 | Safety equipment is accessible and available | | | | | |
| MCS4 | Safety first is applied during work pressure | | | | | |
| MCS5 | Overtime work is controlled | | | | | |
| MCS6 | Blame game is prohibited | | | | | |
| Worker Contributions (WC) | | | | | | |
| WC1 | Workers encourage one another to be safe | | | | | |
| WC2 | Workers keep worksite clean | | | | | |
| WC3 | Workers use SWPs to get the job done | | | | | |
| Supervisor Contributions (SC) | | | | | | |
| SC1 | Supervisors disallow safety violations | | | | | |
| SC2 | Supervisor prioritise productivity | | | | | |
| SC3 | Supervisors ignore SWP deviations | | | | | |

Thank you for your contribution towards positive safety culture among construction SMEs in Ghana.